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NOTE: *Information Resources on Swine Housing, Care and Welfare* may be viewed as one complete publication below or by individual chapters at swinehousing2.htm.

United States Department of Agriculture

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National Agricultural Library

Animal Welfare Information Center

Information Resources on Swine Housing, Care and Welfare

AWIC Resource Series No. 21

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The Animal Welfare Information Center acknowledges **CAB International** and **CABI Publishing**, a leading international, not-for-profit publisher in applied life sciences, including animal science, nutrition, integrated crop management, plant sciences and forestry, for the use of more than sixty abstracts from the CAB Abstracts database. More information on CABI Publishing and CAB International is available at http://www.cabi.org

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Preface

Stockperson training represents an integral component of any successful farm operation. Recent studies conducted by Coleman et al. (2000), have demonstrated that training programs aimed at modifying stockperson attitudes and behaviors have led to a number of positive benefits for pigs. These include a reduction of fearful behaviors displayed by pigs and an improvement in their reproductive performance. English et al. (1992), have defined a number of desirable characteristics in good stockpeople which include: a sound knowledge of the pigs and their requirements, patience, empathy, effective animal handling skills, recognition of individual pigs, an understanding of normal behavior and possess the ability to recognize and treat pigs that are ill or injured. Training programs and educational materials, that support knowledge in these areas, should be easily available to producers, extension swine specialists, animal scientists, veterinarians, truckers, and others involved in the swine industry.

In an effort to supply these materials the following resource guide was developed through a collaborative effort with representatives from government, academia, and nonprofit organizations. The resource guide contains a detailed listing of training materials, books, selected web pages, research papers, and more.

Funding was made available through the United States Department of Agriculture (USDA) Cooperative State Research, Education, and Extension Service (CSREES) and administered through Purdue University to assist with the purchasing of training materials in a variety of forms (videocassettes, training kits, and CD-ROMs). These materials have been added to the collection of the National Agricultural Library (NAL) and are listed in the following document in the *Training Materials* section. Documents in the collection of the National Agricultural Library (NAL) are assigned an NAL Call Number. Information on how to request materials at NAL may be found at: http://www.nal.usda.gov/borrow-materials.

An effort has been made to include training materials that appeal to all learning styles and program sizes. Farm managers, extension agents, and others, are encouraged to be creative with the resources listed and integrate their use into their regular training programs. Sponsoring a video session night, featuring a training CD at a farm meeting, or conducting a book review, are just a few ideas of how the resources listed could be used to facilitate discussion and learning. It is hoped that producers and other swine professionals will find this resource an excellent tool for exploring and locating information regarding the care and welfare of pigs.

How to Use This Document

This publication is divided into four major sections: Training Materials, Books and Proceedings, Website Resources, and a comprehensive Bibliography. Documents in the collection of the National Agricultural Library (NAL) are assigned an NAL Call Number. Information on how to request materials at NAL may be found at: http://www.nal.usda.gov/borrow-materials

Training Materials

This section includes a listing of swine training materials divided into three different media types: Multimedia Training Packages, Audiovisuals and Kits, and Manuals and Booklets. All entries in this section are annotated, contain keywords, and NAL call numbers if available at the National Agricultural Library (NAL). Materials cover stockmanship, handling, housing, health, reproduction, and husbandry.

Books and Proceedings

A bibliographic listing of books and proceedings covering swine welfare, biology, genetics, nutrition, production, housing, handling, and pork quality is included here. Each citation is arranged alphabetically according to the last name of the primary author. Citations include a listing of keywords and a NAL call number if available at the National Agricultural Library (NAL). Entries were included with publication dates ranging from 1999-2003.

Web Site Resources

More than fifty annotated web site resources relating to the care, welfare, and housing of swine have been selected and listed alphabetically for convenience. Resources selected cover: codes of practice, animal welfare requirements, housing, disease, nutrition, and general husbandry information. All resources are accessible through the internet and are current as of July 2003.

Bibliography

An extensive bibliography categorized into eleven subject subsections covering all aspects of swine husbandry comprise this section of the publication. Records in this section were retrieved primarily from the

AGRICOLA, Medline, CAB International, and BIOSIS databases. Each citation is arranged alphabetically according to the last name of the primary author. Citations include a listing of keywords and a NAL call number if available at the National Agricultural Library (NAL). Entries were included with publications dates ranging from 1999-2003. **Please note that citations with a copyright notice are protected by U.S. and/or international copyright laws and are used by special permission.**

Training Materials

This listing includes multimedia training packages, audiovisuals, kits, manuals, and educational booklets. With the exception of the Pig ProHand program the following materials are available for a loan through the National Agricultural Library (NAL).

Patrons interested in obtaining these materials are encouraged to initiate interlibrary loans through their local libraries. Information on how to request materials at NAL may be found at: http://www.nal.usda.gov/borrow-materials.

Commerical Endorsement Disclaimer

The inclusion of trade, firm, or corporation names in this section is for the information and convenience of the reader. Listing of a product does not constitute an official endorsement or approval by the USDA, Agricultural Research Service of any product or service to the exclusion of others that may be suitable.

Multimedia Packages

Pig Enterprise CD ROM Multimedia Training Package
http://www.thepigsite.com/backroom/166/pig-enterprise-training-cds

An interactive CD-ROM jointly developed by the University of Aberdeen, Garth Veterinary Group, the Meat and Livestock Commission, the National Pig Association and the University of Newcastle, with additional assistance from the Agskills training group. There are three main elements to the training package: stockmanship and husbandry, health management, and cost effective feeding strategies. Photos and video clips of a variety of outdoor pig production systems are reviewed. Practical hints for managing pigs in cold, hot, and wet weather conditions are included. A comprehensive and high quality training tool.

A second CD is available that is more advanced and is targeted at unit managers and includes: staff management, financial planning, food safety, biosecurity, legislation, and product quality. The CD-ROM format consists of self assessments, skills exercises, questionnaires, feedback, video footage, pictorials and guidelines. All exercises are self-paced and require only basic computer skills.
NAL Call No.: SF395 P544 2000.
Keywords: multimedia, instructional materials, self paced, housing, health, stockmanship, husbandry.

Pig ProHand Training Program
http://www.monashcommercial.com
Monash Commercial PTY LTD, PO Box 3B, Monash University,Victoria 3800, Australia
Tel: +613 9905 9910, Fax: +613 9905 9911, E-mail: inquires@monashcommercial.com

This program is presented as a multimedia package with an interactive CD ROM, videos, and group discussions facilitated by a trainer. Stockpeople can individually undertake the program in a non-threatening setting and progress through the modules at their individual paces with review and checks on progress. The CD ROM includes a series of reviews and discussions on experimental and field-based research with video footage that identifies both appropriate and inappropriate behaviours by stockpeople towards pigs, and fear responses in pigs.

The program is normally facilitated by a qualified trainer to about 6 stockpeople per session, but it is also suitable in a smaller group setting. The program takes about 9 hours to complete. It is structured around a first session of 6 hours and a revision session several weeks later to reinforce the principles learned in the first session. Video and written material summarizing the key concepts together with posters, promotional material, and a newsletter are provided for revision and reinforcement of the key messages.
Pig ProHand is not currently a stand alone self-study program. It is currently offered by licensed trainers who are themselves trained by the inventors. The trainers then offer it to small groups of trainees in a group training session. A follow-up session is then re-convened some time later for reinforcement to ensure that the lessons have been absorbed into the behavioral patterns of the stockpeople. Pig ProHand is suitable for offer by a training center to maximize its benefits.

Pre-Slaughter Handling of Pigs
SLU, Swedish University of Agricultural Sciences
Box 234, S-53223
Skara, Sweden
Tel: +46-511-67000, Fax: +46-511-67268, E-mail: Anne.Algers@lmv.slu.se

A multi-media teaching program developed through collaboration between the Swedish University of Agricultural Sciences, Cornell University and University of Guelph. The program addresses three major concerns: increasing public concern related with animal welfare; meat quality concerns as a result of poor pre-slaughter handling; and the importance of food safety.

The program should be of interest to students as well as professionals dealing with the handling procedure of slaughter animals and meat quality. It is designed for use in formal educational settings, in distance learning programs and in training programs for professionals. Seven modules cover the following disciplines: legislation, behavior, stress, physiology, handling, animal welfare, meat quality, and meat microbiology/ hygiene.
NAL Call No.: SF395 P74 2001.
Keywords: training materials, animal welfare, meat quality, hygiene, legislation, literature review.

Reproductive Management of Pigs: Guides and Problem Solving
http://www.susmultimedia.com/
SUS Multimedia Publications
P.O. Box 5332, Fargo, ND 58105-5332, USA
E-mail: support@susmultimedia.com

This CD-ROM can be used as a self paced on-farm training tool for breeding herd managers and others. It is organized into two main parts: the problem solving area and guides to breeding herd management. The solving known problems section of the CD allows users to select a problem from a categorized list and then investigate its most likely causes and solutions. If a user cannot identify a problem within their herd, they can enter the identifying and solving problems section of the CD, which will lead them through a decision-tree. Lists of likely causes and solutions are then provided.

To improve specific management practices throughout the reproductive cycle, to solve longer-term problems, to aid strategic planning, and to facilitate training of personnel, users can enter the guides to breeding herd

management. These guides offer best-practice management advice for each stage of the pig's life.
NAL Call No.: SF396.9 R47 2000.
Keywords: reproductive management, decision making tool, problem solving, breeding, herd management.

Audiovisuals and Kits

Alternative Housing for Gestating Sows [videocassette]. Guelph, Ontario, Canada: Ontario Pork; Ottawa, Ontario, Canada: Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA); Guelph, Ontario, Canada: Agriculture and Agri-Food Canada, Agricultural Adaptation Council; Fergus, Ontario, Canada: LP Production Audio Video Services; 2002; 1/2", 40 min.; Includes one handout.

Farm managers at three different farms using loose housing for dry sows discuss feeding methods, use of straw for bedding and/or enrichment, vaccinating sows, estrus detection, pregnancy checking, labor, muck handling, and building design. Managers share what they like about their current housing systems and what they would change in the future.

The video concludes with a segment comparing costs of the three farm systems featured with a traditional stall barn. A handout is included that provides design layouts for sow barns at the three farms and adjustments for barn sizes containing 100, 300, and 1000 sows.
NAL Call No.: Videocassette no. 3260.
Keywords: sows, loose housing, husbandry, straw, enrichment, partially slatted flooring, pens, space allowance, feeding systems, watering systems, ventilation, labor, cost comparison.

Artificial Insemination: Striving for Perfection [videocassette]. Lubbock, TX: CEV Multimedia, Ltd.; 199?; 1/2" VHS, 17 min.

Produced by National Pork Producers, this videotape details information presented during their artificial insemination training seminars. Vital factors discussed include proper procedures, safety, hygiene, temperature control and contamination control. A video quiz is included.
NAL Call No.: Videocassette no. 3210.
Keywords: boars, sows, artificial insemination, semen evaluation, collection methods.

Caring for Pigs: Stockperson Training [videocassette] Victoria, Australia: Victorian Department of Agriculture, 1992, 9 min, 1/2", VHS. (available from AITEX International PTY LTD)

Caring for pigs requires special attention to their welfare. Examples are given of good stockmanship and welfare during routine maintenance, with indicators to assess welfare and guidelines for appropriate action.
NAL Call No.: Videocassette no. 3221.
Keywords: welfare, stockmanship, human animal relationships, moving pigs, loading pigs.

Dry Sow Housing: Alternative Systems [videocassette]. London, United Kingdom: Department for Environment, Food and Rural Affairs (formerly MAFF); 1996; 1/2" VHS, 21 min.

The use of close confinement stalls and tether systems to house sows were banned in the UK in 1999. In an effort to meet sow welfare requirements a number of alternative housing options have been implemented. This video highlights some of the main features of straw based loose housing systems for small and large sow groupings. In addition a number of feeding systems are reviewed including manual, floor dump, trickle, and spin. Labor requirements and manure handling methods are also discussed.
NAL Call No.: Videocassette no. 3220.
Keywords: sows, housing, alternatives, loose housing, straw based, large groups, small groups, mixing, aggression, flooring, concrete, feeding systems, labor, waste removal.

Field Trip: Swine Production [videocassette]. Lubbock, TX: CEV Multimedia, Ltd.; 1994; 1/2" VHS, 47 min.

Visit the Texas division of National Hog Farms, whose state-of-the-art facilities house more than 17,000 sows, yielding 350,000 marketable pigs per year. Three phases of production including breeding, farrowing, and finishing are featured. Housing, handling, disease control, ventilation, immunization and waste management are reviewed. A quiz is included.
NAL Call No.: Videocassette no. 3214.
Keywords: large farm, intensive production, confinement operation, tour of farm, breeding, farrowing, finishing, facility design, herd health management.

Good Health Manual for Pigs [kit]. Kingston, Australia: Pig Research and Development Corporation; 1995, 1/2", VHS, 20 min, 10 min, 6 min. Includes two manuals and two videocassettes. (available from AITEX International PTY LTD)

This kit contains three video segments and two manuals that enable producers, with the aid of their veterinarians, to learn how to identify health problems, determine probable causes, administer treatment, and take steps to prevent recurrence. Common diseases are reviewed as well as procedures for administering medicines including proper injection techniques.
NAL Call No.: SF971 G67 1995.
Keywords: training kit, disease identification, post mortem exams, administering medications, proper injection techniques.

How to Decrease Piglet Mortality [videocassette]. Victoria, Australia: Victorian Department of Agriculture, 1990?, 19 min, 1/2", VHS. (available from PigWorld, Inc.).

This video reviews the care of sows before, during and after farrowing. Practical descriptions on saving piglets with splay legs, managing weak piglets, milking colostrum from sows, fostering piglets, and controlling diseases such as scours and arthritis are presented.
NAL Call No.: Videocassette no. 3222.
Keywords: farrowing, preparation, assisting with births, sow health, piglet health, disease prevention.

Human/Pig Behaviour [videocassette]. Victoria, Australia: Victorian Department of Agriculture, 199?, 13 min, 1/2", VHS. (available from PigWorld, Inc.).

The importance of human/pig interactions is reviewed. Examples of positive and negative handling techniques are presented. The importance of proper facility design and understanding the perception and behavior of pigs is discussed.
NAL Call No.: Videocassette no. 2601.
Keywords: pig behavior, visual perception, stockmanship, human animal relationships, handling methods.

Injection Techniques for Swine [videocassette]. Des Moines, IA: National Pork Producers Council; Pork Quality Assurance Video Series - #1; 1996; 1/2" VHS, 17 min. Includes booklet, guide, and quiz.

Covers medication types, injection sites, routes of administration, restraint methods, and needle size and gauge.
NAL Call No.: Videocassette no. 2359.
Keywords: techniques, injection, restraint.

Low Stress Handling of Pigs [videocassette]. Fort Collins, Colorado: Grandin Livestock Handling System, Inc.; 1998, 1/2" VHS, 30min.

Dr. Temple Grandin, livestock handling expert, discusses behavioral principles which will help improve swine productivity and preserve meat quality. Moving pigs, loading pigs, reducing heat stress, PSE, and safe boar

handling are topics covered. Ideal tool for training employees on pig farms and for teaching in swine production classes.
NAL Call No.: Videocassette no. 3218.
Keywords: moving, loading, transport of pigs, stress, boar handling.

Mating [videocassette]. Victoria, Australia: Victorian Department of Agriculture, 199?, 20 min, 1/2", VHS. (available from PigWorld, Inc.).

Estrus detection methods are demonstrated using the boar and/or back-pressure test. A new approach to the housing of gilts and sows to improve mating management is presented. Proper technique for hand mating pigs is demonstrated.
NAL Call No.: Videocassette no. 3223.
Keywords: reproduction, mating, estrus detection, housing.

Mating and Reproduction [kit]. Kingston, Australia: Pig Research and Development Corporation; 1994, 1/2", VHS, 7.5 min. Includes manual, guide, and worksheets. (available from AITEX International PTY LTD)

Practical information on the *10 Must Do's* of swine mating and reproduction is presented in an educational kit. Kit comes with a manual, laminated pocket size quick reference guide, training guide, and a 7.5-minute video with tutorial. Full of proven information on "best practices" to improve the reproduction rate of the herd.
NAL Call No.: Videocassette no. 3212.
Keywords: training kit, reproductive performance, evaluation, estrus detection, artificial insemination.

Piglet Techniques: Weaner Diseases [videocassette]. Victoria, Australia: Victorian Department of Agriculture, 199?, 14 min, 1/2", VHS. (available from PigWorld, Inc.).

This video describes teeth-clipping, tail docking, iron injections, ear notching, treatment of splaylegs, and cross-fostering management techniques for piglets. A second section of the video reviews treatment and prevention of weaner scours, *Strep. suis* and arthritis.
NAL Call No.: Videocassette no. 3224.
Keywords: nursery pigs, weaner pigs, management practices, disease prevention.

Pork Quality Assurance [kit]. National Pork Producers Council: Des Moines, Iowa; 1994. Includes 1 videocassette, 2 booklets, 1 set of self-assessment materials, 1 calendar.

A learning program designed to teach hog farmers the proper use of veterinary drugs. Two booklets contain the texts of the three learning modules. A videotape is used with learning module three. Issues discussed include: food safety, illegal drug residues, HACCP, drug regulators such as the FDA, EPA and FSIS, medicated feeds, mixing guidelines, and GMP (Good Management Practices).
NAL Call No.: Kit no. 278.
Keywords: pork quality assurance, FDA, veterinary drug residues, law and legislation, United States.

Practical Outdoor Pig Production [videocassette]. Ipswich, UK: Farming Press Videos. Distributed in N. America by Diamond Farm Enterprises, Alexandria Bay, NY; 1993; 1/2" VHS, 40 min.

This video features examples of breeding units. Basic requirements, essential services, housing, equipment, record keeping, and integration with other farming enterprises are covered.
NAL Call No.: Videocassette no. 1912.
Keywords: breeding, housing, record keeping.

Proper Pig Handling for Markets and Packers [videocassette]. Bowling Green, KY: Livestock Conservation Institute; 1997; 1/2" VHS

This video demonstrates how to handle pigs at livestock markets and at the packing plant in order to increase pork quality. Provides information on product consistency, understanding and concern for animals, stress reduction, flight zone, range of vision, point of balance, handling equipment maintenance, loading and unloading, lighting, handling stressed pigs, and handling prior to stunning. The video is bilingual (English and Spanish).
NAL Call No.: Videocassette no. 2673.
Keywords: handling, livestock markets, packing plants, loading.

Stimulus Response [videocassette]. Cambridge, UK: The Association for the Study of Animal Behavior, Department of Biological Sciences, Homerton College; 1996; 1/2" VHS, 33 min.

Using a variety of farm animal species, the teaching video examines the five steps of stimulus response. Steps include stimulus perception, the response of physiological receptors, coordination of the response, effector response, and behavioral response. The video is geared toward high school and undergraduate college levels and is a collaborative effort between the Universities of Bristol and Cambridge.
NAL Call No.: Videocassette no. 2350.
Keywords: behavior, welfare, learning principles, nervous system, psychology, teaching tool.

Stockperson Training Course: Trainers Manual [kit]. Kingston, Australia: Pig Research and Development Corporation; 1997, 1/2", VHS, 1 hr.,17 min. Includes notebook. (available from AITEX International PTY LTD)

Video contains live footage of swine being handled on the farm in both positive and negative ways. Handling of pigs when moving from place to place as well as handling during mating is presented. Video comes with a notebook for Trainers and Trainees that contains six training modules: stock sense and welfare; handling pigs, farrowing management and preweaming mortality; estrus detection and mating management; weaner health, and grower/finisher management.
NAL Call No.: SF395 S65 1997.
Keywords: instructional materials, welfare, handling, stockmanship, human animal relationship.

Swine Abnormalities [videocassette]. Lubbock, TX: CEV Multimedia, Ltd.; 1987; 1/2" VHS, 26 min.

Extensive abnormalities in swine are provided using live examples. Examples of pigs with skin and hair abnormalities (sarctopic mange, wrinkling, swirls), skeletal structure abnormalities (weak pasterns, sickle hocked, missing vertebrae), reproductive abnormalities (vaginal prolapse, infantile genitalia, cryptorchidism), and digestive system abnormalities (rectal prolapse, artresia ani), are presented. A video quiz is included.
NAL Call No.: Videocassette no. 3217.
Keywords: disease, genetic defects, system disorders, skeletal disorders, evaluation.

Swine Breeds ID [videocassette]. Lubbock, TX: CEV Multimedia, Ltd.; 1995; 1/2" VHS, 21 min.

Swine Breeds is a visually-packed presentation detailing 16 breeds of swine: Berkshire, Hampshire, Poland China, Spotted Poland China, Duroc, Chester White, Yorkshire, Landrace, Hereford, Pietrain, Red Waddle, Mulefoot, Yucatan, Ossabaw Island, Tamworth and Gloucester Old Spot. The history of these breeds, their specific traits and origin is presented. In addition important terminology (such as barrow, carcass merit, growth rate, insular dwarfism) is reviewed. A supplement is included.
NAL Call No.: Videocassette no. 3213.
Keywords: swine breeds, characteristics, history, recognition of.

Swine Handling for Pork Producers [videocassette]. Des Moines, IA: National Pork Producers Council; Pork Quality Assurance Video Series - #3; 1996; 1/2" VHS, 15 min. Includes a manual and quiz. Available online at http://www.pork.org

The effect of proper handling on meat quality, methods of handling pigs based on pig behavior, facility design, and loading for transport are reviewed in this video.
NAL Call No.: Videocassette no. 2332.
Keywords: handling, behavior, loading, meat quality, facility design.

Swine Handling and Transportation [videocassette]. Madison, WI: Livestock Conservation Institute; 1989?; 1/2" VHS, 21 min.

Dr. Temple Grandin describes basic principles of pig behavior. Swine vision, flight zones, reactions to noise, and following behavior, are reviewed. Handling and transportation practices that reduce bruising, decrease injury, and increase efficiency are also discussed.
NAL Call No.: Videocassette no. 1593.
Keywords: handling, transport, behavior, injury prevention.

Swine Handling and Transportation: Video Training Kit [kit]. Bowling Green, KY: National Institute for Animal Agriculture; 2001; 1/2" VHS, 20 min. Includes booklet.
This video training kit presents information on proper swine handling and transportation. Video contains both English and Spanish versions and is accompanied by a bilingual facilitator guide. The booklet and video are designed to show and explain proper pig handling techniques. Video contains live footage of swine being loaded and transported from the farm.
NAL Call No.: Videocassette no. 3211.
Keywords: training kit, handling, moving pigs, loading, proper facilities, behavior, visual perception.

Swine Handling for Transporters [videocassette]. Des Moines, IA: National Pork Producers Council; Pork Quality Assurance Video Series - #4; 1996; 1/2" VHS, 17 min. Includes manual, guide, quiz, and laminated adverse weather chart. Available online at http://www.pork.org

The effect of proper handling during loading and transport on meat quality is explored. Transport guidelines for adverse weather conditions included.
NAL Call No.: Videocassette no. 2333.
Keywords: handling, meat quality, loading, transport, weather.

Swine Housing and Well-being [videocassette] Des Moines, IA: National Pork Board; co-sponsored by the U.S.Dept. of Agriculture, The Cooperative State Research Education Extension Service; 2002; 1/2" VHS. Includes a series of three videocassettes.

Video recordings from meeting sessions held during P.O.R.K. Academy 2002, an educational workshop intended for swine producers. Presentations from researchers, government, and industry representatives covering stockmanship and training, practical sow housing and system design, and consumer perspectives are presented.
NAL Call No.: Videocassette No. 3259.
Keywords: ethics, stockmanship, welfare, training, resources, housing.

Swine Housing and Well-being [sound recording]. Des Moines, IA: National Pork Board; co-sponsored by the U.S.Dept. of Agriculture, The Cooperative State Research Education Extension Service; 2002. Includes a series of three audiotapes.

Audio tape recordings from meeting sessions held during P.O.R.K. Academy 2002, an educational workshop intended for swine producers. Presentations from researchers, government, and industry representatives covering stockmanship and training, practical sow housing and system design, and consumer perspectives are presented.
NAL Call No.: Videocassette No. 403.

Keywords: ethics, stockmanship, welfare, training, resources, housing.

Swine Learning Laboratory Kit [kit]. Columbus, Ohio: Ohio State University; Curriculum Materials Service; 1994. Includes 1/2" VHS videocassette, guide, charts, diagrams, posters, duffle bag.

This resource kit contains: situation/ task statements, charts and diagrams, identification tags and instructions, Educators' Curriculum Guide, Critical Points of Quality Assurance and Animal Care video, animal medication product label and insert posters, color retail meat identification photos, color breed identification prints with name tags and trait descriptions; animal skeleton structure poster, ear notching pig head diagram, wholesale meat cut poster, animal handling and management poster. All printed materials are laminated for durability. A duffle bag is included for easy transport of learning materials to offsite locations such as farms, fair grounds, or class rooms. Suitable teaching aid for use with 4-H, FFA, and other youth agricultural organizations.
NAL Call No.: Kit no. 404.
Keywords: instructional materials, youth, breed identification, quality assurance, retail meat cuts, pig identification, handling.

Swine Management Practices I [videocassette]. Lubbock, TX: CEV Multimedia, Ltd.; 1995; 1/2" VHS, 18 min.
This video reviews swine characteristics, housing, and management of sows and piglets during farrowing. Includes a summary, quizzes, and answers on a supplemental CD.
NAL Call No.: Videocassette no. 2578.
Keywords: management practices, farrowing, housing.

Swine Management Practices II [videocassette]. Lubbock, TX: CEV Multimedia, Ltd.; 1995; 1/2" VHS, 19 min.

Techniques for processing baby pigs including tooth clipping, tail docking, iron injections, ear notching, and castration are presented. Segments on weaning, feeding, finishing, and paint branding are included. Includes summary, quizzes, and answers.
NAL Call No.: Videocassette No. 2579.
Keywords: management practices, processing litters, identification.

Manuals and Booklets

Artificial Insemination of Pigs: Trainers Manual [notebook] Kingston, Australia: Pig Research and Development Corporation; 1997, (available from AITEX International PTY LTD).

Knowledge of swine physiology and the use of proper techniques are necessary for a successful on farm artificial insemination program. This notebook contains training manuals for Trainers and Trainees with modules on advantages of artificial insemination, perceived disadvantages of artificial insemination, other technologies, reproductive tract of the sow, and physiology of reproduction in the sow. Estrus detections methods and techniques used to inseminate sows are reviewed.
NAL Call No.: SF396.9 L96 1997.
Keywords: instructional materials, reproductive physiology, breeding, artificial insemination, estrus detection.

Effluent and Housing: Trainers Manual [notebook] Kingston, Australia: Pig Research and Development Corporation; 1997. (available from AITEX International PTY LTD).

This training manual for Trainers only, covers the following modules: housing design principles, water and cooling, building components, pen design, handling and PSE, effluent planning and pre-treatment of, and effluent treatment and land application. Standard commercial housing designs are used.

NAL Call No.: SF396.3 T39 1997.
Keywords: instructional materials, housing, design, heating,, cooling, waste management.

Farrowing: Trainers Manual [notebook] Kingston, Australia: Pig Research and Development Corporation; 1997. Slide set included. (available from AITEX International PTY LTD).

Performance benchmarks are set to measure progress and identify problems that arise in production. Record keeping provides information required to set or change benchmarks. This notebook contains training manuals for Trainers and Trainees with modules on farrowing house targets, pre farrowing management, sow and environment, farrowing management and preweaning mortality, and post farrowing management. A slide set is included of various types of farrowing crate designs and farrowing huts.
NAL Call No.: SF396.3 P66 1997.
Keywords: instructional materials, sows, gilts, farrowing, management, housing.

Health: Trainers Manual [notebook] Kingston, Australia: Pig Research and Development Corporation; 1997. (available from AITEX International PTY LTD).

Keeping good records, recording diseases, and setting realistic targets are important in any swine herd health program. This notebook contains training manuals for Trainers and Trainees with modules on the cost of disease, herd health, medication and hygiene, grower/finisher health, respiratory disease complex, reproductive failure, destruction, disposal, and post mortems.
NAL Call No.: SF971 C37 1997.
Keywords: instructional materials, herd health, disease, mortality, post mortem exams.

Herd Manager: Trainers Manual [notebook] Kingston, Australia: Pig Research and Development Corporation; 1997. (available from AITEX International PTY LTD).

This notebook was developed for swine managers. It contains training manuals for Trainers and Trainees with modules on decision making, cost of production, stockmanship and animal welfare, matings and farrowing, nutrition and feeding, herd health, cost of disease, genetics, and emerging technologies.
NAL Call No.: SF395 S642 1997.
Keywords: instructional materials, production costs, stockmanship, breeding, farrowing, feeding, herd health.

Human Resources: Trainers Manual [notebook] Kingston, Australia: Pig Research and Development Corporation; 1997. Includes slide set. (available from AITEX International PTY LTD).

Consideration of procedures to induct new employees to work on the swine farm is important but often overlooked. Few trained pig specialists are available in the current labor market. New workers need to be provided with opportunities to develop husbandry and management skills.
This notebook contains training manuals for Trainers and Trainees with modules on induction programs and coaching, occupational health and safety, self image, and working in teams. A series of slides covering occupational health and safety risks in the piggery are included.
NAL Call No.: HD9435 A2 S56 1997.
Keywords: instructional materials, labor, husbandry skills, occupational health, safety.

Mating and Reproduction: Trainers Manual [notebook] Kingston, Australia: Pig Research and Development Corporation; 1997. (available from AITEX International PTY LTD).

The purpose of this course is to evaluate and set performance targets for the mating shed. This notebook contains training manuals for Trainers and Trainees with modules on mating management objectives, estrus detecion and mating, gilt pool management, boar management, weaned sow management, and pregnancy.
NAL Call No.: SF396.9 T74 1997.

Keywords: instructional materials, sows, gilts, reproductive performance, record keeping, management.

Nutrition: Trainers Manual [notebook] Kingston, Australia: Pig Research and Development Corporation; 1997. Slide set included. (available from AITEX International PTY LTD).

Feed costs represent a high proportion of total feed costs (more than 55%) for the Australian swine producer. It is vital for producers to have an understanding of swine nutrition and how it can affect herd performance. This notebook contains training manuals for Trainers and Trainees with modules on basic pig nutrition, measuring nutritional performance of the herd, optimizing feed intake and feed quality, and feeding programs. More than forty slides covering nutritional issues on the farm included.
NAL Call No.: SF396.5 V37 1997.
Keywords: instructional materials, feeding, nutrition, feed intake, quality, feed costs.

On Farm Euthanasia of Swine Options for the Producer [booklet]. Des Moines, Iowa: American Association of Swine Practitioners; National Pork Producers Council in cooperation with the National Pork Board; revised 2001; 5 p. Available online at http://www.pork.org

Because it is usually impossible or impractical for the veterinarian to be available for all euthanasia on-farm, producers themselves often need to perform humane euthanasia of pigs. Five methods are described with consideration of human safety, pig welfare, skill required, cost, aesthetics, and limitations.
NAL Call No.: HV4731 O5 2001.
Keywords: euthanasia, welfare, humane, methods.

Pig Welfare Advisory Group [booklets]. London, United Kingdom: Department for Environment, Food, and Rural Affairs (formerly MAFF); 1997. 9 booklets. Available online at http://www.defra.gov.uk

In the United Kingdom the Welfare of Livestock Regulations of 1994 required that the use of tethers and confinement stalls for pigs be phased out by January 1999. The Pig Welfare Advisory Group represents organizations involved in pig production concerned with the need for guidance on alternatives systems to sow stalls and tethers. The Pig Welfare Advisory Group is credited with the development of a series of booklets which provide information on alternative dry sow housing systems. The following booklets are included in the series:

Introduction of sows into groups.
NAL Call No.: SF396.3 I58 1997

Non-straw or low straw systems for housing dry sows.
NAL Call No.: SF396.3 N66 1997

Cubicles and free-access stalls.
NAL Call No.: SF396.3 C83 1997

Yards and individual feeders.
NAL Call No.: SF396.3 Y37 1997

Yards or kennels with floor feeding.
NAL Call No.: SF396.3 Y371 1997

Outdoor sows.
NAL Call No.: SF396.3 O98 1997

Electronic sow feeders (ESF).

NAL Call No.: SF396.3 E44 1997

Keywords: sows, housing, alternative production systems, electronic feeding systems, stalls, cubicles, outdoor housing.

Profitable Pork: Strategies for Hog Producers [bulletin]. Washington, D.C.: Sustainable Agriculture Network; 2001; 15 p. Available online at http://www.sare.org/publications/hogs.htm

An informative bulletin exploring successful alternative hog production systems in the United States. Methods for determining the right system appropriate for each farm are discussed. Descriptions of deep straw systems, farrowing in deep straw, hoop structures, and pigs on pasture, are reviewed. Environmental concerns and organic pork are also covered. A listing of organizations, additional publications, Websites, and listservs are included.
NAL Call No.: SF395.8 A1 P76 2001.
Keywords: sows, finishing pigs, housing, alternative production systems.

Pork Industry Handbook [notebook] West Lafayette, Ind.: Cooperative Extension Service, Purdue University; 1978?-present.

Periodically updated looseleaf notebook containing educational extension service fact sheets and bulletins divided into ten major subject areas: swine production systems, breeding and genetics, reproduction, nutrition, management, housing, waste management, herd health, marketing, and pork quality.
NAL Call No.: SF395 P62.
Keywords: feeding, housing, production systems, waste management, health.

Swine Care Handbook [booklet] Des Moines, Iowa: National Pork Board; revised 2002; 34 p. Available online at http://www.pork.org

The purpose of this handbook is to provide pork producers with current information on swine care practices that are recommended for safe, humane, and efficient pork production. Subjects covered include: husbandry, handling, breeding herd management, environmental management, facilities and equipment, feeding and nutrition, and herd health management.
NAL Cal No.: IPM030304216.
Keywords: feeding, health, husbandry, breeding, housing, ventilation, waste management.

Swine Management Manual [notebook] Honolulu, Hawaii: Agriculture Development in the American Pacific (ADAP) Project; 1996.

An instruction manual developed for swine educators located in the Pacific islands. Modules on health programs, vaccination and parasite control, nutrition, reproductive health, and baby pig management are included.
NAL Call No.: SF395 S94 1996.
Keywords: instructional materials, swine producers, feeding, herd health, husbandry, Hawaii.

Swine Welfare Fact Sheets [fact sheet series]. Des Moines, Iowa: National Pork Board in cooperation with the American Association of Swine Practitioners; Four fact sheets. Available online at http://www.pork.org

A series of fact sheets focusing on swine welfare. Fact sheets on U.S. Pork Producer Code of Practice, ethics, transport, and stress available online and in print. Emphasis on science based information.
Keywords: welfare, code of practice, transport, stress.

Weaners Growers Finishers: Trainers Manual [notebook] Kingston, Australia: Pig Research and

Development Corporation; 1997. (available from AITEX International PTY LTD).

Profitability and sustainability are the ultimate tests of a successful piggery. This notebook contains training manuals for Trainers and Trainees with modules on production costs in Australia, health, grower herd performance, and emerging technologies and industry changes.
NAL Call No.: SF395 S643 1997.
Keywords: instructional materials, cost of production, herd health, performance, technology.

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Books and Proceedings

This section contains a listing of books and proceedings published from 1999-2003 relating to swine care and welfare.

American Society of Agricultural Engineers (2000). ***Swine Housing: Proceedings of the First International Conference: October 9-11, 2000***, Des Moines, Iowa. American Society of Agricultural Engineers, St. Joseph, Michigan, ASAE publication 701P0001, 401 p., ISBN: 1-892769-10-7.
NAL Call No.: SF396.3 S952 2000.
Keywords: swine housing, production, new and traditional systems for farrowing, wean-to-finish, finishing facilities, animal welfare, environment.

Cowart, R.P.; Casteel, S.W. (2001). ***An Outline of Swine Diseases: A Handbook***, 2nd ed., Iowa State University Press, Ames, Iowa, 191 p.
NAL Call No.: SF971 C695 2001.
Keywords: swine medicine, veterinarian's role in swine production, health management techniques, etiology, epidemiology, clinical signs, diagnosis, treatment, prevention, disease control, toxic agents, North America.

Cranwell, P.D. (2001). ***Manipulating pig production VIII. Proceedings of the Eighth Biennial Conference of the Australian Pig Science Association, Adelaide, Australia, November 25-28, 2001***, 281 p., Australasian Pig Science Association: Werribee, Australia, ISBN: 0-957-7226-1-3.
Keywords: breeding, husbandry, nutrition, health, production, feeds, food safety, meat quality, meat hygiene, Australia.

Dohner, J.V. (2001). ***The Encyclopedia of Historic and Endangered Livestock and Poultry Breeds*** Yale University Press: New Haven, USA, 514 p., ISBN: 0-300-08880-9.
NAL Call No.: SF105.275 U6 D65 2001.
Keywords: goats, sheep, pigs, cattle, equines, poultry, humans and animals, natural history, domestication, husbandry, breed profiles, conservation, endangered species.

EMBRAPA (2001). ***Proceedings of the 1st International Virtual Conference on Pork Quality: Welfare, Transport, Slaughter and Consumer, November 16- December 16, 2000***, Concordia, Brazil, EMBRAPA Suinos e Aves, 251 p.,
Keywords: animal welfare, boars, carcass quality, food consumption, meat quality, handling, slaughter.

English, P. (1992). ***Stockmanship: Improving the Care of the Pig and Other Livestock*** Ipswich, Farming Press: U.K., 190p.
NAL Call No.: SF71.2 S76 1992.

Keywords: human-animal relationships, livestock workers, handling, production.

Ewing, S.A.; Lay, D.C.; Borell, E. von (1999). ***Farm Animal Well-being: Stress Physiology, Animal Behavior, and Environmental Design*** Prentice Hall: Upper Saddle River, NJ, 357 p., ISBN: 0-13-660200-2.
NAL Call No.: SF756.7 E94 1999.
Keywords: behavior, stress, housing, design, biology of the stress response, stressors, control, physical environment, diet, social environment.

Federation of Animal Science Societies (1999). ***Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching*** Federation of Animal Science Societies: Savoy, IL, 1st rev. ed., 120p.
NAL Call No.: QL55 G8 1999.
Keywords: laboratory animals, guidelines, husbandry, teaching, testing, animal welfare, humane education.

Gordon, I.R. (1997). ***Controlled Reproduction in Pigs*** CAB International: Wallingford, Oxon, UK; New York, 247 p., ISBN: 0851991165.
NAL Call No.: SF768.2 S95G67 1997.
Keywords: reproduction, breeding, review of literature, reproduction control and manipulation, controlled breeding, sows, estrous cycle, associated events, artificial control of estrus and ovulation, pregnancy testing, control of farrowing, more frequent farrowing in pigs, increasing litter size, embryo transfer, breeding pigs at younger ages.

Graeme, T.; Kruger, I.; Ferrier, M.(1994). ***Plan It, Build It*** NSW Agriculture: Tamworth, N.S.W., 331 p.
NAL Call No.: SF396.3 P54 1994.
Keywords: pig housing, farm buildings, design, construction, Australia.

Grandin, T. (2000). ***Livestock Handling and Transport***, 2nd ed., CAB International: Wallingford, UK; New York, 449 p., ISBN: 0-85199-409-01.
NAL Call No.: SF88 L58 2000.
Keywords: cattle, swine, sheep, handling, fear, human animal relationships, stock person training, manager training, stress, welfare, assessment, transport, thermoregulation, meat quality, loading, unloading, slaughter.

Harmon, J.(2001). ***Swine Breeding and Gestation Facilities Handbook*** MidWest Plan Service: Ames, Iowa, 103 p.
NAL Call No.: SF396.3 S89 2000.
Keywords: breeding and gestation facilities, housing, management options, building layouts, equipment needs, manure handling options, environmental control systems, utility requirements.

Hemsworth, P.H.; Coleman, G.J. (1998). ***Human-livestock Interactions: the Stockperson and the Productivity and Welfare of Intensively Farmed Animals*** CAB International: New York, NY, 152p.
NAL Call No.: HV4757 H46 1998.
Keywords: animal welfare, moral and ethical aspects, stockperson, skills, knowledge, status, attitudes, stockperson behavior, animal behavior, future opportunities.

Hovi, M.; Garcia Trujillo, R. (2000). ***Diversity of Livestock Systems and Definition of Animal Welfare. Proceedings of the Second NAHWOA Workshop, Cordoba, Spain, 8-11 January 2000***, University of Reading Library (RUL): Reading, UK, 165p., ISBN: 0-7049-1092-6. Available online at http://www.veeru.reading.ac.uk/organic/proceedings.htm
Keywords: farming, research methodologies, diversity, organic livestock systems, Austria, Spain.

Kyriazakis, I. (1999). ***A Quantitative Biology of the Pig*** C.A.B. International: Wallingford, Oxon, UK ; New York, 408p., ISBN: 0-85199-273-0.
Keywords: genetics, growth, physiology, welfare, quantitative models, production, mathematical models,

physiological processes, feedstuffs, analysis, environment, thermal, social environment, food intake, mating, pregnancy, lactation, body composition, endocrine, voluntary food intake, diet selection, digestion, absorption, excretion, macroelements, carbohydrate, lipid metabolism.

Leopold Center for Sustainable Agriculture (1999). ***Swine System Options for Iowa, Proceedings of a Conference Held February17, 1999***, Iowa State University, Ames, Iowa, Leopold Center for Sustainable Agriculture: Ames, Iowa, 78 p.
NAL Call No.: SF396.3.S954 1999.
Keywords: housing, hoop structures, outdoor pig production, health, feeding, bedding, management.

McGlone, J.; Pond, W.G. (2003). ***Pig Production: Biological Principles and Applications*** Delmar Publishers: USA 480p., ISBN: 0-8273-8484-X.
NAL Call No.: SF395 M37 2003.
Keywords: genetics, reproduction, nutrition, growth, resource management, social farming issues, economics, handling, animal welfare, environmental concerns, modern farming.

National Research Council (1998). ***Nutrient Requirements of Swine*** Subcommittee on Swine Nutrition, Committee on Animal Nutrition, Board on Agriculture, National Research Council 10th ed., National Academy Press: Washington, D.C., 189p. + 1 computer laser optical disc.
NAL Call No.: SF396.5 N87 1998.
Keywords: nutrition, requirements, growth, physiology, water requirements, energy, proteins, amino acids, feed intake, minerals, vitamins, sex and age differences.

Pond, W.G.; Mersmann H.J. (2001). ***Biology of the Domestic Pig***, Comstock Pub. Associates, Cornell University Press: Ithaca, NY, 745 p.
NAL Call No.: SF768.2 S95 B56 2001.
Keywords: physiology, ethology, psychology, husbandry, anesthesia, surgery, genetics, reproduction, growth, body composition, nutrient requirements, digestive system, skeletal and muscular system, respiratory tract, cardiovascular system, hematology, excretory system, integument, endocrinology, immunology, xenotransplantation.

Rothschild, M.F.; Ruvinsky, A. (1998). ***The Genetics of the Pig*** C.A.B. International: Wallingford, Oxon, UK ; New York, 622 p., ISBN: 0851992293,
NAL Call No.: SF396.9.G45.
Keywords: genetics, management, production, technology, improvement in performance, phylogeny, morphological traits, diseases, behavior, transgenics, performance traits, genetic conservation, genome mapping, linkage maps, domestication, breeds, origin, color variation, morphological traits, inherited disorders, reproduction, meat and carcass traits.

Sims, L.D.; Glastonbury, J.R.W. (1996). ***Pathology of the Pig: A Diagnostic Guide*** Barton, A.C.T.: Pig Research and Development Corporation; Bendigo Mail Centre, Victoria, Australia, 456 p.
NAL Call No.: SF971 P382 1996.
Keywords: oral cavity, oesophagus and stomach, small intestine, large intestine, liver, pancreas, peritoneal cavity, cardiovascular system, blood, spleen, lymph nodes, thymus, nasal passages, larynx and trachea, lungs, endocrine glands, bones, joints, skeletal muscle, nervous system, eye, ear, skin, urinary tract, female reproductive tract, mammary gland, male reproductive tract, semen, neonatal mortality, health monitoring, slaughter, diseases, diagnosis, anatomy, veterinary pathology.

Smith, P. (2001). ***Practical Pig Keeping*** Crowood Press: Marlborough, UK, 208 p., ISBN: 1-86126-388-0.
Keywords: piglets, husbandry, feeding, health, breeding, marketing, practical manual.

Straw, B.E. (1999). ***Diseases of Swine*** Iowa State University Press: Ames, Iowa, 8th ed., 1209 p.

NAL Call No.: SF971 D57 1999.
Keywords: physical examination, diagnosis, interpretation of laboratory results, differential diagnosis, viral diseases, bacterial diseases, behavioral problems, coccidia, protozoa, external parasites, gastric ulcers, genetic diseases, developmental diseases, neoplastic diseases, internal parasites, mycotoxins, nutrient deficiencies and excesses, porcine stress syndrome, prolapses, toxic minerals, chemicals, plants, and gases, veterinary practice, immune system, digestive system, mammary gland and lactation problems, nervous system diseases, locomotor diseases, animal welfare, methods of disease control, disease surveillance at slaughter, anesthesia and surgical procedures in swine, therapeutic, veterinary services.

Taylor, D.J.(1999). ***Pig Diseases*** Iowa State Press, Blackwell Publishing: Glasgow, Scotland, 7th ed., 412 p., ISBN:095069326X,
NAL Call No.: SF971 T39 1999.
Keywords: animal welfare, veterinary profession, meat quality, food safety, humane endpoint for slaughter, risks to man, disease therapy.

Varley, M.A. (1995). ***The Neonatal Pig: Development and Survival*** CAB International: Wallingford, 342 p., ISBN: 085198925X.
NAL Call No.: SF395 N46 1995.
Keywords: neonatal pig, piglets, mortality, review, genetics, physiology, gut and nutrition, probiotics, diseases, immunology, behavior, thermoregulation, environment, husbandry, human animal interactions.

Varley, M.A.; Wiseman, J. (2001). ***The Weaner Pig: Nutrition and Management*** CABI Publishing: Wallingford, UK; New York, 336 p., ISBN: 0-85199-532-2.
NAL Call No.: SF396.5 W43 2001.
Keywords: piglets, weaning, transition, liquid diet, dry feed, digestive physiology, immune status, social, physical environments, growth, feed efficiency, development, nutrition, immunology, health, ethology, physical environment.

Whittemoore, C.T. (1998). ***The Science and Practice of Pig Production*** Blackwell Science: Oxford; Malden, Mass, 2nd ed., 624 p., ISBN: 0-632-05086-1.
NAL Call No.: SF395 W48 1998.
Keywords: carcass quality, growth, reproduction, genetics, welfare, behavior, codes of practice, disease prevention, energy value of feedstuffs, nutritional value of proteins and amino acids, energy and protein requirements, water, mineral, vitamin, requirements, appetite, feed intake, diet formulation, product marketing, environmental requirements, production performance monitoring, simulation modeling, housing diagrams, photographs, charts, tables, extensive resource.

Wiseman, J.; Varley, M.A.; Chadwick, J.P. (1998). ***Progress in Pig Science*** Nottingham University Press: Thrumpton, Nottingham, 472 p.
NAL Call No.: SF395 P76 1998.
Keywords: comprehensive overview, genetics, neonate, weaning, growing pig, reproduction, marketing, meat quality, environmental aspects, management, health, welfare, marker assisted selection, immunological development, gut regulation, post weaning enteric and respiratory syndromes, crop biotechnology, feed improvement, embryo survival, nutrition-endocrine interaction in the female pig, GATT, meat assessment, aroma, flavor, robots for meat assessment, pollutants.

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Website Resources

Website addresses change periodically. The sites listed are current as of July 2003. Emphasis was placed on selecting resources relevant to the care, welfare, and housing of swine.

AgNIC Swine Page
http://www.lib.iastate.edu/services1/ref/agnic/aboutpage_txt.html

This site provides links to notable World Wide Web resources that deal with the production, marketing, and research aspects of swine and pork. Agricultural, marketing, and statistical sites; databases, library and publisher catalogs, and other reference sources are also listed.

Agriculture and Agri-food Canada
http://www.agr.gc.ca/index_e.phtml

Agriculture and Agri-Food Canada provides information, research and technology, and policies and programs to achieve security of the food system, health of the environment and innovation for growth. Abstracts available from "The Lennoxville Symposium on Farm Animal Welfare in Canada: New technologies, research and world trade."

AITEX
http://www.aitex.com.au/aitexpig/edm_index.html

Quality educational materials for producers and swine educators can be found here. Training modules, audiovisuals, and books, covering swine health, breeding, stockmanship, and farm management can be ordered through this site.

Alberta Farm Animal Care (AFAC) Association
http://afac.ab.ca

AFAC is an association started by farmers. AFAC's goal is to promote responsible animal care and enhance public understanding of Alberta's animal agriculture. AFAC participates in issues and legislation that encourage research into relevant to animal care. Website contains *Farm Animal Welfare News*, a publication that contains current information on farm animal welfare initiatives, relevant issues, and research conducted in Canada. Links to reports, codes of practice, legislative information, and information on training courses for swine handling and transport, are included.

Alternatives to Intensive Confinement Systems for Farm Animals: An Annotated Bibliography
http://labanimals.awionline.org/farm/alt-farming.html#pigs

Full text links to articles on alternative hog production systems. Hoop structures, Swedish deep-bedded systems, huts, pasture raising, and other alternative housing systems are reviewed. Information on sustainable methods that allow the expression of species typical behaviors such as nesting and rooting is included.

American Association of Swine Veterinarians (AASV)
http://www.aasv.org/

The AASV is an educational professional society organized to increase the knowledge of veterinarians in the field of swine medicine and practice.

Animal Well-Being and Stress Control Systems
http://www.nps.ars.usda.gov/programs/105s2.htm

The Agricultural Research Service (ARS) is the principal research agency of the U.S. Department of Agriculture. ARS is charged with extending the Nation's scientific knowledge across a broad range of program areas. This Website describes ARS research initiatives in the area of farm animal well-being and stress.

Animal Welfare Information Center (AWIC)
http://awic.nal.usda.gov

National Agricultural Library
10301 Baltimore Ave.
Beltsville, MD 20705
Tel: (301) 504-6212, Fax: (301) 504-7125, Contact us: http://awic.nal.usda.gov/contact-us

The Animal Welfare Information Center (AWIC) located at the U.S. Department of Agriculture's National Agricultural Library provides reference services primarily for patrons using animals covered by the Animal Welfare Act. Farm animals used in teaching, testing, and non production oriented research, are covered by the Act. AWIC produces bibliographies on the welfare and husbandry of swine, cattle, horses, sheep, poultry, dogs, cats, rabbits, and rodents. The Animal Welfare Information Center Bulletin contains several articles on agricultural animal care and use including anesthesia, analgesia, animal transport, and animal welfare issues. The AWIC Website includes these documents. The site also contains links to US farm animal policies, guidelines, and congressional activity.

Animal Welfare Issues: Swine
http://www.nal.usda.gov/awic/newsletters/v9n3/9n3holde.htm#toc1

An overview of current welfare issues facing the swine industry today, including animal welfare assessment, current practices, and alternative production systems are briefly reviewed.

Full text Codes of Recommendations and Minimum Standards for swine and other species are available at this site. Humane treatment of swine during transport, slaughter, and sale yards covered.

Animal Well-Being and Stress Control Systems
http://www.nps.ars.usda.gov/programs/105s2.htm

The Agricultural Research Service (ARS) is the principal research agency of the U.S. Department of Agriculture. ARS is charged with extending the Nation's scientific knowledge across a broad range of program areas. This Website describes ARS research initiatives in the area of farm animal well-being and stress.

Animal Welfare and Behavior Group at Michigan State
http://www.msu.edu/~zanella/current.html

Description of current research projects of the Animal Welfare and Behavior Group at Michigan State. Projects include studies on memory and learning in pigs, and a novel animal welfare training program patterned after traditional animal judging teams. The program offers students the opportunity to assess the welfare of animals maintained under different housing, husbandry and environmental conditions.

Animal Health and Welfare
http://www.defra.gov.uk

The health and welfare of animals are central to Department for Environment, Food and Rural Affair's (DEFRA) work of protecting and improving livestock and controlling and eradicating disease. The Animal Health and Welfare pages are divided into various subject areas including: BSE, Tuberculosis, Identification, Animal Welfare, International Trade, Disease surveillance and control. The Animal Welfare page for swine includes

codes of practice, a series of online booklets on alternative sow housing, outdoor pig production, stress, lameness, and condition scoring.

Annotated Database on Refinement of Housing and Handling Conditions and Environmental Enrichment for Laboratory Animals. Part II: Cattle, Calves, Chickens, Goats, Horses, Quails, Pigs, Sheep
http://www.awionline.org/Lab_animals/biblio/refine.htm

An annotated database of articles, abstracts, book chapters, and books, on all aspects of refinement and environmental enrichment are available at this site. Housing and handling of farm animals is included. The database is regularly updated

ARS News and Information "New Feeder Curbs Pregnant Sows' Hoggish Ways"
http://www.ars.usda.gov/is/pr/2002/020715.htm

This article describes an automated feeding system that is currently being tested at Texas Tech University. The feeding system eliminates the need for crating sows during their four-month pregnancies.

Combined Livestock Issues Database Information
http://www.liru.asft.ttu.edu/refman/index.htm

A reference database compiled for farm animal researchers and educators. The database provides references on contemporary issues in animal agriculture.

Companion Animals and Livestock
http://www.dpi.nsw.gov.au/agriculture/livestock/pigs

This site is provided by New South Wales Department of Agriculture. Swine pages contain information on swine breeding, selection, health, nutrition, and housing. Low cost straw-based housing is reviewed.

Cooperative State Research Education and Extension Service (CSREES) Home Page
http://www.nifa.usda.gov/

CSREES link the research and education programs of the U.S. Department of Agriculture and works with land-grant institutions in each state, territory and the District of Columbia. The mission of CSREES is in cooperation with partners and customers, to advance a global system of research, extension and higher education in the food and agricultural sciences and related environmental and human sciences to benefit people, communities, and the Nation. A clickable map of extension programs by state is also available. Swine producers are encouraged to use this site to locate extension materials that are specific to their state's climatic conditions, types of housing, feed resources, etc.

Danish National Committee for Pig Production
http://danishpigproduction.dk/

This site contains English translations of annual reports and other important documents prepared by the Danish National Committee for Pig Production. The Annual Report 2002 contains information summarizing current research findings and developments on swine housing, feeding, health, and welfare in Denmark.

Dr. Temple Grandin's Web Page
http://www.grandin.com/

Full text, abstracts, reviews, and general information based on or related to the work of applied ethologist Temple Grandin. Topics include livestock behavior, design of stockyards and restraining systems, humane and ritual slaughter, stress and meat quality, current research, animal welfare/rights, and books.

Encyclopedia of Farm Animal Behavior (EFAB)
http://www.liru.asft.ttu.edu/EFAB/default.asp

This online encyclopedia containing audio and video clips of farm animals exhibiting various behaviors, is intended for research and teaching purposes. The encyclopedia is provided by the USDA, ARS, Southern Plains Area, Livestock Issues Research Unit, and Multimedia Division.

European Commission on Animal Welfare
http://europa.eu.int/comm/food/index_en.htm

The European Commission's activities on animal welfare recognize that animals are sentient beings. The Directorate General for Health and Consumer Protection is responsible for setting standards for the welfare of animals on the farm, during transport and at slaughter. Links are available to animal welfare policy objectives, legislative action, ongoing initiatives, and international animal welfare issues.

Healthy Animals
http://www.ars.usda.gov/is/np/ha/

The Healthy Animals Website offers an online compilation of animal health related research news. The site is maintained by the U.S. Department of Agriculture's chief scientific agency, the Agricultural Research Service.

Humane Hogs
http://www.newfarm.org/features/0103/wilson_hogs/index.shtml

An article describing the experiences of an Iowa farm family that uses pasture farrowing and Swedish deep-bedded systems to raise hogs.

International Veterinary Information Service (IVIS)
http://www.ivis.org

A not-for-profit organization created to provide clinically relevant, up-to-date information to veterinary practitioners, veterinary students, clinicians and researchers worldwide using the internet. The IVIS Website allows users free access to original, electronic textbooks, reviews, updates, and other resources on a wide variety of veterinary topics. All publications are original contributions written specifically for the IVIS Website and reviewed by the editor(s) of the book. Each book includes links to information about relevant medications. Book chapters can be printed on a desktop printer for easy reading. Veterinary related information available for farm, laboratory, companion, and exotic animal species.

Is Outdoor Housing an Enriched Environment for Pigs?
http://www.nal.usda.gov/awic/newsletters/v7n3/7n3morro.htm

Segment of an article entitled *Environmental Enrichment for Dairy Calves and Pigs*, written by Julie Morrow-Tesch, Ph.D. Discussion of the effects of environmental enrichment on the brain development in pigs.

National Pork Board
www.porkboard.org

Many swine related resources available online including brochures, fact sheets, video clips, handbooks, and

conference listings. Subject coverage includes, health, biosecurity, genetics, animal care, environmental issues, and quality assurance. Emphasis on swine production issues that are of relevance to U.S. producers.

National Institute for Animal Agriculture (NIAA)
http://www.animalagriculture.org

The National Institute for Animal Agriculture (NIAA) is an umbrella organization of producers, veterinarians, processors, corporations, and commodity organizations that advocate programs that improve animal health, care, and food safety. NIAA produces educational videos and pamphlets on animal care, behavior, handling, transportation, and disease. Authors include animal scientists working in academic research institutions and commercial production facilities. Videos, pamphlets, and meeting proceedings may be ordered directly from NIAA.

NetVet
http://netvet.wustl.edu/vet.htm

NetVet focuses on veterinary resources with links to veterinary education, listservs, organizations, publications, and images. This award-winning site is an excellent starting point for looking for materials for training personnel in care and use of agricultural animals. A useful feature of NetVet is the Electronic Zoo. Among the Electronic Zoo animal group icons are horses, cows, pigs, small ruminants, and birds. Each icon contains a list of Websites related to these species.

Ohio Agricultural Education WWW Server
http://www-cms.ag.ohio-state.edu/Home.html

This server provides ordering and pricing information for Learning Laboratory Kits, interactive CDs, books, videos, and brochures. Subject coverage includes quality assurance, animal care, welfare, and handling, of beef, dairy, swine, goats, sheep, rabbits, and dogs. Teaching materials for FFA projects are listed as well.

Oklahoma State University, Department of Animal Science Web Page
http://www.ansi.okstate.edu

This is a quality Website containing sections covering breeds of livestock, free ration formulation software, extension publications, youth instructional materials, and more.

Ontario Pork
http://www.ontariopork.on.ca/

Information on animal welfare standards, codes of practice, guidelines, humane pig transport, and current Canadian animal welfare legislation are available.

Ontario, Canada, Ministry of Agriculture, Food and Rural Affairs, Livestock Web Page
http://www.omafra.gov.on.ca/english/livestock/index.html

Web pages are available for dairy, beef, swine, goats, and alternative livestock. The swine page includes information on animal welfare, housing, health, genetics, reproduction, and more.

Pasture Based Swine Management
http://www.clt.astate.edu/dkennedy/index.htm

The purpose of this site is to provide a description of a project funded by USDA, Sustainable Agriculture

Research and Education (SARE) to support the development of sustainable swine enterprises for limited-resource farmers in the Mississippi Delta. General and technical information about alternative methods of producing pork are presented.

Pig Health Website
http://www.PIGHEALTH.COM/

A searchable Website which includes information on pig health, swine welfare, hog management, pork safety, and new books in print.

ThePigSite
http://www.thepigsite.com

A Website devoted to pig health and welfare. Information on disease descriptions, clinical signs, diagnosis, treatment, management, and disease control are covered.

Pork Industry Institute Texas Tech University
http://www.depts.ttu.edu/porkindustryinstitute/index.htm

Well maintained site featuring research papers, presentations, and lectures from swine expert John McGlone, PhD. Current information on alternative housing systems for sows including many photos of outdoor pig production systems is included. Discussion of EU legislation and current trends in the US.

PORK@PURDUE
http://www.ces.purdue.edu/pork/

Full text fact sheets, bulletins, slide presentations, and conference proceedings covering swine care, behavior, welfare, stress, housing, and management. Recent research report comparing two different types of housing for pregnant gilts are included.

Prairie Swine Centre
http://www.prairieswine.com/

Center for research excellence in research, technology transfer and education all directed at efficient, sustainable pork production in Canada. Scope includes nutrition, behavior, welfare, housing, environment, management, and training programs.

Profitable Pork: Strategies for Hog Producers
http://www.sare.org/publications/hogs.htm

An informative full text bulletin exploring successful alternative hog production systems in the United States is presented. Methods for determining the right system appropriate for each farm are discussed. Descriptions of deep straw systems, farrowing in deep straw, hoop structures, and pigs on pasture, are reviewed. Environmental concerns and organic pork are also covered. A listing of organizations, additional publications, Websites, and listservs are included.

Recognition of Pain in Farm Animals
http://www.nal.usda.gov/awic/newsletters/v5n1.htm

An article written by James E. Breazile, M.A., D.V.M., Ph.D., in the Animal Welfare Information Center's Newsletter, that discusses pain perception in farm animals.

Review of Swine Genetics in the U.S.
http://www.nsif.com/Conferences/1995/review.htm

Author Larry D. Young, USDA-ARS, U.S. Meat Animal Research Center Clay Center, Nebraska, reviews the history of swine genetics in the United States.

Stotfold Pig Development Unit (Unit was closed after 23 years. See article below.)
http://www.thepigsite.com/swinenews/14924/development-unit-closes-after-23-years

The Stotfold Pig Development Unit is one of the British pig industry's centers of excellence for practical research and communication of technical information. This informative web page contains booklets on sow feeding, sow welfare, tail docking, tooth clipping, and environmental issues.

Stress Assessment for Pigs
http://www.stress-counselling.co.uk/pigs.htm

Information on a new product developed to monitor sounds occurring in pig buildings or transport vehicles that may indicate distress. The device detects and warns of a specific frequency spectrum associated with distress vocalization of hogs. The system is intended to give hog producers an early warning of stressful experiences occurring to the pigs, so that action can be taken before the welfare of the pigs and the economic viability of the swine farm enterprise is unduly compromised.

Sustainable Hog Production Overview
http://www.attra.ncat.org/attra-pub/Hogs.html

This publication discusses various aspects of sustainable hog production including: breed selection, feed alternatives, odor and dust problems, waste and crop nutrient management, health, humane concerns, vertical integration, and methods for identifying alternative markets. Information on hooped shelters for finishing hogs and gestating sows, pasture production and farrowing, Swedish deep-bedded group nursing system, and alternative marketing of pork is available. Links for sources of additional information are also provided.

Swine Care Handbook
http://www.pork.org

The purpose of this handbook is to provide pork producers with current information on practices that are recommended for safe, humane, and efficient pork production. Subjects covered include: husbandry, handling, breeding herd management, environmental management, facilities and equipment, feeding and nutrition, and herd health management. The handbook is produced by the National Pork Board and was revised in 2002.

Swine Breeds
http://www.ansi.okstate.edu/breeds/swine/

This site provides educational and informational resources on breeds of swine throughout the world, provided by the Oklahoma State University, Department of Animal Science.

Swine Health and Production
http://www.aasv.org/shap.html

A refereed journal published bimonthly by the American Association of Swine Practitioners.

Swine Resources
http://www.ansi.okstate.edu/library/swine.htm

This site is provided by the Oklahoma State University, Animal Science Department Virtual Library. It contains links to many swine related resources including extension materials, teaching materials, software information, and more.

University of Minnesota Extension Service: Swine Production
http://www.extension.umn.edu/topics.html?topic=4&subtopic=87

This educational Website contains swine extension publications on natural and organic pork production, niche marketing, alternative hog production systems, and more.

US Pig Gene Mapping Coordination Program
http://www.animalgenome.org/pig/

Links provided to swine gene databases, swine gene maps, and species comparative gene maps.

USDA APHIS Veterinary Services (VS) Centers for Epidemiology and Animal Health (CEAH)
http://www.aphis.usda.gov/about_aphis/programs_offices/veterinary_services/ceah.shtml

Information on bio security strategies for swine farms. E coli, Salmonella other disease pathogens covered.

Walking Farrowing Pen: New Welfare Solution for Nursing Sows
http://nationalhogfarmer.com/mag/farming_unique_design_gives/
http://www.mardar.pl/pobieranie/swob_utrzymanie_loch_rus.pdf

Description and design photos of a farrowing pen that allows the sow freedom to move around are found here. The “Walking Farrowing Pen” was developed in Poland through research carried out at the University of Agriculture in Lublin and IBMER in Poznan.

Welfare of Intensively Kept Pigs: Report of the Scientific Veterinary Committee, 1997
http://europa.eu.int/comm/food/fs/sc/oldcomm4/out17_en.html

A comprehensive report on swine management and housing options that ensure good health and welfare. The contents include a review of the concepts and measurement of animal welfare; biology and behavior of pigs in natural and semi-natural conditions; husbandry; production system comparisons, economics, and future research.

Worldcat
http://www.worldcat.org/

This is a great way to locate library resources near your home or farm. Your local librarian can assist you in borrowing training materials from state libraries and/or the National Agricultural Library (NAL). However, not all local libraries have web pages. For libraries not listed check your local telephone directly.

XPLOR, University of Missouri, Cooperative Extension Swine Publications
http://muextension.missouri.edu/explore/agguides/ansci/swine.htm

This site contains fact sheets and abstracts relating to swine feeding, management, breeding, housing, and waste management. Hoop structures for gestating sows are included.

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This section should be of interest to researchers, graduate students, extension specialists, and veterinarians. Citations were selected from scientific journals and proceedings from 1999-2003.

Behavior

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Keywords: restraint of animals, urine, escape responses, alarm pheromones, animal behavior, feeding behavior, vocalization, alert behavior, exploratory behavior.

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NAL Call No.: QL750.A6.
Abstract: The extent to which the size of the gestation stall, relative to the size of the sow, affects the normal basic postural behavioural needs of sows like standing, sitting and lying was assessed using 25 sows randomly selected from four farms. The postural behaviour of the animals was recorded using a time-lapse video recorder. The relationships of duration of postures, time taken for various postural changes and frequency of postural changes with stall measurements in relation to sow measurements were analysed. Negative correlations ($P<0.01$) were found between stall length relative to sow length and the duration of time for which the sows were standing. The relationships between the duration of postures and stall width relative to animal breadth were not different ($P>0.05$). The time taken to change from a standing to lying posture was negatively correlated ($P<0.05$) with stall length relative to animal length. Similar correlations ($P<0.05$) were noted between stall width relative animal breadth and the duration of postural change from standing to sitting and from sitting to standing. Stall width relative to animal breadth was negatively related to the frequency of postural change from standing to sitting ($P<0.05$). The results suggested that the freedom of movement of pregnant sows in stalls could be improved by a little increase in the space allowance within the stall.
Keywords: gestation, housing, movement, postural behavior, pregnancy, stall dimensions.

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Beattie, V.E.; Sneddon, I.A.; Walker, N.; Weatherup, R.N. (2001). **Environmental enrichment of intensive pig housing using spent mushroom compost.** *Animal Science: an International Journal of Fundamental and Applied Research* 72 (1): 35-42, ISSN: 1357-7298.

NAL Call No.: SF1.A56.

Abstract: In a comparative study which examined the effect of having access to mushroom compost in an otherwise barren environment there were three treatments and six replicates. The three treatments were (T1) control barren pen providing 0.7 m2 per pig with fully slatted floor, (T2) empty horizontal rack suspended above the pigs' heads and (T3) mushroom compost on rack as in treatment 2. Pigs released particles of compost from the rack by nosing the metal grid from below. Almost twice as many pigs with access to mushroom compost (T3) nosed the rack ($P < 0.001$) and the ground below the rack ($P < 0.001$) as pigs which had a rack with no mushroom compost (T2). Fewer pigs with mushroom compost were involved in behaviours directed at penmates such as nosing, biting and chewing penmates than pigs in treatments 1 and 2 ($P < 0.001$). In addition fewer pigs in T3 were involved in feeding behaviour than in T1 and T2 ($P < 0.05$). Percentages of tail-bitten animals which had to be removed were 11 and 24 for T1 and T2 respectively while T3 had < 1% removed because of tail biting ($P < 0.05$). Apparent food intake was higher ($P < 0.05$) and food conversion ratio tended to be poorer in T1 ($P = 0.1$). It is suggested that pigs will redirect rooting behaviour towards penmates and the feeder in the absence of any rooting substrate. Adding substrate to commercial finishing pens reduces this redirection of behaviour and improves welfare by minimizing injury through tail biting.

Keywords: housing, enrichment, mushroom compost, physical activity, aggressive behavior, tail biting, animal behavior, feed intake, feed conversion, animal welfare, rooting behavior.

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NAL Call No.: 49 J82.

Abstract: This paper examines the validity of a model that is embedded in a computer-based decision support system to assess the welfare status of pregnant sows in housing and management systems. The so-called SOWEL (SOw WELfare) model was constructed using a formalized procedure to identify and weight welfare-relevant attributes of housing systems in relation to the animal's needs, and evidenced by scientific statements collected in a database. The model's predictions about welfare scores for 15 different housing systems and weighting factors for 20 attributes were compared with expert opinion, which was solicited using a written questionnaire for pig-welfare scientists. The experts identified tethering and individual housing in stalls as low welfare systems. The group of mid-welfare systems contained indoor group-housing systems and an individual-housing system with additional space and substrate. The five best systems were all systems with outdoor access

and the provision of some kind of substrate such as straw. The highest weighting factors were given for the attributes “social contact,” “health and hygiene status,” “water availability,” “space per pen,” “foraging and bulk,” “food agonism,” “rooting substrate,” “social stability,” and “movement comfort.” The degree of concordance among the experts was reasonable for welfare scores of housing systems, but low for weighting factors of attributes. Both for welfare scores and weighting factors the model correlated significantly with expert opinion (Spearman's Rho: 0.92, P<0.001, and 0.72, P<0.01, respectively). The results support the validity of the model and its underlying procedure to assess farm animal welfare in an explicit and systematic way based on available scientific knowledge.
Keywords: sows, pregnant, behavior, health, housing, husbandry, animal welfare, computer techniques, foraging, hygiene, prediction, water availability.
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Abstract: The aim of the study is to examine indoor, outdoor and mixed kinds of keeping pigs and their influences on animal health, fattening efficiency and meat quality. Considering prevention of cruelty to animals and from a veterinarian and ethological point of view, exclusive outdoor keeping is the most profitable for pig health and well being. However, the outdoor keeping of pigs has its drawbacks such as the need for much space, a high expenditure of work, a high feed consumption and a low level of lean meat.
Keywords: crossbreds, thesis, animal health, animal welfare, feed conversion efficiency, feed intake, finishing, meat quality, morbidity, piglets, seasons, Germany, German language.
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NAL Call No.: QL750.A6.
Abstract: The domestic pig, Sus scrofa, builds a maternal nest in the day before parturition. A model for porcine nest building has been established, in which exogenously administered prostaglandin (PG)F2 alpha is used to induce nesting behaviour in cyclic, pseudopregnant and pregnant pigs. This experiment was designed to examine the effect of PGF2 alpha on the preferences of non-pregnant gilts for pens bedded with straw compared with bare pens. Ten 6-month-old nulliparous female pigs (gilts) were tested in an arena, which consisted of four pens (1.8 m x 1.7 m), a neutral area (1.5 m x 3.4 m) and a start area (1.5 m x 3.4 m). Two of the pens contained 2 kg of fresh straw and the remainder of the testing arena was devoid of straw. On the first day of testing half of the pigs were given a control intramuscular injection of 3 ml 0.9% saline and the remainder were given an intramuscular injection of 15 mg PGF2 alpha and their behaviour scored for 1 h after treatment. On the following day the treatments were reversed, such that each pig was given both treatments (saline or PGF2 alpha). There was no significant effect of the order of treatment on behaviour. After saline-treatment the pigs spent most of their time in the pens containing straw (59%) and the least amount of time in bare pens (5%). In the straw pens, saline-treatment induced bouts of oronasal contact with straw of a relatively long duration (11-100 s), which we interpret as foraging. In the hour after PGF2 alpha, treatment the pigs also spent most of their time in the pens containing straw (44%) and the least amount of time in bare pens (10%), but they interacted with the straw in a markedly different way. PGF2 alpha, treated pigs displayed bouts of oronasal contact with straw of a relatively short duration (2-10 s) which, together with high frequencies of pawing at straw, lifting and carrying straw in the mouth, we interpret as nest building behaviour. Superimposed on this is the finding that gilts spend more time in the neutral areas after PGF2 alpha, treatment than they did after saline-

treatment. PGF2 alpha, treated pigs spent most of their time engaged in nesting behaviour within the straw pens but they also gathered and deposited straw in different areas of the test arena (neutral and start areas); behaviours not seen after saline-treatment. We conclude that pigs generally prefer a pen containing straw bedding to a bare pen but that PGF2 alpha alters the way they interact with straw, inducing behaviour similar to prepartum nest building.
Keywords: behavior, gilts, litter, nesting, pregnancy, prostaglandins.
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Abstract: A number of behavioural problems are associated with weaning piglets including belly nosing, ear and tail biting, and low intake of solid food. These appear to be less pronounced in piglets reared on outdoor systems, which initially consume more solid food and show less belly nosing and aggression than comparable indoor-reared piglets. The objective of this study was to investigate how these differences in post-weaning behaviour relate to the piglets' pre-weaning behaviour in the two rearing environments. The study was carried out at a commercial pig unit, where piglets of the same genotype are born into conventional indoor or outdoor farrowing systems. In the intensive system, sows were singly housed prior to farrowing in crates and their piglets received a solid "creep" food prior to weaning. On the outdoor system, sows were allowed to build straw nests in arks for farrowing and both sow and piglets had access to pasture. Indoor and outdoor piglets were weaned at 24 (+/-3) days of age and mixed in straw-yard housing with access to a solid food. Prior to weaning, teat-directed activity was more common in indoor piglets than outdoor piglets. Outdoor piglets performed more rooting, standing and locomotion and were seen chewing the sows' roll-nuts. Following weaning, outdoor-reared piglets performed more feeding and rooting, and less fighting than indoor-reared piglets. This study supports previous findings that undesirable activities such as fighting are less common in piglets weaned from outdoor systems, even when mixed with indoor piglets. In addition, outdoor-reared piglets were more likely to exploit solid food even though they did not have access to creep food prior to weaning.
Keywords: piglets, weaning, pig housing, farrowing pens, creep feeding, animal behavior, floor pens, agonistic behavior, tail biting, physical activity, age differences, teats, animal welfare, farrowing crates, farrowing arks.

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NAL Call No.: QL750.A6.
Abstract: In a 2x2 factorial experiment, the effects of gestation and farrowing housing on: (1) periparturient behaviour and circulating prolactin, prostaglandin F2 alpha (PGF2 alpha) and oxytocin in gilts with access to peat, straw and branches, and (2) correlational relationships between the periparturient behaviour and hormones

were studied. The treatments consisted of housing in stalls or pens from mating to day 110 of gestation followed by housing in farrowing crates or pens until after parturition. Landrace x Yorkshire gilts were observed from video recordings (n=25) from 20 h prepartum and blood sampled via jugular catheters (n=16) from 24 h prepartum until 2 h after the birth of the first piglet. There was an interaction between gestation and farrowing housing affecting the start of nest-building (P=0.03). Gilts that experienced a change in type of housing accommodation commenced nest-building closer to parturition than gilts that were penned both during gestation and at farrowing (both P<0.05). The housing environment did not affect the timing of termination of nest-building, behaviour during parturition, or the course of parturition. However, relative to base level, crated gilts sat more from 16 to 6 h prepartum, whereas this was the case for penned gilts only from 9 to 7 h prepartum. Crated gilts also tended to change posture more often (P=0.07) and to lay more in sternal recumbency (P=0.095). This suggests that familiarity with the environment in combination with space to move about and/or availability of materials is important in the timing of nest-building. Confinement during farrowing did not appear to impair feedback from the materials and the nest, although increased number of postural changes may reflect the motivation but inability to nest-build, or general discomfort in the crate. There was a development over time in postural and nest-building behaviours as well as in plasma concentrations of prolactin, PGF2 alpha (measured by the metabolite PGFM) and oxytocin, but there were only few effects of housing treatments on hormones or associations between behaviour and hormones. The results suggest that nest- building occurs independently of a prepartum rise in prolactin, but that oxytocin may be associated with the termination of nest-building as there was a negative correlation with nosing (P<0.01) and arranging of nest-building materials (P<0.001). Farrowing crate housing appeared to have fewer effects on periparturient behaviour and course of parturition than reported in previous studies where effects of confinement and provision of nest-building materials may have been confounded. Thus, provision of nest-building materials to crated sows may have beneficial effects on sow behaviour and welfare.

Keywords: behavior, farrowing houses, farrowing pens, gilts, hormone secretion, nesting, nests, oxytocin, parturition, prolactin, prostaglandin F2alpha.

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NAL Call No.: QL750.A6.

Abstract: The aim of this experiment was to determine the interactive effects of handling and environmental enrichment on the behaviour, performance and welfare of the growing/finishing pigs. Groups of pigs were exposed to one of eight treatments arranged in a 2 x 4 factorial design with two levels of handling (M: minimal and P: pleasant), and four levels of environmental enrichment (B: barren, C: chain, S: chopped straw, or T: destructible toy). Daily food intake was significantly affected by handling during 1-6 weeks with the P groups eating slightly more food than the M groups (1.88 vs. 1.75 kg/day; S.E.D.=0.077; P<0.05), however, this increased intake was not reflected in daily liveweight gain or food conversion ratio during the same period. The time taken for a group of pigs to exit their pen during a routine handling test was significantly affected by the handling treatments (46.2 vs. 37.8 s for P and M groups, respectively; S.E.D.=3.38; P<0.05). Behavioural time budgets, and postmortem muscle pH and stomach lesion scores were unaffected by treatment. These results suggest that pleasantly handled pigs are more difficult to move during routine husbandry tasks which may be mediated through their reduced fear of humans. 27 ref.

Keywords: behavior, animal welfare, environmental impact, feed conversion efficiency, feed intake, finishing, live weight gain.

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Keywords: farrowing pens, growth, maternal behaviour, pig housing, piglets, preweaning period, sows, suckling, survival.
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NAL Call No.: 44.8 J822.
Keywords: behavior, lying behavior, posture, space requirements, meeting abstract.

English, P.R.; Grant, S.A.; McPherson, O.; Edwards, S.A.(1999). **Evaluation of the effects of the positive "befriending" of sows and gilts ("pleasant" treatment) prior to parturition and in early lactation on sow behaviour, the process of parturition and piglet survival.** In: *Farm Animal Welfare, Who Writes the Rules? Proceedings of an International Symposium Organized by the British Society of Animal Science, Edinburgh, UK, 1999*, A.J.F. Russel, C.A. Morgan, C.J. Savory, M.C. Appleby, and T.L.J. Lawrence (eds.), British Society of Animal Science (No. 23): UK, pp.132-136.

NAL Call No.: SF5 B74 no. 23.
Keywords: gilts, lactation, parturition, piglets, young animals, sows, survival, animal welfare, livestock, legislation, handling, stockmen, pregnancy.

Erhard, H.W., M. Mendl, and D.D. Ashley (1999). **Aggression in pigs: an example of using basic research in an applied context.** In: *Farm Animal Welfare, Who Writes the Rules? Proceedings of an International Symposium Organized by the British Society of Animal Science, Edinburgh, UK, 1999*, A.J.F. Russel, C.A. Morgan, C.J. Savory, M.C. Appleby, and T.L.J. Lawrence (eds.), British Society of Animal Science (No. 23): UK, pp.163-164.
NAL Call No.: SF5 B74 no. 23.
Keywords: animal welfare, livestock, legislation, aggressive behavior.

Erp-van der Kooij, E. van; Kuijpers, A. H.; Schrama, J. W.; Eerdenburg, F. J. C. M. van; Schouten, W. G. P.; Tielen, M. J. M. (2002). **Can we predict behaviour in pigs? Searching for consistency in behaviour over time and across situations.** *Applied Animal Behaviour Science* 75 (4): 293-305, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Abstract: Individual differences in animal behaviour could elucidate the differences in stress coping style, which have consequences for production, health and welfare. Therefore, individual behavioural differences in pigs and consistency of responses in different test situations were studied. If differences in behaviour reflect coping characteristics, then behaviour in one situation should predict behavioural reactions in other situations and at other times. In this study, a backtest was performed on 315 Great Yorkshire Dutch Landrace piglets at 3, 10 and 17 days of age. On day 3, groups of approximately 10 piglets per sow were formed, based on escape behaviour in the first backtest (backtest score): high resisting (HR, all scores >3), low resisting (LR, all scores <3), miscellaneous (MISC, various scores between 0 and 10) or original (OR) litters to determine if group composition would influence coping behaviour. In weeks 5-7 and/or 10-12, a human approach test (HAT), a novel object test (NOT), and an open door test (ODT) were performed with all pigs simultaneously, in the home pen. Pearson correlation coefficients were calculated between the test results and a factor analysis was performed. Furthermore, data were analysed on pen level, and within MISC- and OR-pens on animal level, using multivariate linear models. Significant correlations were found between the backtests and between HAT, NOT and ODT. Backtest results on three ages loaded on the same factor, and HAT, NOT and ODT at one age also loaded on one factor. No differences were found in HAT, NOT and ODT for the different pens (HR, LR, MISC and OR). On animal level, animals with higher backtest scores also had higher HAT scores at 5-7 weeks ($P<0.05$) within the MISC-pens. At 10-12 weeks, no differences were found. This study suggests that there are consistencies in behaviour of pigs over time and across situations, so coping can be regarded as a trait variable. However, since correlations are well below one, we suggest that other factors such as time (development) and (test) situation may also play an important role in determining an individual's behavioural reaction. The absence of correlations between backtest and the group tests is explained by the theory that these different tests measure different aspects of the coping style.
Keywords: piglets, Landrace, Yorkshire, breed, behavior, breed differences, stress, stress response.
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Farmer, C.; Palin, M.F.; Sorensen M.T.; Robert, S. (2001). **Lactation performance and behaviour of Upton Meishan and Large White sows and litters.** *Livestock Production Science* 70 (1-2): 179, ISSN: 0301-6226.
NAL Call No.: SF1.L5.
Keywords: sows, Upton Meishan, Large White, breed, lactation performance, litter behavior, milk energy content, nursing frequency, sow behavior, meeting abstract.

Gallagher, N.L.; Giles, L.R.; Wynn, P.C. (2002). **The development of a circadian pattern of salivary cortisol secretion in the neonatal piglet.** *Biology of the Neonate* 81 (2): 113-118, ISSN: 0006-3126.
NAL Call No.: QH301.B46.
Keywords: neonatal piglets, saliva, cortisol, glucocorticoid, secretion, circadian rhythm, behavior, escape attempts, vocalization, intensity, alternative to blood sampling.

Gardner, J.M.; Lange, C.F.M. de.; Widowski, T.M. (2001). **Belly-nosing in early-weaned piglets is not influenced by diet quality or the presence of milk in the diet.** *Journal of Animal Science* 79 (1): 73-80, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: piglets, early weaning, animal behavior, feed intake, liveweight, liveweight gain, diets, dried whey, milk substitutes, blood plasma, soybean oilmeal, fish meal, stereotyped behavior.

Gardner, J. M.; Duncan, I.J.H.; Widowski, T.M. (2001). **Effects of social "stressors" on belly-nosing behaviour in early-weaned piglets: is belly-nosing an indicator of stress?** *Applied Animal Behaviour Science* 74 (2): 135-152, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Abstract: Belly-nosing is a behaviour pattern commonly observed in early-weaned piglets. Although belly-nosing has been referred to as an indicator of stress, the factors involved in its causation are unknown. The objective of this study was to determine if the differences in stress at weaning influence the development of belly-nosing behaviour in piglets weaned at 12-14 days of age. To test this, we attempted to create varying degrees of stress at weaning, by subjecting piglets to different combinations of social stressors. The experimental design was a 2 x 2 factorial, with group composition (mixed litters versus littermates) and density (0.15 m2 per pig (HD) versus 0.4 m2 per pig (LD)) as the main factors. Six replicates per treatment, of six piglets/replicate were used in three, 3-week trials (n = 144). Behaviour was recorded every 5 min during one 4 h period on day 1 and during two 4 h periods on days 3, 7, 10, 14, 17 and 21 post-weaning. Feed intake, water intake and growth rate were determined weekly. Blood was collected, from half of the piglets, on day 2 pre-weaning and days 3 and 10 post-weaning for neutrophil:lymphocyte ratios (N:L) and plasma cortisol concentrations. During the first week post-weaning, feed intake was higher for piglets housed at HD ($P<0.05$) but no other differences in performance were observed. Contrary to what was expected, aggression was greater for piglets housed at LD than those housed at HD overall, and on days 10 ($P<0.05$) and 17 ($P<0.05$) post-weaning. On day 3 post-weaning, variation in N:L was greater for piglets weaned with littermates ($P< 0.05$) and piglets housed at LD ($P<0.05$). On day 10 post-weaning, both mean plasma cortisol ($P<0.05$) and variation in N:L ($P<0.05$) were higher for piglets housed at LD. Although plasma cortisol, N:L and aggression were all suggestive of a greater stress response in piglets housed at LD, there were no differences in belly-nosing for any treatment ($P>0.10$). Belly- nosing did develop across all treatments by day 7 post-weaning. Belly-nosing does not appear to be a general behavioural indicator of stress.
Keywords: behavior, blood picture, feed intake, growth rate, hydrocortisone, lymphocytes, neutrophils, piglets, stress, water intake, weaning.
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NAL Call No.: QP801.H7H64.
Keywords: gilts, prostaglandin (PG)F2alpha treatment, stimulates nest building, behavior, pseudopregnant nulliparous gilts, pseudopregnancy, exposure to newborn piglets, standing, pawing, rooting, lifting, carrying straw, scratching, savaging of piglets.

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NAL Call No.: SF55.A78A7.
Keywords: behavior, growth, illumination, artificial lighting, wavelengths, feed intake, aggressive behavior, performance, body condition, red light, feed conversion efficiency, animal welfare.

Gonyou, H.W. (2001). **The social behaviour of pigs.** In: *Social Behaviour in Farm Animals* Keeling, L.J.; Gonyou, H.W. (Eds.), CABI Publishing: Wallingford, UK, pp.147-176, ISBN: 0-85199-397-4.
Keywords: abnormal behavior, husbandry, animal welfare, communication between animals, group interaction, group size, social behavior, social structure, social systems, space requirements.

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NAL Call No.: QL750.A6.
Keywords: cattle, pigs, slaughter, restraint, handling, welfare, auditing, technology transfer.

Gregory, S.A.; Friend, T.H.; Piedrahitab, J.; Nevilla, C.H.; Walker, S. (2003). **Behavioral variation among cloned pigs.** *Applied Animal Behaviour Science* 81(4): 321-331, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: genetics, clone, behavior, variation, resting, play, food preferences.

Groot, J. de; Ruis, M.A.W.; Scholten, J.W.; Koolhaas, J.M.; Boersma, W.J.A. (2001). **Long-term effects of social stress on antiviral immunity in pigs.** *Physiology and Behavior* 73 (1/2): 145-158, ISSN: 0031-9384.
NAL Call No.: QP1.P4.
Abstract: Mixing of unfamiliar pigs is common practice in intensive pig husbandry. Since pigs maintain a dominance hierarchy, mixing often leads to vigorous fighting. Apart from the negative impact that fighting has on welfare, there is evidence that the social stress associated with fighting suppresses immune function. In the present experiment, we investigated the impact of mixing on specific long- term immune responses and protection against challenge infection after vaccination with pseudorabies virus (PRV). Specific pathogen-free (SPF) pigs were mixed pairwise with an unfamiliar same-gender conspecific or left undisturbed with a same-gender littermate at 3 days after vaccination with PRV. Half of the pigs were females (gilts) and half were castrated males (barrows). Mixing increased agonistic behaviour to the same degree in gilts and barrows. Cortisol concentrations in saliva and catecholamine excretion in urine were increased in mixed pigs, and these effects were independent of dominance status and gender. Subsequently, the effects of mixing, gender, dominance status and interactions between these factors on immune response parameters were studied. The main result was that mixed barrows showed suppressed immune responses after vaccination and increased clinical symptoms after challenge infection compared to control barrows. Mixed gilts however did not differ from control gilts. It also appeared that mixed dominants were more seriously affected than mixed subordinates were. We conclude that, in some pigs, social stress after mixing suppresses the immune response to a viral vaccine and consequently impairs protection against challenge infection. 59 ref.
Keywords: agonistic behavior, antiviral properties, catecholamines, gender relations, gilts, hydrocortisone, immune response, immunity, stress, vaccination, vaccines, Aujeszky virus, porcine herpesvirus.
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Guy, J.H.; Rowlinson, P.; Chadwick, J.P.; Ellis, M.(2002). **Behaviour of two genotypes of growing-finishing pig in three different housing systems.** *Applied Animal Behaviour Science* 75 (3):193-206, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Abstract: This trial compared the behaviour of 720 growing-finishing pigs, progeny of either indoor (Large White x Landrace) or outdoor (part-Meishan or part-Duroc) sows mated to Large White boars, when housed in either outdoor paddocks, straw yards or fully-slatted pens. Space allowance per pig in outdoor paddocks, straw yards and fully-slatted pens was 19.98, 1.63 and 0.55 m2, respectively with a group size of 20. Pigs were fed ad libitum from an average of 30-80 kg liveweight. Pig behaviour was observed during daylight for a total of 6 h, using both individual (focal) and group (scan) sampling. There were relatively few differences in behaviour between genotypes, although the outdoor genotype spent a higher proportion of observations in straw yards and fully-slatted pens engaged in social activity ($P<0.05$) compared to the indoor genotype. Pigs housed in straw yards spent significantly more time examining the floor and moving ($P< 0.001$), and significantly less time tail-biting ($P<0.01$) compared to those housed in fully-slatted pens, where a larger proportion of observation time was spent lying inactive ($P<0.001$). Pigs in outdoor paddocks spent a large proportion of observation time inside the shelter hut (0.69), where it was not possible to determine their behaviour, although rooting and exploring the floor was the most frequently observed behaviour when the pigs were outside. Interaction between genotype and housing system did not occur to any major degree. It is concluded that, for the housing systems used in this study, pig behaviour was enriched and welfare enhanced in straw yards compared to fully-

slatted pens. Further research is needed, however, before any conclusions can be made regarding the behaviour of pigs in outdoor paddocks. 13 ref.
Keywords: Duroc, Landrace, Large White, Meishan, pig breeds, progeny animal behavior, housing, finishing, genotypes, slatted floors, tail biting.
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Harris, M.J.; Li, Y.; Gonyou, H.W. (2001). **Savaging in gilts and second parity sows: A study of seven commercial farms.** *Journal of Dairy Science* 84 (Supplement 1): 15, Joint Meeting of the American Dairy Science Association, American Meat Science Association, American Society of Animal Science and the Poultry Science Association, Indianapolis, Indiana, USA, July 24-28, 2001, ISSN: 0022-0302.
NAL Call No.: 44.8 J822.
Keywords: sows, gilts, piglets, farrowing date, fear response, parity, piglet mortality, piglet savaging, vocalization, meeting abstract

Hay, M.; Orgeur, P.; Levy, F.; Le Dividich, J.; Concordet, D.; Nowak, R.; Schaal, B.; Mormede, P. (2001). **Neuroendocrine consequences of very early weaning in swine.** *Physiology and Behavior* 72 (1-2): 263-9, ISSN:0031-9384.
NAL Call No.: QP1.P4.
Abstract: An experiment was conducted to investigate the consequences of very early weaning of piglets on neuroendocrine variables and growth. Sixty piglets from eight litters were either weaned on Postnatal Day 6 (early weaning, or EW piglets) or left with their dam until normal weaning at Day 28 (control piglets, or C). At Days 5, 7, 11, 14, and 19, urine was collected between 7:00 and 8:00 a.m. for the measurement of catecholamines, glucocorticoids, and creatinine. Compared with C, EW piglets displayed a transient increase in urinary cortisol on the day following separation from their dam (Day 7) (P<.05). Urinary norepinephrine (NE) was three times lower in EW compared to C piglets from Day 7 until Day 14 (P<.01) but there was no difference between the two groups on Day 19. Urinary epinephrine (EPI) did not differ between C and EW piglets on the day after weaning. Thereafter, EW piglets displayed a three times drop in urinary EPI as compared to C piglets until the end of the period (P<.01). Weaning induced an immediate reduction in food intake and growth rate and at Day 28, the body weight of EW piglets was 1.60 kg lower than that of C piglets (P<.0001). In conclusion, weaning of 6-day-old piglets results in a marked and prolonged suppression of the release of catecholamines. This result likely reflects physiological responses to insufficient energy intake after weaning, as reflected also by changes in thermoregulatory behavior. The transient increase in cortisol excretion in weanlings may be caused by both emotional distress and acute food deprivation.
Keywords: neurosecretory systems, physiology, weaning, aging, behavior, body weight, catecholamines, urine, chromatography, high pressure liquid, ion exchange, cortisone, hormones, hydrocortisone.

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NAL Call No.: SF396.5 W43 2001.
Keywords: age at weaning, aggressive behavior, husbandry, feeding behavior, housing, piglets, social behavior, stress, stress response, vocalization.

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NAL Call No.: HV4701.A557.
Keywords: learning ability, foraging, food source, social dominance, experimental design, visual perspective, subordinate behavior, animal welfare.

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Keywords: competitive foraging task, analytical method, animal welfare, cognitive ability, social behavior, social status, stress, visual perspective, meeting abstract.

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NAL Call No.: 49 J82.
Keywords: behavior, cognition, production, animal well-being, meeting abstract.

Hemsworth, P.H. (2003). **Human animal interactions in livestock production.** *Applied Animal Behaviour Science* 81(3):185-198, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: dairy cattle, pigs, human-animal relationships, stockperson attitude, behavior, fear, productivity, welfare.

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NAL Call Number: HV4701.A557.
Keywords: piglets, weaning, group size, metabolism cages, animal behavior, fearfulness, escape responses, mental stress, housing, animal experiments, experimental design, animal welfare, Denmark.

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NAL Call No.: QL750.A6.
Keywords: piglets, rearing, enrichment, weaning, behavior, novel environment, social encounter.

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http://www.nal.usda.gov/awic/newsletters/v9n3/9n3holde.htm
NAL Call No.: aHV4701.A952
Keywords: pigs, animal welfare, pig housing, floor space, social dominance, stress factors, extensive livestock farming.

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NAL Call No.: HV4701.A557.
Keywords: sows, nose, extensive livestock farming, animal behavior, paddocks, damage, grazing, physical activity, mastication, animal welfare, frustration, stone chewing, bull rings, clip rings.

Hunter, E.J.; Jones, T.A.; Guise, H.J.; Penny, R.H.C.; Hoste, S. (2001). **The relationship between tail biting in pigs, docking procedure and other management practices.** *The Veterinary Journal* 161 (1): 72-79, ISSN: 1090-0233.
NAL Call No.: SF601.V484.
Abstract: The tail length (docked, tipped or undocked) and tail status (bitten or unbitten) of 27,870 pigs from 450 units was recorded at six UK abattoirs. A farm survey of the final finishing stage was used to investigate the relationship between management practice and tail biting. This showed that docking was the most important factor influencing the probability of being not bitten, with 2.4% of docked and 8.5% of long-tailed pigs being tail-bitten. The following factors reduced the probability of long-tailed pigs being tail-bitten; light straw provision, use of natural ventilation or artificially controlled natural ventilation (ACNV), mixed sex grouping, meal or liquid feeding, and use of double or multi-space feeders. Docked and long-tailed pigs provided with

light straw and natural ventilation/ACNV had levels of tail biting of 1.2% and 4.3% respectively; 3.9% of docked pigs with artificial ventilation and no straw were tail-bitten. Long-tailed pigs fed via double or multi-space feeders also had 3.9% of tails bitten.
Keywords: behavior, animal, bites and stings, injuries, tail, surgery, husbandry, methods, epidemiology, questionnaires, England.

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NAL Call No.: QL750.A6.
Keywords: handling, animal behaviour, animal welfare, tests, sounds, vision, stress.

Jarvis, S.; Calvert, S.K.; Stevenson, J.; vanLeeuwen, N.; Lawrence, A.B. (2002). **Pituitary adrenal activation in pre-parturient pigs (Sus scrofa) is associated with behavioural restriction due to lack of space rather than nesting substrate.** *Animal Welfare* 1(4): 371-384, ISSN: 0962-7286.
NAL Call No.: HV4701.A557.
Abstract: Previous research has shown that pre-parturient primiparous pigs (gilts) housed in behaviourally restrictive farrowing crates without straw redirect their nest-building behaviour to non-manipulable substrates such as the bars of the crate. These gilts also show elevated plasma adrenocorticotropic hormone (ACTH) and cortisol levels, particularly around the peak of nest-building activity, when compared to gilts in larger pens that have been provided with a manipulable substrate (straw). It remains unclear whether these behavioural and physiological responses to crating result from the lack of a suitable nesting substrate or from the restricted space. This study investigated the effects of space (crate [C] versus pen [P]) and straw (straw [S] versus no straw [NS]) using a 2 x 2 factorial design. Thirty-four gilts were implanted with an indwelling jugular catheter at around 12 days before parturition. They were moved to one of the four environments five days before parturition, and blood sampling and recording of behaviour were carried out during the pre-parturient period. Penned gilts (P), irrespective of straw availability, spent more time standing and walking and performed more total substrate-directed behaviour than crated (C) gilts. When straw was not available to penned gilts, a large proportion of their substrate-directed behaviour was redirected to the floor. Space also had an effect on ACTH and cortisol levels across the entire pre-parturient phase, with C gilts having higher levels than P gilts irrespective of straw availability, but particularly so at the peak of nest-building activity. There was no effect of straw on ACTH or cortisol levels. Overall, it appears that increased space, perhaps through allowing locomotion, increases substrate-directed behaviour of pre-parturient gilts. When space is available but straw is absent, pre-parturient gilts redirect their nest-building behaviourto the floor. The ability to express substrate-directed behaviour as a result of increased space is reflected in lower levels of indicators of physiological stress.
Keywords: sow, piglets, piglets, ACTH, animal welfare, cortisol, farrowing, gilt, nest building, environmental stimuli, prepartum behavior, straw, progesterone, stress.
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Jarvis, S.; Vegt, B.J. van der.; Lawrence, A.B.; McLean, K.A.; Deans, L.A.; Chirnside, J.; Calvert, S.K. (2001). **The effect of parity and environmental restriction on behavioural and physiological responses of pre-parturient pigs.** *Applied Animal Behaviour Science* 71 (3): 203-216, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: gilts, sows, farrowing, farrowing pens, litter, posture, maternal behavior, nesting, behavior patterns, behavior change, blood plasma, hydrocortisone, stress response, farrowing crates, periparturient behavior, restricted nest building.

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Keywords: calves, piglets, operant conditioning techniques, assessment, behavioral needs, social contact, social behavior, aggression, flank pushing.

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NAL Call No.: 44.8 J822.
Keywords: outdoor farrowing, parturition, piglet mortality, sow, posture, lying, sitting, standing, meeting abstract.

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NAL Call No.: 49 J82
Abstract: Two hundred eighty-seven lactating Newsham sows and their litters were used to determine the effects of intensive indoor (n = 147) and intensive outdoor (n = 140) production systems on sow and litter productivity and behavior. All sows were of contemporary age and fed a completely balanced sorghum-based diet. Behavior data were collected by live observation on 40 sows and litters (20 indoor and 20 outdoor) using a 5-min scan sample over a 4-h period in the afternoon (1400 to 1800). The durations of lying (90.0 vs 72.1 +/- 2.76% of time observed) and drinking (4.42 vs 1.41 +/- 0.6% of time observed) were higher (P < 0.01) among indoor than among outdoor lactating sows. Nursing interval and feeding and sitting behaviors were not different (P > 0.05) between production systems. Piglets spent more (P < 0.05) time walking (10.1 vs 5.2 +/- 1.72% of time observed) and engaged in play activity (5.0 vs 1.7 +/- 1.26% of time observed) when housed outdoors than indoors. Outdoor piglets had more (P < 0.05) nursing behaviors directed toward the sow (27.5 vs 20.3 +/- 2.02% of time observed) but time spent in contact with the sow did not differ between environments (38.8 vs 39.2 +/- 2.78% of time observed). Treatments did not influence (P > 0.05) any of the sow or piglet production parameters. In conclusion, outdoor-kept Newsham sows and their piglets showed a richer behavioral repertoire, but the diverse environments did not influence production parameters.
Keywords: sows, piglets, performance, animal behavior, animal housing, intensive production, duration, nursing, growth.

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NAL Call No.: QL750.A6.
Keywords: young animals, social behavior, discrimination, stimuli, smell, olfactory stimulation, ammonia, animal welfare, social discrimination, social preferences.

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Keywords: hyperthermia, body temperature, heart rate, stress, animal welfare, physiology, animal behaviour, pig housing, aggression.

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Keywords: male, castrated, pigs, housing, concrete floor versus concrete with straw, stress response, autonomic, endocrine, cortisol, saliva, vasopressin, expression, slaughter, brain removal, formalin fixed, paraventricular

nucleus, immunocytochemistry, image analysis, meeting abstract.

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NAL Call No.: QL750.A6.
Keywords: Yorkshire-Swedish Landrace, piglets, sows, behavior, suckling, vocalization, recorded sow grunts, playback, video recordings.

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NAL Call No.: 49 J82
Abstract: In this study the effects of barren vs enriched housing conditions of pigs on their behavior during the lairage period (2-h holding period before slaughter), carcass characteristics, postmortem muscle metabolism, and meat quality were studied. The barren housing system was defined by common intensive housing conditions (i.e., with slatted floors and recommended space allowances), whereas the enriched environment incorporated extra space and straw for manipulation. Salivary cortisol concentrations were measured before transport and at the end of the lairage period. During the lairage period the percentage of time spent walking and fighting by the pigs was registered. Carcass characteristics such as weight, meat percentage, and backfat thickness were determined. At 5 min, 45 min, 4 h, and 24 h postmortem, pH, temperature, and lactate concentrations were determined in the longissimus lumborum (LL) and biceps femoris (BF) muscles. Capillarization of the muscle, mean muscle fiber area, and color and drip loss after 2 and 5 d of storage were determined for both muscle types. Pigs from the barren environment had a significantly higher increase in cortisol from farm to slaughter, but no differences in behavior were observed during the lairage period. Carcass characteristics did not differ between pigs from barren and those from enriched housing conditions. Postmortem lactate formation was significantly lower in LL muscles of enriched pigs at 4 and 24 h postmortem. Capillary density and mean muscle fiber area did not differ between the groups of pigs. The percentage of drip loss at 2 and 5 d after storage of LL muscle samples from enriched-housed pigs was significantly lower than that of the barren-housed pigs. Similar tendencies were found for the BF muscle from pigs kept in an enriched environment, but these were not statistically significant. The housing system did not affect meat color. It is concluded that on-farm improvement of animal welfare by environmental enrichment can also lead to beneficial economic effects after slaughter by improving the water-holding capacity of pork.
Keywords: husbandry, handling, housing, meat standards, physiology, abattoirs, animal welfare, behavior, psychology, hydrocortisone, blood, hydrogen-ion concentration, lactic acid, metabolism, skeletal muscle chemistry.

Koba, Y.; Tanida, H. (1999). **How do miniature pigs discriminate between people? The effect of exchanging cues between a non-handler and their familiar handler on discrimination.** *Applied Animal Behaviour Science* 61(3):239-252, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: animal welfare, animal behaviour, perception, vision, colour, smell, odors, senses.

Larsen, V.A.; Kongsted, A.G. (2001). ***Outdoor pig production: production, feeding, reflections on grass cover. [Frilandssohold: produktion, foderforbrug, udsaetningsarsager og graesdaekke.]*** DJF Rapport, Husdyrbrug (No.30), Danmarks JordbrugsForskning: Tjele, Denmark, 46p., ISSN: 1397-9892.
Abstract: In 1996, the Danish Institute of Agricultural Sciences initiated the project “Outdoor pig production.” The project included identification and evaluation of different outdoor production systems on pig farms in Denmark and the implications for animal health and welfare, as well as environmental impact. In addition, the project focused on specific subjects such as piglet mortality, maintenance of pasture, feed consumption and requirements, nutrient balances, reproduction and management of the production in a broad sense. This report is based on the production results obtained in the 3rd year (1999), and also describes feed intake, health and culling of sows, and the level of grass cover. The production systems included single and group farrowing paddocks, dynamic and stable groups, natural service and artificial insemination, as well as outdoor and indoor

facilities for serving and gestation. Arable land varied from 56 to 100 ha, and herd size varied from 117 to 391 sows. Three farms kept some weaned pigs for finishing. Production results varied considerably (8.3-10.3 weaned piglets/litter), and so did feed consumption (1542-1800 SFU/sow/year). Differences in production systems, stocking rates, and production levels resulted in significant variation in the nutrient surplus for nitrogen (114-306 kg N/ha) and phosphorus (9-60 kg P/ha). Outdoor piglet production required special attention with regard to feeding and grass maintenance in order to obtain an acceptable level of environmental pollution. During periods with unfavourable climatic conditions for grass growth, a higher level of grass cover can be maintained by increasing the area available per sow or moving sows to well-established pasture. Experiences with different grass mixtures indicated that a mixture of miniturf and white clover (Trifolium repens) was very suitable, providing a low dense cover. Feed intake was on average 20% higher than theoretical requirements of sows. Possible explanations include the waste of or the fact that feeds are supplied to groups of animals. It is important to consider the requirements of nutrients/energy unit to limit feed costs and environmental impact. In addition, the potential development of individual feeding systems should be considered. 31 ref.
Keywords: health, housing, production, animal welfare, environmental impact, feed intake, grassland management, grasslands, nutrient requirements, pastures, pig farming, feeding, piglet feeding, production costs, sows, Poaceae, Trifolium repens, Denmark, Danish language.
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Maletinska, J.; Spinka, M. (2001). **Cross-suckling and nursing synchronisation in group housed lactating sows.** *Applied Animal Behaviour Science* 75(1): 17-32., ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: sows, pig housing, group size, suckling, synchronization, litter size, age differences, lactation number, lactation stage, sow lactation, fostering, piglets.

Maletinska, J.; Spinka, M. (2001). **Occurrence of allosucking in group housed lactating sows.** *Advances in Ethology* (36): 210, ISSN: 0931-4202.
NAL Call No.: 410 Z35B.
Keywords: behavior, allosucking, lactation, litter age, litter size, nursing synchronization, meeting abstract.

Marchant, J.N.; Broom, D.M.; Corning, S. (2001). **The influence of sow behaviour on piglet mortality due to crushing in an open farrowing system.** *Animal Science: an International Journal of Fundamental and Applied Research*. 72 (1): 19-28, ISSN: 1357-7298.
NAL Call No.: SF1.A56.
Abstract: The objectives of this study were to establish what changes in posture by sows carried a high risk of piglet crushing in a group farrowing system during early lactation and also to determine what factors influenced the risk of crushing during lying down. A total of 24 Large White X Landrace sows were studied during the first 7 days of lactation in a group farrowing system. Cross-fostering was not carried out so as not to influence behaviour. Dead piglets were removed and cause of death ascertained from external observation and post-mortem examination. Sow and piglet behaviour was video-recorded continuously. A total of 268 piglets were born alive, with 67 liveborn piglets subsequently dying during the 7-day experimental period, 50 as a result of crushing. A total of 7425 posture changes were analysed and 11 types of posture change were identified, the most dangerous being lying down from standing and those involving swapping sides, or rolling over, whilst lying. Dangerous events during lying down were more likely to occur (1) in the first 24 h after farrowing, (2) when the sow lay down in the middle of the pen, (3) when the sow lay down without carrying out much piglet-directed pre-lying behaviour and (4) when the piglets were spread out but near to the sow. The amount of pre-lying behaviour decreased over time and crushing mortality also decreased. The results confirm that the piglets are most vulnerable to crushing during the first 24 h of life, when they are spending much of their time near the udder and have relatively poor mobility. Co-ordination of behaviour between the sow and her litter is important to reduce the risk of crushing. It is also important that the design of open farrowing systems incorporates knowledge about how crushing deaths occur in order to improve piglet welfare.
Keywords: sows, maternal behavior, posture, behavior patterns, perinatal mortality, age differences, puerperium, farrowing houses, farrowing pens, piglets.

Marchant, F.J.N. (2002). **Piglet and stockperson directed sow aggression after farrowing and the relationship with a pre farrowing, human approach test.** *Applied Animal Behaviour Science* 75 (2): 115-132, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: gilts, sow, piglets, stockperson, aggression by sow, savaging, farrowing, conventional versus open system, human approach test, touching of snout, familiar, unfamiliar, heart rate, social rank, lactation, litter size, mortality, growth rate, survival.

Marchant, J.N.; Whittaker, X.; Broom, D.M. (2001). **Vocalisations of the adult female domestic pig during a standard human approach test and their relationships with behavioural and heart rate measures.** *Applied Animal Behaviour Science*.72 (1): 23-39, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: gilts, vocalization, animal behavior, locomotion, heart rate, interactions, human animal interactions

McGlone, J.J.; Fullwood, S.D. (2001). **Behavior, reproduction, and immunity of crated pregnant gilts: effects of high dietary fiber and rearing environment.** *Journal of Animal Science* 79 (6): 1466-1474, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: The objective of this study was to examine effects of increased gut fill and diverse developing environments on pregnant gilts' behavior and physiology. Gilts were cross-fostered at 1 d of age and transferred to either an indoor or outdoor production unit. Littermate gilts remained in their different environments during development and were moved into individual gestation crates in an indoor gestation unit. Of the 42 gilts, 19 were fed a control diet of fortified sorghum-soybean meal and 23 were fed the same diet with 25% beet pulp (high fiber). Control sows ate 2.0 kg/d and high-fiber sows ate 2.67 kg/d in a large pellet (thus resulting in approximately equal energy intake and differing total dietary intakes). Pregnant gilts had behavior and immune measures sampled at 30, 60, and 90 d of gestation. The day x diet interaction was significant ($P = 0.01$) for duration of standing: sows fed high-fiber diets stood less on d 30, but on d 60 and 90 they and the control sows stood for a similar duration. Sham chewing duration and frequency showed significant ($P < 0.05$) effects of gestation stage x diet x environment. Gilts reared outdoors and fed high fiber increased sham chewing over gestation, whereas all other treatment groups decreased this behavior over time. Outdoor-reared gilts had greater ($P < 0.05$) frequency and duration of drinking behavior than indoor-reared gilts. White blood cell numbers were higher ($P < 0.05$) for gilts fed high-fiber diets than for gilts fed the control diet. Immune (humoral and cellular systems) and reproductive measures (farrowing rate and litter size) and plasma cortisol concentrations were generally not influenced ($P > 0.10$) by diets and rearing environments, suggesting that in spite of significant changes in behavior and feed intake gilts' immune systems were not suppressed or enhanced. Behavioral data alone suggested that indoor-reared gilts showed fewer behavioral adaptations to the crates than outdoor-reared gilts. However, immune measures did not indicate that any treatments resulted in physiological effects indicative of stress.
Keywords: gilts, pregnancy, animal behavior, sexual reproduction, fiber, digesta, litters, feed rations, feeds, feed intake, duration, stress, animal welfare.

Meers, L.; Chedad, A.; Odberg, F.O.; Berckmans, D. (2001). **The effect of a new foraging device on food related aggression in fattening pigs.** *Advances in Ethology* (36): 216, ISSN: 0931-4202.
NAL Call No.: 410 Z35B.
Keywords: fattening pigs, behavior, foraging device, equipment, food related aggression, spatial distribution, meeting abstract.

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NAL Call No.: QL750.A6.
Keywords: animal behavior, aggressive behavior, handling, social behavior, social interaction, arousal, familiarity.

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Keywords: sows, behavior, feeding behavior, stereotypic, operant conditioning, motivation, diets, fiber, performance, physiological functions, reviews.

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NAL Call No.: SF95.A55.
Keywords: sows, food restriction, feed rations, fiber, animal behavior, health, nutritional state, pregnancy, performance, hunger, aggressive behavior, feeding, energy intake, nutrient intake, glucose, insulin, volatile fatty acids, fermentation, stress, animal welfare, literature reviews.

Moinard, C.; Mendl, M.; Nicol, C.J.; Green, L.E. (2003). **A case control study of on-farm risk factors for tail biting in pigs.** *Applied Animal Behaviour Science* 81(4): 333-355, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: pig production, growing/finishing pigs, epidemiology, behavior, tail biting, tail docking, effects, welfare, stocking density, post-weaning mortality, England.

Morgan, C.A.; Lawrence, A.B.; Chirnside, J.; Deans, L.A. (2001). **Can information about solid food be transmitted from one piglet to another?** *Animal Science: an International Journal of Fundamental and Applied Research* 73 (3): 471-478, ISSN: 1357-7298.
NAL Call No.: SF1.A56.
Abstract: When weaned early, piglets commonly take some time to accept solid food, resulting in a growth check and reduced welfare. The transmission of information about food between animals has been demonstrated in other species and it would be advantageous if this occurred in piglets. This experiment investigated the effects of pairing piglets that were consuming solid food with newly weaned piglets. Six litters of piglets did not receive solid food until weaning. In each litter four piglets (3 plus 1 spare) were weaned at 21 days of age and housed together for 7 days and offered one of two foods (3 litters per food). At 28 days of age the remaining piglets were weaned and four pairs of piglets were formed, such that there were three experienced animals paired with three inexperienced observers, each pair having visual contact and varying degrees of physical contact (1: none, 2: through wire mesh, 3: housed together), and a pair of inexperienced piglets (4: housed together) to act as controls. Food intake and weight gain were recorded over a period of 7 days. There was no effect of food type on food intake or live-weight gain of the pairs but the inexperienced pigs had higher gains on food 1 than food 2. The inexperienced pairs ate less food than the other pairs and the experienced/observer pairs that were housed together had the greatest weight gain. The level of variation between piglets was such that there were no significant effects of pairing treatment on the weight gain of the inexperienced animals. Total time spent feeding increased with time from pair formation. The number of simultaneous feeding events was higher for the experienced/observer pairs housed together than for the inexperienced pairs. This experiment has indicated that food intake is stimulated when an inexperienced piglet is housed with an experienced piglet and, with further work, this could be exploited to alleviate the weaning check. 16 ref.
Keywords: piglets, feeding, pair feeding, feed intake, food type, liveweight gain.
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Morgan, C.A.; Nielsen, B.L.; Lawrence, A.B.; Mendl, M.T.(1999). **Describing the social environment and its effects on food intake and growth.** In: *A Quantitative Biology of the Pig* I. Kyriazakis (ed.), CAB International Wallingford, UK, ISBN: 0-85199-273-0, pp. 99-125.
NAL Call No.: IPM990717336.
Keywords: reviews, animal welfare, feeding behavior, group effect, stress, performance, growth, feed intake, environmental factors, pig feeding, housing.

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behaviour of weaned pigs. *Livestock Production Science* 74(1): 13-17, ISSN: 0301-6226.
NAL Call No.: SF1.L5.
Keywords: pigs, weaning, performance, animal behavior, feed dispensers, water, feed intake, feed conversion efficiency, growth rate, aggressive behavior, welfare.

O'Connell, N.E; Beattie, V.E. (1999). **Influence of environmental enrichment on aggressive behaviour and dominance relationships in growing pigs.** *Animal Welfare* 8(3): 269-279, ISSN: 0962-7286.
NAL Call No.: HV4701.A557.
Keywords: aggressive behavior, animal behavior, dominance, environment, aggression, pig housing, suckling, body weight, social behaviour, animal welfare, age differences, husbandry.

Olsen, A.W.; Simonsen, H.B.; Dybkjaer, L. (2002). **Effect of access to roughage and shelter on selected behavioural indicators of welfare in pigs housed in a complex environment.** *Animal Welfare* 11(1): 75-87, ISSN: 0962-7286.
NAL Call No.: HV4701.A557
Abstract: The aim of this study was to examine the effects of roughage and shelter on certain welfare indicators in growing pigs that have access to ample straw and space. The effects of the two treatments were evaluated both by recording the pigs' use of the various areas of the pen and by measuring the frequency of two specific behaviours, "aggression" and "play" that are considered to be significant indicators of welfare in pigs. Seven replicates were used, each involving 96 pigs. The pigs were randomly allocated to eight experimental pens at 10 weeks of age and were observed from 13 to 22 weeks of age. The two treatments, roughage and shelter, were distributed according to a 2x2 design in the pigs' outdoor runs, four of which were located on each side of the barn (north side versus south side). The pigs spent most of their time in the straw- provided areas and the frequency of their aggressive behaviour was also the highest in these areas, suggesting that these locations were the most attractive to the pigs. The pigs with access to roughage showed a lower frequency of aggression ($P<0.05$) and spent more time in the outdoor area where the roughage was placed than those pigs with no access to roughage ($P<0.05$). No other effects of treatment were found on the length of time spent in the different pen locations. Play frequency decreased with age ($P<0.05$) and with increasing temperature ($P<0.01$). Moreover, when housed on the south side of the building, the pigs with access to shelter played more than those without (2.0 versus 1.0 events per hour ($E=0.3$); $P<0.05$); this suggests that the opportunity to regulate the body temperature by use of shade results in improved welfare. In conclusion, the pigs' behaviour indicated that their welfare was improved by free access to roughage and shelter.
Keywords: growing pigs, age differences, aggression, behavior, play, animal welfare, environmental temperature, physical activity, housing, roughage, straw, shelters.
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Olsen, A.W. (2001). **Behaviour of growing pigs kept in pens with outdoor runs. I. Effect of access to roughage and shelter on oral activities.** *Livestock Production Science* 69 (3): 255-264, ISSN: 0301-6226,
NAL Call No.: SF1.L5.
Keywords: behavior, pig housing, straw, shelter, aggressive behavior, roughage, silage, lesions, animal welfare.

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NAL Call No.: SF1.L5.
Keywords: housing, animal behavior, body temperature, thermoregulation, shelter, excretion, orientation, roughage, duration, air temperature.

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NAL Call No.: QL750 B4.
Keywords: stress, aggressive behavior, dominance, piglets, sows, aggression, pig housing, animal welfare.

Orgeur, P.; Hay, M.; Mormede, P.; Salmon, H.; Le Dividich, J.; Nowak, R.; Schaal, B.; Levy, F. (2001). **Behavioural, growth and immune consequences of early weaning in one week old Large-White piglets.** *Reproduction, Nutrition, Development* 41 (4): 321-32, ISSN: 0926-5287.
NAL Call No.: QL1 R35
Abstract: Genetic improvement in sows' prolificity is limited by their milk capacities, which do not allow all piglets to survive or grow normally. This experiment compared the behaviour, growth and immune responses of piglets that were weaned early at 6 days of age (EW) vs. control Large White piglets' (C) suckled by their mothers. Behaviour of 9 litters of 5 to 8 piglets in each group were observed from d5 to d20. All piglets were weighed from birth to d74. Three piglets from each group were slaughtered on d36 for immunological analysis. Until they began to eat dry food, EW piglets walked and vocalised more than C piglets. After that time, when resting, they were less often lying down and more frequently in contact with littermates under the heater. Aggressive behaviour and belly-nosing were more frequent. They displayed a more marked growth check after weaning than did C piglets until 28 days of age. In EW piglets, at 36 days of age, there was a higher density of T- and B-lymphocytes in the gut epithelium and lamina propria, fespectively, in relation to the size of lymphoid follicles of Peyer's patches. The results indicate great behavioural adaptation capacities of very early-weaned piglets, together with earlier maturation of their gut immune system.
Keywords: physiology, aging, drinking behavior, feeding behavior, intestinal mucosa, immunology, growth and development, weaning, adaptation, newborn, growth and development, suckling, b-lymphocytes, t-lymphocytes, body weight, litter size, motor activity.

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NAL Call No.: 49 AR23.
Abstract: The effects of a daily restraint of sows during the last third of pregnancy on endocrine stress reactions, immune responses and growth of offspring were examined. Stress and immune reactions of piglets were tested using an immobilization and ACTH test at 3, 7, 21 and 35 days of age. Lower basal plasma cortisol and increased basal cortisol binding globulin concentrations at 3 days of age were found in piglets exposed to prenatal stress compared with the control piglets. Prenatal stress caused a decrease in the number of glucocorticoid receptors in the hypothalamus, enlargement of adrenal cortex and reduction in thymus weight one day after birth. Prenatal stress also suppressed immune functions on day 1 of life as shown by lower IgG levels and decreased in vitro lymphocyte response to T and B cell mitogens. In addition, piglets that were exposed to prenatal stress had a higher mortality after birth and a tendency for lower birth weights. Morphological, endocrine and immune effects of prenatal stress were observed only on the first days after birth. It is suggested that prenatal stress during late pregnancy in pigs affects the ontogeny of fetal neuroendocrine system via increased maternal stress hormone concentrations.
Keywords: piglets, fetal development, growth, immune response, mortality, pregnancy, stress.
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Keywords: sows, piglets, weaning, pig housing, piglet feeding, floor pens, animal behavior, vocalization, responses, weight losses, bites, liveweight gain, feed intake, litter weight, temperament, maternal behavior, animal welfare.

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NAL Call No.: 41.8 B45.
Abstract: Viewing dominance as an attribute of repeated agonistic interactions between two individuals, the present paper reviews theoretical approaches towards concepts of dominance, methods of measurement, and basic principles and problems connected with social dominance in domestic pigs. Domestic pigs are able to establish social organization structures during all stages of their ontogeny. According to definition, dominance relationships occur when a consistent asymmetry of the result of dyadic agonistic interactions can be assessed. This must not necessarily be connected immediately with a better availability of resources, or a high stability of existing dominance relationships, or a functional definition of dominance. When sociometric characteristics are calculated, it seems to be appropriate to use them for different levels of a biological system (individual, individual pair, group). Investigations of social behaviour and dominance in farm animals should take into account that mechanisms of social behaviour in confined environments are often carried out in parts only. Connections of the dominance concept with other concepts of behavioural regulation should be theoretically considered and further investigated by experimental studies. (91 Refs.).
Keywords: social behavior, social dominance, psychology.

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Keywords: animal welfare, organic farming, animal behavior, disease prevention.

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NAL Call No.: 49 J82.
Keywords: fiber, pregnancy, sows, crude fiber, energy intake, mastication, behavior, appetite, feeding behavior, animal welfare.

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Keywords: breed, Large White x Landrace, newborn, piglets, analgesia, animal welfare, sucrose, tail docking, teeth clipping, pain, human infants, distress, management procedures.

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Keywords: sows, vices, pig farmers, farm surveys, farmers' attitudes, bites, vulva, incidence, dry period, aggressive behavior, floor pens, competition for food.

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NAL Call No.: QL750.A6.
Keywords: gilts, feeding behavior, motivation, operant conditioning tests, pushing a button, food reward, stereotypy, vacuum chewing, chain manipulation, nutrition, diets, feed intake, feeding frequency, number of meals, fiber.

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NAL Call No.: 49 J82.
Keywords: piglets, fostering, fighting, sows, skin lesions, maternal behavior, litter size, sucking, body weight, stress, animal welfare.

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NAL Call No.: S3.A27.
Keywords: sows, pregnant, animal welfare, assessment, definition, indicators, protocol, decision support, human animal relationships, loose housing.

Ruis, M.A.W.; Brake, J.H.A. te; Engel, B.; Buist, W.G.; Blokhuis, H.J.; Koolhaas, J.M. (2002). **Implications of coping characteristics and social status for welfare and production of paired growing gilts.** *Applied Animal Behaviour Science* 75 (3): 207-231, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Abstract: This paper considers the question whether knowledge on individual coping characteristics of growing pigs may be used to improve welfare and production after mixing. Gilts with either reactive or proactive coping characteristics were identified according to behavioural resistance in a backtest, respectively, being low (LR) and high resistant (HR) in this test. At 7 weeks of age, several pairs of unfamiliar gilts were formed, and pairs and dominance relationships were studied over a 3-week period. The following pairs (combinations) were established: two LR gilts (LR/LR; n=12), two HR gilts (HR/HR; n=12), one LR and one HR gilt (LR gilt dominant: LR(d)/HR; n=11), and one LR and one HR gilt (HR gilt dominant: LR/HR(d); n=12). Results showed that on the day of mixing, aggression subsided less quickly and increases in body temperature were higher in LR/HR(d) and HR/HR pairs. Also, during the first week post-mixing, feed efficiency was lower and skin damage was higher in LR/HR(d) and HR/HR pairs. Mixing of two HR gilts caused highest levels of stress, indicated by greater catecholamine concentrations in urine following the day of mixing, and higher baseline levels of plasma ACTH at 1 week post-mixing. The lower tendency of gilts within HR/HR pairs to contact a novel object may present higher fearfulness. In contrast to those of LR/HR(d) pairs, responses of LR(d)/HR pairs revealed much lower levels of stress, which emphasized the importance of dominance relationships, being independent of coping characteristics of individual gilts. We speculate that in LR/HR pairs, dominant LR gilts were able to suppress aggressiveness of HR subordinates. HR or proactive gilts, however, may become aggressive when being dominant. General effects of social status, independent of combination, were also found. Compared to dominants, subordinates showed higher acute cortisol, body temperature and vocal responses to mixing. In the longer term, they showed a higher vocal and parasympathetic responsitivity towards the novel object, and their body growth was impaired. Measures not influenced by combination and social status included those of leukocyte subsets, prolactin, and average heart rates during novelty tests. To conclude, aggressive conditions in newly formed groups, and consequently welfare and production, may largely depend on coping characteristics of individual pigs, but also on dominance relationships. Accordingly, the practical value of the backtest is being discussed.
Keywords: gilts, animal welfare, feed conversion efficiency, group behavior, social status, mixing, aggression, dominants, subordinates, stress, stress response.
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Ruis, M.A.; Brake, J.H.; Engel, B.; Buist, W.G.; Blokhuis, H.J.; Koolhaas, J.M. (2001). **Adaptation to social isolation. Acute and long-term stress responses of growing gilts with different coping characteristics.** *Physiology and Behavior* 73 (4): 541-51, ISSN: 0031-9384.
NAL Call No.: QP1.P4.
Abstract: The present experiment studied the acute and long term stress responses of reactive and proactive prepubertal gilts to social isolation. Gilts with either reactive or proactive features were identified according to

behavioral resistance in a backtest at a young age (2-4 days), respectively being low (LR) and high resistant (HR) in this test. At 7 weeks of age, 12 gilts of each type were socially isolated. Initially, isolation was stressful for both types of gilts, as shown by increased cortisol concentrations and decreased body temperatures. Moreover, both types reacted with increases in exploration and vocalizations. Stress responses to isolation, however, differed in magnitude and/or duration between LR and HR gilts, which was in line with expected reaction patterns on the basis of preferred ways of coping. The cortisol response to isolation was higher in LR gilts, and they generally showed more explorative behavior. HR gilts seemed to be more engaged in walking/running behavior in the first hour after isolation, they generally vocalized more and their noradrenaline excretion in urine was higher at 3 weeks after the start of isolation. Several responses to isolation in the longer term pointed to a prolonged higher general state of stress of HR gilts. Body temperature in HR gilts, for instance, did not recover during 3 weeks of isolation, but values returned to “normal” within 1 day in LR gilts. At 1 week of isolation, relatively high parasympathetic responsivity to novelty was observed in HR gilts, probably due to stress-related high sympathetic reactivity. A shift in percentages of leucocyte subsets, typically occurring under conditions of stress, only developed in HR gilts during isolation. Finally, gastric ulceration was found in one HR gilt, but did not occur in LR gilts. To conclude, LR and HR gilts differed in their strategies to adapt to social isolation, and especially for HR gilts, this procedure seemed to become a chronic stressor.

Keywords: adaptation, psychological physiology, social isolation, stress, acute disease, body temperature, chronic disease, fear, heart rate, hormones, blood, hydrocortisone, hypothalamo-hypophyseal system, organ weight, pituitary-adrenal system, stomach ulcer, pathology.

Ruis, M.A.W.; Groot, J. de., Brake, J.H.A. te.; Ekkel, E.D.; Burgwal, J.A. van de.; Erkens, J.H.F.; Engel, B.; Buist, W.G.; Blokhuis, H.J.; Koolhaas, J.M. (2001). **Behavioural and physiological consequences of acute social defeat in growing gilts: effects of the social environment.** *Applied Animal Behaviour Science* 70 (3): 201-225, ISSN: 0168-1591.

NAL Call No.: QL750.A6.

Keywords: gilts, animal behavior, social interaction, stress, social environment, pig housing, isolation, stress response, hydrocortisone, corticotropin, prolactin, epinephrine, norepinephrine, blood plasma, saliva, leukocyte count, granulocytes, heart rate, growth, social stress, social isolation, litter-mate pair housing, social support, habituation.

Schon, P.C.; Puppe, B.; Manteuffel, G. (2001). **Classification of stress calls of the domestic pig (Sus scrofa) using LPC- analysis and a self organizing neuronal network.** *Archiv fur Tierzucht* 43 (Special): 177-183, ISSN: 0003-9438.

NAL Call No.: 49 AR23.

Abstract: A procedure for characterization, classification and visualization of stress calls in domestic pigs is described. Starting from the acoustic model of sound production features were extracted from calls using the linear prediction method. This procedure, linear prediction coding (LPC), delivered an extremely compact short time representation of the call with a relatively low effort of calculation and a low number of features. A neuronal network was trained so that topological relations of the neurons represented the input vector space of the determined LPC-coefficients. This resulted in a feature map, where the positions of neurons allowed conclusions about the structure of input data. Visualizations of the clustering structure of calls were performed using various types of representations. It is concluded that this procedure allows the development of online monitoring stress calls in farm environments.

Keywords: monitoring, farm environment, stress calls, linear prediction coding, neuronal network.

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Schonreiter, S.; Zanella, A.J. (2001). **Assessment of cortisol in swine by saliva: new methodological approaches.** *Archiv fur Tierzucht* 43 (Special): 165-170, ISSN: 0003-9438.

NAL Call No.: 49 AR23.

Abstract: The common method of saliva sampling with cotton buds was compared with a new Oral Diffusion Sink (ODS) method. ODS method allowed continuous measuring without any manipulation of animals. Steroids from saliva were accumulated for 8 h with a defined flow rate through the ODS. After alcohol extraction all samples were analysed using a radioimmunoassay. Daily profile of cortisol concentration, as well

as the effects of 2 stressors, social isolation and a 2-h transportation, were assessed in 10 German Landrace pigs. The concentration of cortisol in cotton buds was significantly higher in the morning than in the evening. During social isolation, significantly higher cortisol concentrations and disintegration of the circadian rhythm were observed in cotton buds, but not in ODS. Highest cortisol concentrations were found during transportation 60 min after loading (18.9 plus or minus 3.9 nmol/litre). It is suggested that the ODS may be suitable for continuous monitoring of acute stress.

Keywords: German Landrace, breed, diagnostic techniques, hydrocortisone, saliva, sampling, stress, transportation, social isolation.

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Schulze, V.; Roehe, R.; Looft, H.; Kalm, E. (2001). **Effects of continuous and periodic feeding by electronic feeders on accuracy of measuring feed intake information and their genetic association with growth performances.** *Journal of Animal Breeding and Genetics* 118 (6): 403-416, ISSN: 0931-2668.

NAL Call No.: 442.8 Z35.

Keywords: electronic feeding stations, equipment, continuous feeding regime, periodic feeding regime, growth rate, backfat thickness, feed intake, estimation accuracy, measurement accuracy, feed intake behavior, feeder visits per day, time per day, time per visit.

Sneddon, I.A.; Beattie, V.E.; Dunne, L.; Neil, W. (2000). **The effect of environmental enrichment on learning in pigs.** *Animal Welfare* 9 (4): 373-383, ISSN: 0962-7286.

NAL Call Number: HV4701.A557.

Keywords: pigs, learning ability, enrichment, housing, litter, straw, peat, stimuli responses, test rigs, animal welfare.

Spinka, M.; Stehulova, I.; Zacharova, J.; Illmann, G. (2001). **Repeatability and laterality in pig maternal behaviour.** *Advances in Ethology* (36): 266, ISSN: 0931-4202.

NAL Call No.: 410 Z35B.

Keywords: sows, piglets, distress calls, growth rate, lactation, laterality, maternal behavior, nursing behavior, nursing frequency, meeting abstract.

Straw, B.E.; Bartlett, P.; Perry, IA (2001). **Flank or belly nosing in weaned pigs.** *Journal of Swine Health and Production* 9 (1): 19-23. Available online at http://www.aasv.org/shap.html

NAL Call No.: SF971.N472.

Keywords: growth rate, animal behavior, behavior disorders, belly, body regions, sex differences, skin lesions, weaning weight, liveweight gain, nosing behavior.

Studnitz, M.; Jensen, K.H. (2002). **Expression of rooting motivation in gilts following different lengths of deprivation.** *Applied Animal Behaviour Science* 76 (3): 203-213, ISSN: 0168-1591.

NAL Call No.: QL750.A6.

Keywords: Landrace x Yorkshire, breed, female, gilt, behavior, video recording, nose ring, rooting, animal welfare, concrete floor, peat covered floor, rooting, deprivation, duration, motivation, expression.

Sustr, P.; Spinka, M; Cloutier, S; Newberry, R.C. (2001). **Computer-aided method for calculating animal configurations during social interactions from two-dimensional coordinates of color-marked body parts.** *Behavior Research Methods, Instruments, and Computers* 33 (3): 364-70, ISSN: 0743-3808.

Abstract: In an experiment investigating the impact of preweaning social experience on later social behavior in pigs, we were interested in the mutual spatial positions of pigs during paired social interactions. To obtain these data, we applied a different colored mark to the head and back of each of 2 pigs per group and videotaped the pigs' interactions. We used the EthoVision tracking system to provide x,y coordinates of the four colored marks every 0.2 sec. This paper describes the structure and functioning of a FoxPro program designed to clean the raw data and use it to identify the mutual body positions of the 2 animals at 0.2-sec intervals. Cleaning the data was achieved by identifying invalid data points and replacing them by interpolations. An algorithm was then applied to extract three variables from the coordinates: (1) whether the two pigs were in body contact; (2) the mutual

orientation (parallel, antiparallel, or perpendicular) of the two pigs; and (3) whether the pig in the "active" position made snout contact in front of, or behind, the ear base of the other pig. Using these variables, we were able to identify five interaction types: Pig A attacks, Pig B attacks, undecided head-to-head position, "clinch" resting position, or no contact. To assess the reliability of the automatic system, a randomly chosen 5-min videotaped interaction was scored for mutual positions both visually (by 2 independent observers) and automatically. Good agreement was found between the data from the 2 observers and between each observer's data and the data from the automated system, as assessed using Cohen's kappa coefficients.
Keywords: behavior, computing methodologies, observation methods, social behavior, spatial behavior, observer variation, reproducibility of results, software, videotape recording.

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Keywords: piglets, castration, age, animal behavior, vocalization, pain, suckling, age differences, animal welfare, Netherlands.

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NAL Call No.: 44.8 J822.
Keywords: weanling pigs, Landrace, breed, plasma, cortisol, serotonin, gamma-coat-radioimmunoassay, detection method, farrowing date, genetic selection, belly-nosing, loin-eye area, handling, stress, lean growth, meeting abstract.

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Keywords: sows, piglets, Yorkshire, breed, behavior, growth, lactation, litter performance, live weight gain, maternal behavior, repeatability, suckling, successful nursings.

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Keywords: piglet, sow, behavior, coping behavior, stress, immune response.

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NAL Call No.: SF395 W48 1998.
Keywords: welfare, behavior, codes of practice, self-choice feeding, reproductive behavior, mating, parturition, nest building, nursing behavior, aggressive behavior, mixing, housing designs, feeding stations, locomotion, ingestion, elimination, injury, fighting, stress, pale soft exudative (PSE) meat, stereotypic behaviors, transportation, review.

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NAL Call No.: QL750.A6.
Keywords: animal welfare, behavior, piglets, weaning, age differences, husbandry, animal production, abnormal

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Keywords: malignant hyperthermia, recessive autosomal disorder, local pig breeds, rare breeds, Bisaro, out crossing, controlled breeding, restriction fragment length polymorphism analysis, analytical method, single strand conformational polymorphism analysis, Portugal, Alentejano, Bisaro.

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Abstract: Selection in commercial populations on aspects of output, such as for growth rate in poultry, against fatness and for growth rate in pigs, and for milk yield in cows, has had very large effects on such outputs over the past 50 years. Partly because of the cost of recording intake, there has been little or no selection for food intake or feeding behaviour. In order to predict the effects of such past, and future, selection on intake it is necessary to have some suitable theoretical framework. Intake needs to be predicted in order to make rational feeding and environmental decisions. The idea that an animal will eat 'to meet its requirements' has proved useful and continues to be fruitful. An important part of the idea is that the animal (genotype) can be described in a way that is sufficient for the accurate prediction of its outputs over time. Such keywords can be combined with a set of nutritional constants to calculate requirements. There appears to have been no change in the nutritional constants under selection for output. Under such selection it is simplest to assume that changes in intake follow from the changes in output rates, so that intake changes become entirely predictable. It is suggested that other ways that have been proposed for predicting intake cannot be successful in predicting the effects of selection. Feeding behaviour is seen as being the means that the animal uses to attain its intake rather than being the means by which that intake can be predicted. Thus, the organisation of feeding behaviour can be used to predict neither intake nor the effects of selection on it.
Keywords: livestock, feeding behavior, feeding, selection program, feed intake, prediction, genotype nutrition interaction, performance, nutrient requirements, energy requirements, efficiency, growth, lactation, body fat, animal production, literature reviews.

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NAL Call No.: QL750.A6.
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Keywords: sows, breed, Dutch Landrace, genetic parameters, reproduction traits, farrowing after first insemination, mothering ability, still born piglets, number of piglets born, interval from weaning to first insemination, gestation length, age at first insemination, parity number.

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NAL Call No.: 49 J82.
Abstract: The objective of this study was to investigate whether pigs with different genetic merit for survival differed in birth weight, progress of farrowing, early postnatal behavior, or rectal temperature within 24 h after birth. On a nucleus farm in Rio Verde, Brazil, information was collected on 280 pigs, originating from 25 litters with known estimated breeding values for pig survival (EBVps). Litters were selected in such a way that a continuous range of EBVps with a maximum genetic contrast was achieved. Birth weight was recorded for all pigs. Indicators for progress of farrowing were birth intervals and duration of farrowing. Behavioral indicators of pig vitality were time until first upright standing (FUS), time until first udder contact (FUC), time until first teat in mouth (FTM), and time until first colostrum uptake (FCU). Rectal temperature was measured within 24 h after birth. Farrowing survival and early postnatal survival (within 3 d after farrowing) were registered. Farrowing survival and early postnatal survival both increased with increasing EBVps (farrowing survival: P = 0.007; early postnatal survival: P = 0.027). Birth weight decreased with increasing EBVps (P = 0.01). Birth intervals tended to increase with increasing EBVps (P = 0.10) and duration of farrowing was not related to EBVps. Time until first teat in mouth increased with increasing EBVps (P = 0.05), but the other behavioral indicators of pig vitality were not related to EBVps. Rectal temperature within 24 h after birth was not related to EBVps. Pigs with a higher genetic merit for survival have a lower birth weight but nevertheless have an increased farrowing survival and early postnatal survival. Their increased survival cannot be explained by differences in progress of farrowing, early postnatal behavior, or rectal temperature within 24 h after birth.
Keywords: behavior, survival, genetic variation, farrowing, body temperature, litters, breeding value, duration, time, vigor, Brazil.

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NAL Call No.: 44.8 J822.
Keywords: breed, Berkshire, Chester White/Landrace, Duroc, Hampshire, Poland-China/Spot, Yorkshire, crossbreds, carcass quality, meat product, meat quality, meeting abstract.

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NAL Call No.: 44.8 J822.
Keywords: weanling pigs, Landrace, breed, plasma, cortisol, serotonin, gamma-coat-radioimmunoassay, detection method, farrowing date, genetic selection, belly-nosing, loin-eye area, handling, stress, lean growth, meeting abstract.

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Abstract: Disease is a major issue in animal production systems and society demands that the use of medicines and vaccines be reduced. This review describes the breeding approaches that could be used to improve disease resistance and focuses especially on their application to pigs. Disease reduction by genetic means has certain advantages through cumulative and permanent effects, and direct and indirect selection methods are available. Direct selection for disease incidence requires, besides a unique pig identification and disease registration system, challenge routines that are inconvenient in intensive pig production. Indirect selection for the expression of immune capacity may be an alternative but requires detailed knowledge of the different components of the immune system. There is ample opportunity for genetic improvement of the immune capacity because immune traits show substantial genetic variation between pigs. We therefore conclude that indirect selection via immune traits is very interesting, also for practical implementation, and that there is an urgent need for knowledge, within lines, about the genetic relationships between immune capacity traits and resistance to specific diseases or to disease incidence in general. Furthermore, knowledge about the relationship between immune system traits and production traits is needed as well as knowledge about the effect of selection on the epidemiology of disease at a farm/population level and on the host-pathogen interaction and coevolution.
Keywords: genetic selection, disease resistance, immune capacity traits, direct and indirect selection, variation.

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NAL Call No.: 442.8 Z35.
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Feeding

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Abstract: Early-weaned pigs (n = 64) averaging 5.3 +/- 0.3 kg and distributed into two environments (dirty and clean) were used to evaluate effects of conjugated linoleic acid (CLA) on growth performance, immune competence, and empty body composition. A factorial (2 x 4) arrangement within a split-plot design, with four littermate pigs as the experimental unit for the environment, pig within litter as the experimental unit for dietary treatment, and d-0 body weight used as covariate, were used in data analysis. Diets were formulated to contain CLA at 0, 0.67, 1.33, or 2% and to exceed the NRC (1988) nutrient needs of pigs. Animals were given ad libitum access to feed for 7 wk in three phases (I, 1 to 2; II, 3 to 5; and III, 6 to 7 wk). Within phases, diets were isocaloric and isonitrogenous. In Phase I, as dietary CLA concentration increased, ADG and ADFI decreased linearly ($P < 0.05$ and $P < 0.02$, respectively). In Phase II, upon adaptation to dietary CLA supplementation, ADG increased quadratically (603, 623, 622, and 548 g/d; $P < 0.01$), ADFI decreased linearly (873, 840, 867, and 717 g/d; $P < 0.02$) and gain:feed ratio tended to increase linearly (691, 742, 715, and 763; $P < 0.07$). In Phase III, no differences in growth performance were attributed to either dietary or environmental treatments. The poor health status associated with the dirty environment induced a growth suppression; pigs in the clean room had a greater cumulative ADG ($P < 0.01$) and ADFI ($P < 0.01$) than pigs in the dirty room. In Phase I, lower plasma urea nitrogen levels observed in pigs found in the dirty room ($P < 0.03$) indicated a lower protein intake caused by a lower ADFI. The effects of dietary CLA on peripheral phenotypic profiles of lymphocytes did not appear until d 42. However, as indicated by the growth suppression of pigs in the dirty room, the negative effects of the environmental challenge on pig health and growth had already appeared during phase I. On d 42, CLA induced a linear increase in percentages of CD8+ lymphocytes (21.7, 22.3, 28.0, and 32.7%, $P < 0.001$). These data suggest that a 42-d dietary CLA supplementation preceding a disease challenge could have prevented disease-associated growth suppression. Also, CLA-mediated amelioration of particular infectious diseases will depend on which CD8+ T cell subset (i.e., CD8alphaalpha immunoregulatory or CD8alphabeta-cytotoxic) is most influenced by dietary CLA supplementation.
Keywords: piglets, linoleic acid, isomers, early weaning, hygiene, body weight, cd8+ lymphocytes, cell mediated immunity, unrestricted feeding, liveweight gain, feed conversion, health, cd4+ lymphocytes, lymphocyte transformation, leukocyte count, body composition, blood plasma, urea, blood composition, glycoproteins.

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NAL Call No.: SF396.5 W43 2001.
Keywords: piglets, antibiotic digestive enhancers, antimicrobial growth promoters (AGPs), gut health, antibiotic withdrawal, husbandry, hygiene, vaccination, in-feed enzymes, nutrition, increased nutrient and energy

retention, organic acids, herb and spice formulations, probiotics, lactobacillus cultures, microflora, vitamin E, health, antibiotic residues, digestive tract mucosa, drug residues, growth promoters, immunity, piglets, public health, weaning, United Kingdom.

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Keywords: housing, group effect, feeding behavior, feeding frequency, eating rates, time budgets, feed intake, social behavior, aggressive behavior, liveweight gain, feed conversion efficiency, individual housing.

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NAL Call No.: 44.8 J822.
Keywords: breed, Yorkshire, piglet, early weaned, digestive system, Lincomix, antiinfective drug, antibiotics, formic acid, dietary, fumaric acid, organic acids, dietary supplementation, diarrhea, average daily gain, blood urea nitrogen, feed efficiency, growth performance, low cost diet, organ weight gain, meeting abstract.

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Keywords: ileum, blood plasma, blood meal, digestibility, growth, nutrient availability, immune response, early weaning, escherichia coli, health, casein, protein hydrolysates, immunoglobulins, feed rations, performance, mortality, nitrogen, adhesion, intestinal mucosa, IgA, South Korea.

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NAL Call No.: SF396.5 W43 2001.

Keywords: piglets, diets, feed intake, fermentation, liquid diets, nutrition, feeding, water intake, weaning.

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NAL Call No.: 389.78 Z3.
Abstract: Three batches of weanling pigs (total n=310 pigs) were used in a 34-day experiment to validate the use of an IVOG feeding station as a tool for monitoring individual feed intake of group-housed weanling pigs. An IVOG feeding station for weanling pigs consists of a single-space dry feeder placed on a load cell in combination with electronic identification. Data of 192 weanling pigs (18 pens) fed by IVOG feeding stations were used to develop a protocol for the screening of IVOG data. To assess the quality of the IVOG data, the feed intake per pen computed from the screened IVOG data was compared with the feed intake calculated from feed weighing. To assess the suitability of the use of IVOG feeding stations under practical pig husbandry conditions, performance of 96 weanling pigs fed by the IVOG feeding stations was compared with that of 118 weanling pigs that were fed using commercial single-space dry feeders (11 pens). Feed intake per pen computed from the IVOG data was similar to the feed intake calculated from feed weighing (average recovery 101.1%) for all test periods ($p > 0.1$). Furthermore, feed recovery did not differ among feeding stations ($p > 0.1$). During the first 13 days after weaning, the average daily feed intake (ADFI) of weanling pigs fed by the single-space dry feeders was higher ($p < 0.05$) than that of weanling pigs fed by the feeding stations. Average daily gain and gain to feed ratios did not differ ($p > 0.1$) between both feeding systems. During the remaining 21 days and averaged over the entire experimental period, performance did not differ between the feeding systems ($p > 0.1$). It can be concluded that IVOG feeding stations for weanling pigs are a suitable tool to monitor individual feed intake of group-housed weanling pigs.
Keywords: husbandry, instrumentation, body weight, physiology, energy intake, growth and development, animal feed, feeding behavior, reproducibility of results, sensitivity and specificity, time factors, weaning record.

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Keywords: pigs, growth, performance, maize, extrusion, wheat, amino acids, digestibility, early weaning, feces, feed intake, ingredients, liveweight gain, feed conversion.

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NAL Call No.: SF391.P55.
Abstract: Spray-dried animal plasma is a byproduct of the meat packing industry and is considered by many to be an essential ingredient in the initial nursery diet for early-weaned pigs. With the exception of methionine, this protein source has a high concentration of amino acids. Also, spray-dried animal plasma contains a substantial amount of immunoglobulins, the most predominant being immunoglobulin G. Numerous studies have been conducted with weanling pigs to compare spray- dried animal plasma to various plant and animal protein sources. These comparative experiments have been conducted in a variety of housing environments, and represent a diversity of pig genetics, a broad range of plasma protein inclusion rates, and various plasma protein sources. In a vast majority of these studies, feeding spray-dried animal plasma has resulted in improved growth rate and feed intake. Studies conducted to determine the optimum inclusion rate of spray-dried animal plasma have been inconclusive, with the reported optimum dietary level ranging from 6 to 15%. The optimum inclusion rate of spray-dried animal plasma is likely dependent on many factors including age at weaning, level of environmental stress, health status, and complexity of the diet. Despite considerable research efforts, the specific mechanism(s) by which spray-dried animal plasma improves weanling pig performance remains unclear. Some have suggested that spray-dried animal plasma acts as a flavour or palatability enhancer, and elicits its effects solely through increasing feed intake. However, results from several different researchers have provided substantial evidence that plasma acts to improve the immunocompetence of the weaned pig, most

likely mediated by the immunoglobulins found in spray-dried animal plasma.
Keywords: blood products, blood proteins, diets, feed additives, feed intake, growth, immune competence, reviews.
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Collin, A.; Milgen, J. van.; Dubois, S.; Noblet, J. (2001). **Effect of high temperature on feeding behaviour and heat production in group-housed young pigs.** *The British Journal of Nutrition* 86(1): 63-70, ISSN: 0007-1145.
NAL Call No.: 389.8 B773.
Abstract: To assess the acclimation of pigs to heat stress, the effects of high (33 degrees C) or thermoneutral (23 degrees C) constant temperatures on feeding behaviour and components of energy balance were studied in group-housed young pigs. Three groups of five pigs were used at each temperature. After 1 week of adaptation, voluntary feed intake (VFI) and heat production (HP) were recorded for thirteen consecutive days. Animals were fed ad libitum. Fasting HP was measured on the last day. Average initial body weights (BW) were 21.4 and 20.9 kg at 23 and 33 degrees C respectively. Feeding behaviour was measured individually and rate of feed intake and characteristics of feeding behaviour were calculated. The O2 consumption, CO2 production and physical activity of the group were used to calculate total HP (HP(tot)) and its components, i.e. fasting HP (HP(fas)), HP due to physical activity (HP(act)) and thermic effect of feed (TEF). The BW gain and VFI were reduced by 37 and 30% respectively at 33 degrees C. The decrease in VFI corresponded to reduced consumption time (-34%) and size of the meals (-32%). Feeding behaviour was mostly diurnal (66% of the VFI), and the rate of feed intake (28 g/min) was not affected by temperature. Daily HP(tot), HP(fas) and TEF, expressed per kg metabolic weight (BW(0.60)), were significantly decreased at 33 degrees C by 22, 18 and 35% respectively, whereas HP(act) was not affected; TEF expressed per g feed was not affected (2 kJ/g). The decrease in HP(tot) at 33 degrees C was caused by a reduction in TEF and HP(fas) (kJ/d per/kg BW(0.60)), which are both related to reduction in VFI.
Keywords: environmental temperature, time, feeding behavior, heat production, housing, heat stress, feed intake, liveweight gain, water intake, oxygen consumption, carbon dioxide, gas production, physical activity, energy balance, feeding.

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NAL Call No.: 49 J82.
Keywords: sows, large litters, reproductive performance, amino acid requirements, lysine, high production, lactation, lactation effects, nutrient intake, sow performance, threonine requirements.

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NAL Call No.: 44.8 J822.
Keywords: dietary additive, growth promoting additive, plant extract blend, CSP 250, antibiotic, zinc oxide, meeting abstract.

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Keywords: sows, suckling, sounds, lactation, piglets, growth, farms, housing, efficacy, growth rate, animal husbandry, creep feeding, liveweight gain

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NAL Call No.: SF95.A55.
Keywords: sows, pregnancy, fiber, feeds, reproductive performance, animal behavior, barley, soybean oilmeal, ingredients, beet pulp, wheat bran, husks, oats, grass meal, solubility, energy intake, appetite, lactation, liveweight gain, farrowing, litter weight, weaning weight, eating, duration.

Dijk, A.J. van; Niewold, T.A.; Nabuurs, M.J.A.; Hees, J. van; Bot, P. de; Stockhofe-Zurwieden, N.; Ubbink-Blanksma, M.; Beynen, A.C. (2002) . **Small intestinal morphology and disaccharidase activities in early-weaned piglets fed a diet containing spray-dried porcine plasma.** *Journal of Veterinary Medicine, Series A* 49 (2): 81-86, ISSN: 0931-184X.
NAL Call No.: 41.8 Z5.
Keywords: casein, diet, disaccharidases, feed intake, intestinal mucosa, liveweight gain, morphology, piglets, small intestine, villi.

Dijk, A.J. van; Everts, H.; Nabuurs, M.J.A.; Margry, R.J.C.F.; Beynen, A.C. (2001). **Growth performance of weanling pigs fed spray-dried animal plasma: a review.** *Livestock Production Science* 68 (2/3): 263-274, ISSN: 0301-6226.
NAL Call No.: SF1.L5.
Abstract: Spray-dried animal plasma (SDAP), mostly of porcine origin, is frequently used as an ingredient of weanling piglets diets in order to improve feed intake and to reduce post-weaning diarrhoea. On the basis of 15 published studies it is concluded that dietary SDAP levels up to 6% increase both average daily gain (ADG) and feed intake (ADFI) in the first 2 weeks after weaning in a dose- dependent fashion. Up to 6% SDAP also reduces feed conversion ratio (FCR). The positive effect of SDAP on ADG and ADFI is much more pronounced in the first than the second week after weaning. There is no positive carry-over effect of SDAP feeding during the period of 2 weeks after weaning on growth performance thereafter. SDAP is an expensive protein source and an economic evaluation should be made before including SDAP in weanling piglets diets. Multiple regression analysis indicated that, apart from SDAP dose, baseline growth rate is an important determinant of the effect of SDAP on ADG, with high baseline growth rate being associated with small effects of SDAP. It should be stressed that SDAP is a non-sterilised product that might spread certain diseases after feeding it to pigs. Porcine plasma has more beneficial effects than bovine plasma. Possible modes of action are discussed. It is suggested that, in addition to improving feed palatability, SDAP reduces post-weaning intestinal disease by preventing attachment of pathogens.
Keywords: feed additives, feed intake, growth, liveweight gain, piglets, weaning.
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Docic, A.; Bilkei, G. (2001). **The effect of short term high feed intake on the onset of puberty in transported gilts.** *Swine Health and Production* 9 (1): 25-27, ISSN: 1066-4963.
NAL Call No.: SF971 N472.
Abstract: A trial, involving 320 incoming gilts (approximately 160 days of age) was conducted to determine whether energy flushing combined with transport, regrouping, and exposure to boars influences the onset of puberty. The gilts were randomly divided into 2 groups. The flushed group (166 gilts) were both transported and energy flushed, and the transported group (154 gilts) were transported only. After transport, gilts were housed in small groups exposed to boars across an aisle. The onset of puberty was determined at slaughter one week after transport. Examination of the reproductive organs revealed that there were more follicles >4 mm and uterine mass was larger (P>.05) in the flushed group than in the transported group. Adrenal gland weight, ovarian weight, and uterine length did not differ between treatment groups. It is concluded that energy flushing increases follicular growth and uterine weight, which are indicators of puberty in gilts.
Keywords: gilts, feed intake, female animals, flushing, ovarian follicles, puberty, transport of animals.
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NAL Call No.: 49.9 C33.
Keywords: piglets, enzymes, feed additives, feed conversion, feeds, liveweight gain, micronization, pig feeding.

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NAL Call No.: 44.8 J822.
Keywords: finishing, growing, protein, feed content, housing, space allocation, meeting abstract.

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NAL Call No.: 41.8 C163.
Keywords: piglets, oligosaccharides, bifidobacterium longum, supplementary feeding, early weaning, growth rate, postweaning interval, feces, fecal flora, liveweight gain, feed conversion, feed conversion efficiency, insulin-like growth factor.

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NAL Call No.: SF1 A56.
Keywords: body protein, feed conversion efficiency, feed intake, floor space, single feeder bin, growth, lipids, live weight gain, lysine, nutrient requirements, protein retention, stocking density.

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NAL Call No.: 49 J82.
Keywords: piglets, early weaning, animal behavior, feed intake, liveweight, liveweight gain, diets, dried whey, milk substitutes, blood plasma, soybean oilmeal, fish meal, stereotyped behavior.

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NAL Call No.: S3.A27.
Keywords: finishing pigs, single-space feeders, multiple feeders, feeder access, health, skin lesions, daily weight gain, feed intake,

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Keywords: sows, welfare, energy consumption, energy value, feed formulation, feed intake, adlibitum feed intake, fiber, net energy, pregnancy, reproductive performance.

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NAL Call No.: QL750.A6.
Keywords: gilts, Large White, Landrace, Duroc and Pietrain, breeds, sires, genetic lines, line differences, body weight, feed conversion efficiency, feed intake, number of feeder visits, feeder occupation, growth rate, lines, liveweight gain, longissimus dorsi, feeding.

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NAL Call No.: TX556 M4J68.
Keywords: feed supplements, genes, genetics, halothane, preslaughter stress, meat quality, minerals, muscles, nutrition, storage quality, vitamins, water holding capacity, meat color.

Han, I.K.; Lee, J.H.; Piao, X.S.; Li, D. (2001). **Feeding and management system to reduce environmental pollution in swine production: Review.** *Asian Australasian Journal of Animal Sciences* 14 (3): 432-444, ISSN: 1011- 2367.
NAL Call No.: SF55 A78A7.
Keywords: production, feeding systems, management systems, pollution, manure, nutrient excretion, feed additives, nitrogen and phosphorus reduction, enzymes, phytase, antibiotics, probiotics, organic acids, growth hormones, beta agonists, porcine somatotropin, synthetic amino acids in feed manufacturing, feed utilization, nutrient digestibility, nutrient excretion, phase feeding regimen, swine production.

Hay, M.; Orgeur, P.; Levy, F.; Le Dividich, J.; Concordet, D.; Nowak, R.; Schaal, B.; Mormede, P. (2001). **Neuroendocrine consequences of very early weaning in swine.** *Physiology and Behavior* 72 (1-2): 263-9, ISSN: 0031-9384.NAL Cal No.: QP1 P4.
Abstract: An experiment was conducted to investigate the consequences of very early weaning of piglets on neuroendocrine variables and growth. Sixty piglets from eight litters were either weaned on Postnatal Day 6 (early weaning, or EW piglets) or left with their dam until normal weaning at Day 28 (control piglets, or C). At Days 5, 7, 11, 14, and 19, urine was collected between 7:00 and 8:00 a.m. for the measurement of catecholamines, glucocorticoids, and creatinine. Compared with C, EW piglets displayed a transient increase in urinary cortisol on the day following separation from their dam (Day 7) (P<.05). Urinary norepinephrine (NE) was three times lower in EW compared to C piglets from Day 7 until Day 14 (P<.01) but there was no difference between the two groups on Day 19. Urinary epinephrine (EPI) did not differ between C and EW piglets on the day after weaning. Thereafter, EW piglets displayed a three times drop in urinary EPI as compared to C piglets until the end of the period (P<.01). Weaning induced an immediate reduction in food intake and growth rate and at Day 28, the body weight of EW piglets was 1.60 kg lower than that of C piglets (P<.0001). In conclusion, weaning of 6-day-old piglets results in a marked and prolonged suppression of the release of catecholamines. This result likely reflects physiological responses to insufficient energy intake after weaning, as reflected also by changes in thermoregulatory behavior. The transient increase in cortisol excretion in weanlings may be caused by both emotional distress and acute food deprivation.
Keywords: neurosecretory systems, physiology, weaning, aging, behavior, body weight, catecholamines, urine, chromatography, high pressure liquid, ion exchange, cortisone, hormones, hydrocortisone.

Hayes, D.J.; Jensen, H.H.; Fabiosa, J. (2002). **Technology choice and the economic effects of a ban on the use of antimicrobial feed additives in swine rations.** *Food Control* 13 (2): 97-101. ISSN: 0956-7135.
NAL Call No.: TP372.7 F66.
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NAL Call No.: 389.78 Z3.
Keywords: crossbred piglets, Deutsche Landrace X Pietrain, feeding study, increased performance, dietary supplements, rare earth elements, alkaline phosphatase, aspartate amino transferase, calcium, cerium, chlorine, glucose, lanthanum, phosphorus, potassium, praseodymium, dietary supplement, sodium, thyroxine, total cholesterol, total protein, triglyceride, triiodothyronine, daily body weight gain.

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NAL Call No.: SF396.5 W43 2001.
Keywords: age at weaning, aggressive behavior, husbandry, feeding behavior, housing, piglets, social behavior, stress, stress response, vocalization.

Hill, G.M.; Mahan, D.C.; Carter, S.D.; Cromwell, G.L.; Ewan, R.C.; Harrold, R.L.; Lewis, A.J.; Miller, P.S.; Shurson, G.C.; Veum, T.L. (2001). **Effect of pharmacological concentrations of zinc oxide with or without the inclusion of an antibacterial agent on nursery pig performance.** *Journal of Animal Science* 79 (4): 934-941, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: piglets, zinc oxide, postweaning interval, early weaning, liveweight gain, feed intake, feed conversion, blood plasma, zinc, copper, antibacterial agent, carbadox, drug effects.

Honeyman, M.S.; Roush, W.B (1999). **Supplementation of mid-gestation swine grazing alfalfa.** *American Journal of Alternative Agriculture*14 (3): 103-108, ISSN: 0889-1893,
NAL Call No.: S605.5.A43.
Abstract: For four years (1991-1994), gestating gilts rotationally grazing alfalfa were compared to gilts in a drylot fed 1,800 g/d of a corn-soy diet (control). The dietary supplementation treatments for the grazing gilts were 1,260 g, 720 g, and 180 g of ground corn (70, 40, and 10% of the gilts' energy needs) plus 45 g of monosodium phosphate and 9 g of salt (sodium chloride) per day. All gilts were fed individually. In 1991 and 1992, the gilts were fed daily. In 1993 and 1994, the gilts were fed their weekly feed ration in three equal feedings on Monday, Wednesday, and Friday. Alfalfa paddocks were grazed for one week with a stocking rate of 62 gilts/ha/wk. All gilts had rings in their noses to minimize rooting. For the 42-d mid-gestation trial, the weight gain of the control gilts did not differ from the gain of the grazing gilts daily fed 720 g corn (40%) ($P < .05$). The interval feeding reduced gains compared to the daily feeding. Gilts daily fed 1,260 g corn/d (70%) gained more than the other grazing treatments ($P < .05$). The gilts daily fed 180 g corn/d (10%) gained less than all other treatments ($P < .05$) and had the greatest backfat loss ($P < .05$) for the 42-d trial. No major trends were noted in number of pigs born per litter or pig birth weight. After one week of grazing, alfalfa height decreased 14.7 cm and DM content of the remaining alfalfa increased 9%. Each grazing season, the alfalfa stand decreased 3.8 plants/m(2). Daily alfalfa intakes per gilt were calculated at 11.5 kg (3.2 kg DM) for 1991 and 1992, and increased to 16.3 kg (4.2 kg DM) for 1993 and 1994. These are composite intakes because all grazing gilts were commingled. Mid-gestation gilts rotationally grazing alfalfa need 720 g of corn per day plus phosphorus and salt to match weight gains of gestating gilts in a drylot fed 1,800 g/d of a corn-soy diet. Daily feeding, rather than interval feeding, resulted in greater weight gains and lower alfalfa intakes. The practice of grazing gestating sows has the advantages of no manure to haul, reduced purchased feed inputs, and inclusion of a soil-building crop like alfalfa in the crop rotation.
Keywords: sows, grazing, medicago sativa, feed supplements, rotational grazing, pregnancy, feed rations, stocking rate, liveweight gain, backfat, fat thickness, litter size, birth weight, plant height, dry matter, persistence, plant density, feed intake, Iowa.

Hong, J.W.; Kim, I.H.; Kwon, O.S.; Lee, S.H.; Bae, H.D.; Kang, S.J.; Yang, U.M. (2001). **Effects of phytezyme supplementation on the growth performance and nutrient digestibility in growing pigs.** *Asian Australasian Journal of Animal Sciences* 14 (10): 1440-1443, ISSN: 1011-2367.
NAL Call No.: SF55 A78A7.
Keywords: breed, Duroc X Yorkshire X Landrace, growing pigs, phytase, dietary supplement, average daily gain, gain/feed, growth performance, nutrient digestibility.

Hong, J.W.; Kim, I.H.; Moon, T.H.; Kwon, O.S.; Lee, S.H.; Kim, Y.G. (2001). **Effects of yucca extract and (or) far infrared emitted materials supplementation on the growth performance, serum characteristics and ammonia production of growing and finishing pigs.** *Asian Australasian Journal of Animal Sciences* 14 (9): 1299-1303, ISSN: 1011-2367.
NAL Call No.: SF55 A78A7.
Keywords: breed, Duroc x Yorkshire x Landrace, finishing, growing pigs, ammonia, blood urea nitrogen, high density lipoprotein cholesterol, low density lipoprotein cholesterol, yucca extract, dietary supplement, average

daily gain, far IR radiological materials, growth performance, nutrient digestibility.

Hyun, Y.; Ellis, M. (2001). **Effect of group size and feeder type on growth performance and feeding patterns in growing pigs.** *Journal of Animal Science* 79 (4): 803-810, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: The effects of four group sizes (2, 4, 8, and 12 pigs per pen) and two single-space feeder types (conventional and electronic feed intake recording equipment [FIRE]) on feed intake, growth performance, and feeding patterns were determined in growing pigs over a 4-wk period. A total of 416 hybrid pigs (barrows and gilts) were grown from 26.5 (SD = 1.6) to 47.8 (SD = 2.7) kg BW and given ad libitum access to a corn-soybean meal-based diet (17.4% CP, 0.9% lysine; 3,298 kcal ME/kg). The floor space allowance was 0.9 m2/pig for all treatments. Pigs using the electronic feeders had similar growth rates but lower feed intakes ($P < 0.01$) and higher gain:feed ratios ($P < 0.01$) compared to those using the conventional feeders. Barrows compared to gilts had higher growth rates ($P < 0.05$), numerically higher ($P > 0.05$) ADFI, and similar feed efficiency and feeding pattern. Feed intakes and growth rates were lowest ($P < 0.05$) for groups of 12 pigs but gain:feed ratio was not affected by group size. Daily feeder occupation time per pig was lower ($P < 0.01$) for groups of 12 than for groups of 2 or 4 pigs, and feed consumption rate was higher ($P < 0.01$) for groups of 12 than for groups of 4 pigs. The proportion of time spent eating was lower ($P < 0.01$) and the proportion of time spent standing was higher ($P < 0.01$) for pigs in groups of 12 compared to groups of 2. Correlations between ADG and ADFI and feed intake per visit were 0.29 and 0.30, respectively ($P < 0.01$), between ADG and ADFI and feed consumption rate were 0.27 and 0.31, respectively ($P < 0.01$), and between ADFI and feeder occupation time per day were 0.33 ($P < 0.01$). This study suggests that, in growing pigs given access to a single feeder, changes in feeding behavior with increasing group size were not sufficient to maintain feed intake and growth rate.
Keywords: pigs, group size, pig feeders, automatic feed dispensers, feed intake, feeding habits, floor space, feed conversion, body weight, liveweight gain, eating patterns, eating rates.

Jakobsen, K.; Hermansen, J.E. (2001). **Organic farming, a challenge to nutritionists.** *Journal of Animal and Feed Sciences* 10 (Supplement 1): 29-42, ISSN: 1230-1388.
NAL Call No.: SF1 J68.
Keywords: cattle, pigs, poultry, disease resistance, energy requirements, essential amino acids, livestock farming, minerals, organic farming, reviews, vitamins, Denmark.

Jefferson, W.A.; Kapp, A.M. (2001). **Piglet milk feed delivery system.** *Official Gazette of the United States Patent and Trademark Office Patents* 1244 (2): No Pagination, ISSN: 0098-1133.
NAL Call No.: T223 A21.
Keywords: patent, orally administered, feed supplements, feeding stations, feed reservoir, spray nozzles, milk feed delivery system, disinfection, farm equipment

Kerth, C.R.; Carr, M.A.; Ramsey, C.B.; Brooks, J.C.; Johnson, R.C.; Cannon, J.E.; Miller, M.F. (2001). **Vitamin mineral supplementation and accelerated chilling effects on quality of pork from pigs that are monomutant or noncarriers of the halothane gene.** *Journal of Animal Science* 79 (9): 2346-2355, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: barrows, gilts, vitamin and mineral supplementation, finishing diet, growth, accelerated chilling of carcasses, carcass and muscle traits, halothane gene carrier versus noncarrier pigs, vitamin E, exudative meat, meat quality, pork quality.

Kim, I.B.; Allee, G.L. (2001). **Effect of carbohydrate sources in phase I and phase II pig starter diets.** *Asian Australasian Journal of Animal Sciences* 14 (10): 1419-1424, ISSN: 1011-2367.
NAL Call No.: SF55 A78A7.
Keywords: weaned pigs, starter diets, carbohydrate by product, lactose, phase I starter diet, nutritional method, phase II starter diet, average daily gain, corn, animal feed, gain/feed ratio.

Kim, S.W.; Baker, D.H.; Easter, R.A. (2001). **Dynamic ideal protein and limiting amino acids for lactating**

sows: The impact of amino acid mobilization. *Journal of Animal Science* 79 (9): ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: primiparous sows, experimental diets, underfed both energy and protein during lactation, threonine, lysine, valine, tissue mobilization, occurs during lactation, amino acids, dynamic ideal protein, body energetics.

Kim. S.W.; Easter, R.A. (2001). **Nutritional value of fish meals in the diet for young pigs.** *Journal of Animal Science* 79 (7): 1829-1839, ISSN: 0021- 8812.
NAL Call No.: 49 J82.
Keywords: menhaden fish meal, mackerel herring fish meal, threonine, serine, alanine, valine, histidine, lysine, arginine, average daily gain, replacement of spray dried porcine plasma, nutritional value evaluations.

Kim, J.H.; Heo, K.N.; Odle, J.; Han, I.K.; Harrell, R.J. (2001). **Liquid diets accelerate in growth of early-weaned pigs and the effects are maintained to market weight.** *Journal of Animal Science* 79 (2): 427-434, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: Piglets (n = 240, 11.0 +/- 0.1 d old, 3.93 +/- 0.05 kg) were allotted to one of four treatments in a 2 x 2 factorial arrangement to examine the effects of diet physical form and nursery environment during the first 14 d after weaning on growth to market weight. During the treatment period, pigs were housed (10 pigs/pen) in either a conventional hot nursery (30 degrees C) or a segregated-temperature nursery (cool ambient temp. of 24 degrees C, with enclosed hot-box hovers at 32 degrees C). Pigs in each environment were fed nutritionally identical diets in either liquid or dry-pellet form for 14 d. Subsequently, all pigs were fed identical dry diets and were housed in common grower-finisher facilities (penned by sex, five pigs/pen). At the end of the treatment period (d 14), pigs fed the liquid diet were 21% heavier than pigs fed the dry pellet diet (9.22 vs 7.60 kg; P < 0.001). Similarly, gain, feed intake, and gain/feed of liquid-fed pigs were 44%, 18%, and 22% greater, respectively, than observed for pigs fed the dry pellet diet. No main effect of environment was observed (P > 0.10); however, an interaction with diet physical form occurred during the early-nursery period (P < 0.01). Pigs fed the liquid diet showed better performance in the conventional nursery, whereas pigs fed the dry pellet diet were favored in the segregated temperature nursery. No major differences in growth performance or in ultrasound carcass measurements were detected during the growing-finishing period; however, the advantage in body weight of liquid-fed pigs gained during the first 2 wk postweaning was maintained to the end of the trial (113.9 vs 110.6 kg; P < 0.05). Pigs that were fed the early-nursery diet in liquid form reached market weight (110 kg) 3.7 d sooner than the dry-fed controls (P < 0.01). Estimates of lean gain (calculated from live ultrasound data) were unaffected, suggesting that composition of growth was not altered. Collectively, these results show that liquid feeding during early life can markedly accelerate piglet growth performance and that the growth advantage is maintained to market weight, with no evidence of compensatory gain in the dry-fed control pigs.
Keywords: piglets, early weaning, liquid diets, milk substitutes, pelleted feeds, environmental temperature, body weight, liveweight gain, feed intake, feed conversion, pigs, slaughter weight, age, backfat, fat thickness, muscles, area, lean.

King, R.H.; Eason, P.E.; Kerton, D.K.; Dunshea, F.R. (2001). **Evaluation of solvent extracted canola meal for growing pigs and lactating sows.** *Australian Journal of Agricultural Research* 52 (10): 1033-1041, ISSN: 0004-9409.
NAL Call No.: 23 Au783.
Keywords: growing finishing pigs, lactating sows, weanling pigs, animal feed, canola meal, solvent extracted, animal performance, carcass quality, feed efficiency, growth, lactation.

Klindt, J.; Yen, J.T.; Christenson, R.K. (1999). **Effect of prepubertal feeding regimen on reproductive development of gilts.** *Journal of Animal Science* 77 (8): 1968-1976, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: The effect of prepubertal feed level on growth and reproductive development of gilts was investigated. At 13 wk of age, white crossbred gilts were penned individually and assigned to the following treatments: Ad lib, ad libitum intake from 13 to 25 wk of age (n = 64); Control, ad libitum intake from 13 wk of age until 100

kg BW and then 90% of ad libitum intake until 25 wk of age (n = 65); and Restricted, 74% of ad libitum intake from 13 wk to 25 wk of age (n = 64). Feed was formulated to primarily restrict energy intake. The study was replicated in two seasons. At 25 wk of age, gilts were moved to group pens, approximately 16 gilts/pen, allowed ad libitum access to feed, and estrus detection was initiated. Gilts were mated at first estrus and those recycling were remated. After mating, gilts were moved to gestation stalls and fed 1.5x maintenance. At 30 d of gestation, reproductive tracts were harvested, and numbers of corpora lutea (CL) and live embryos were recorded. From 13 to 25 wk of age, feed consumption was 258 for Ad lib, 251 for Control, and 189 kg/gilt for Restricted, and, from 13 wk of age until 30 d of gestation, total feed consumption was 367 for Ad lib, 356 for Control, and 299 kg/gilt for Restricted gilts. Age at puberty (196 d) and pregnancy (200 d) was not affected (P >.18) by treatment. However, the rate at which gilts attained puberty (e.g., percentage pubertal at 28 d) was greatest in Ad lib (75) and least in Control (61) gilts. Number of CL and live embryos at 30 d of gestation/gilt assigned to the study was unaffected (P >.21) by treatment. Quantity of feed consumed from 13 wk of age to 30 d of gestation per live embryo in gilts assigned to the study was 40.0 for Ad lib, 39.8 for Control, and 30.6 kg/gilt for Restricted gilts. These results indicate that moderate feed restriction of gilts during prepubertal development may increase efficiency of swine production without negative impact on reproductive performance through 30 d of gestation.

Keywords: gilts, pig feeding, puberty, plane of nutrition, energy intake, unrestricted feeding, restricted feeding, age differences, backfat, liveweight gain, estrus, detection, fat thickness, body weight, pregnancy rate, corpus luteum, litter size, feed conversion.

Knudsen, K.E.B. (2001). **Development of antibiotic resistance and options to replace antimicrobials in animal diets.** *Proceedings of the Nutrition Society* 60 (3): 291-299, ISSN: 0029-6651.

NAL Call No.: 389.9 N953.

Keywords: antibiotic resistance, antimicrobial growth promoters, ban, enteric bacterial infections Oesophagostumum dentatum, Brachyspira hyodesenteriae, nematode infection, parasitic disease, dysentery, gut health, carbohydrates, dietary intake, feed structure, United Kingdom.

Kotara, D.; Fuchs, B. (2001). **The effect of gelatinization degree and source of starch on the ileal and faecal digestibility of nutrients and growth performance of early-weaned piglets.** *Journal of Animal and Feed Sciences* 10 (Supplement 2): 163-170, ISSN: 1230-1388.

NAL Call No.: SF1 J68.

Keywords: piglets, cereal grains, diet, feces, starch gelatinization, ileum, nutrients, ontogeny, starch, ileal digestibility.

Kouba, M.; Hermier, D.; Le Dividich, J. (2001). **Influence of a high ambient temperature on lipid metabolism in the growing pig.** *Journal of Animal Science* 79 (1): 81-7, ISSN: 0021-8812.

NAL Call No.: 49 J82.

Keywords: Large White x Landrace, breed, castrated male pigs, ad libitum fed, restricted fed, heat, housing, lipids, metabolism, growth and development, adipose tissue, anatomy, histology, analysis of variance, castration, chylomicrons, blood, lipids, blood, lipoprotein lipase.

Kuehne, M.; Koerner, U.; Wenzel, S. (2001). **Tetracycline residues in meat and bone meals. Part 2: The effect of heat treatments on bound tetracycline residues.** *Food Additives and Contaminants* 18 (7): 593-600, ISSN: 0265-203X.

NAL Call No.: TX553 A3F65.

Keywords: tetracycline residues, rendering plant, animal feed, meat meal, bone meal, preparation, heating, quantitative analysis, toxic food residue.

Kyriakis, S.C.; Giannakopoulos, C.G.; Alexopoulos, C.; Boscos, C.; Spais, A.; Saoulidis, K. (2001). **The effect of salinomycin on certain blood parameters and milk quality of lactating sows.** *Journal of Veterinary Medicine Series A* 48 (6): 321-329, ISSN: 0931-184X.

NAL Call No.: 41.8 Z5.

Keywords: gilts, lactating sows, salinomycin, antibiotic, dosage, feed additive, sow diet, total solids, ash,

cholesterol, fat, lactose, lipids, protein, ultrasound, blood parameters, gestation, pregnancy, lactation, milk quality, chemical composition, increased piglet weight gain, piglet survival.

Laitat, M.; Vandenheede, M.; Desiron, A.; Canart, B.; Nicks, B. (1999). **Comparison of feeding behaviour and performance of weaned pigs given food in two types of dry feeders with integrated drinkers.** *Animal Science: An International Journal of Fundamental and Applied Research* 68(1):35-42, ISSN: 1357-7298.
NAL Call No.: SF1.A56
Keywords: pigs, dry feeding, water intake, body weight, liveweight gain, pig feeders, feed intake, feed conversion, animal welfare.

Laspiur, J.P.; Trottier, N.L. (2001). **Effect of dietary arginine supplementation and environmental temperature on sow lactation performance.** *Livestock Production Science* 70 (1/2):159-165, ISSN: 0301-6226.
NAL Call No.: SF1.L5.
Keywords: sows, arginine, body temperature, environmental temperature, feed conversion efficiency, feed intake, feed supplements, heart rate, heat stress, lactation, litter performance, litter weight, liveweight gain, lysine, pregnancy, respiration rate, weaning.

Lawlor, P.G.; Lynch, P.B.; O' Doherty, J.V.; Caffrey, P.J. (2001). **The effect of choice feeding complete diets on the performance of weaned pigs.** *Journal of Dairy Science* 84 (Supplement 1): 400, Joint Meeting of the American Dairy Science Association, American Meat Science Association, American Society of Animal Science and the Poultry Science Association, Indianapolis, Indiana, USA, July 24-28, 2001, ISSN: 0022-0302.
NAL Call No.: 44.8 J822.
Keywords: body weight, choice feeding, daily gain, growth performance, phase feeding, starter diet, weaner diet, meeting abstract.

Lawlor, P.G.; Lynch, P.B.; O'Doherty, J.V.; Caffrey, P.J. (2001). **Effect of pre-weaning management and post-weaning nutrition on the performance of weaned pigs.** *Journal of Dairy Science* 84 (Supplement 1): 400, Joint Meeting of the American Dairy Science Association, American Meat Science Association, American Society of Animal Science and the Poultry Science Association, Indianapolis, Indiana, USA, July 24-28, 2001, ISSN: 0022-0302.
NAL Call No.: 44.8 J822.
Keywords: creep feed, feed, daily gain, feed intake, growth performance, litter size, post weaning nutrition, pre weaning management, meeting abstract.

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NAL Call No.: 286.81 F322.
Keywords: antibiotics, pig feeding, animal husbandry, animal nutrition, feed additives, feed composition.

Lee, C.Y.; Lee, H.P.; Jeong, J.H.; Baik, K.H.; Jin, S.K.; Lee, J.H.; Sohn, S.H. (2002). **Effects of restricted feeding, low-energy diet, and implantation of trenbolone acetate plus estradiol on growth, carcass traits, and circulating concentrations of insulin-like growth factor (IGF)-I and IGF-binding protein-3 in finishing barrows.** *Journal of Animal Science* 80 (1): 84-93, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: finishing pigs, barrow, breed, Landrace x Yorkshire x Duroc, estradiol-17-beta, hormone, drug, insulin-like growth factor binding protein 3, insulin-like growth factor I, circulating concentration, trenbolone acetate, anabolic drug, implantation, carcass traits, growth, low energy diet, restricted feeding.

Leser, T.D.; Amenuvor, J.Z.; Jensen, T.K.; Lindecrona, R.H.; Boye, M.; Moller, K. (2002). **Culture independent analysis of gut bacteria: The pig gastrointestinal tract microbiota revisited.** *Applied and Environmental Microbiology* 68 (2): 673 690, ISSN: 0099-2240.
NAL Call No.: 448.3 Ap5.

Keywords: intestinal bacteria, diet, variety, age, herd health status, microbial analysis, ribosomal DNA sequencing, phylogenetic diversity, phylogenetic linkages, phylotypes.

Lien, T.F.; Wu, C.P.; Wang, B.J.; Shiao, M.S.; Shiao, T.Y.; Lin, B.H.; Lu, J.J.; Hu, C.Y. (2001). **Effect of supplemental levels of chromium picolinate on the growth performance, serum traits, carcass characteristics and lipid metabolism of growing finishing pigs.** *Animal Science: an International Journal of Fundamental and Applied Research* 72 (2): 289-296, ISSN: 1357-7298.
NAL Call No.: SF1 A56.
Keywords: growing finishing, chromium picolinate, mechanism of action, supplemental diet levels, carcass characteristics, growth performance, lipid metabolism, serum traits.

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NAL Call No.: SF55 A78A7.
Keywords: weanling pigs, spray dried plasma, average daily feed intake, average daily gain, extruded soybean protein concentrate, feed supplement, growth performance.

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NAL Call No.: 49 J82.
Keywords: barrows, gilts, backfat, carcass quality, dietary fat, diets, finishing, growth rate, lean, liveweight, liveweight gain, lysine.

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NAL Call No.: QR1 J687.
Keywords: Escherichia coli, Salmonella choleraesuis, Aujeszky's Disease, Blue Eye Disease, ensilages based on solid fraction of pig feces, disease transmission mechanisms, analysis, preparation, microbial persistence studies, microsilos.

Mavromichalis, I.; Webel, D.M.; Parr, E.N.; Baker, D.H. (2001). **Growth promoting efficacy of pharmacological doses of tetrabasic zinc chloride in diets for nursery pigs.** *Canadian Journal of Animal Science* 81 (3): 387-391, ISSN: 0008-3984.
NAL Call No.: 41.8 C163.
Keywords: nursery pigs, zinc oxide, tetrabasic zinc chloride, dietary supplement, growth promoting agent, pharmacologic levels, weight gain, feed efficiency.

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NAL Call No.: 49 J82.
Abstract: The objective of this study was to examine effects of increased gut fill and diverse developing environments on pregnant gilts' behavior and physiology. Gilts were cross-fostered at 1 d of age and transferred to either an indoor or outdoor production unit. Littermate gilts remained in their different environments during development and were moved into individual gestation crates in an indoor gestation unit. Of the 42 gilts, 19 were fed a control diet of fortified sorghum-soybean meal and 23 were fed the same diet with 25% beet pulp (high fiber). Control sows ate 2.0 kg/d and high-fiber sows ate 2.67 kg/d in a large pellet (thus resulting in approximately equal energy intake and differing total dietary intakes). Pregnant gilts had behavior and immune measures sampled at 30, 60, and 90 d of gestation. The day x diet interaction was significant (P = 0.01) for

duration of standing: sows fed high-fiber diets stood less on d 30, but on d 60 and 90 they and the control sows stood for a similar duration. Sham chewing duration and frequency showed significant (P < 0.05) effects of gestation stage x diet x environment. Gilts reared outdoors and fed high fiber increased sham chewing over gestation, whereas all other treatment groups decreased this behavior over time. Outdoor-reared gilts had greater (P < 0.05) frequency and duration of drinking behavior than indoor-reared gilts. White blood cell numbers were higher (P < 0.05) for gilts fed high-fiber diets than for gilts fed the control diet. Immune (humoral and cellular systems) and reproductive measures (farrowing rate and litter size) and plasma cortisol concentrations were generally not influenced (P >0.10) by diets and rearing environments, suggesting that in spite of significant changes in behavior and feed intake gilts' immune systems were not suppressed or enhanced. Behavioral data alone suggested that indoor-reared gilts showed fewer behavioral adaptations to the crates than outdoor-reared gilts. However, immune measures did not indicate that any treatments resulted in physiological effects indicative of stress.
Keywords: gilts, pregnancy, behavior, housing, indoor versus outdoor production, sexual reproduction, fiber, digesta, litters, feed rations, feeds, feed intake, duration, stress, animal welfare.

Meulen, J. van der; Graaf, G.J. de; Nabuurs, M.J.A.; Niewold, T.A. (2001). **Effect of transportation stress on intramucosal pH and intestinal permeability.** In: *Digestive Physiology in Pigs. Proceedings of the 8th Symposium, Swedish University of Agricultural Sciences, Uppsala, Sweden, June 20-22, 2000*, Lindberg, J.E.; Ogle, B. (Eds.), CABI Publishing: Wallingford, UK, pp.329-331, ISBN: 0-85199-517-9.
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Keywords: blood flow, intestinal mucosa, permeability, pH, stress, transport of animals.

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Keywords: sows, behavior, feeding behavior, stereotypic, operant conditioning, motivation, diets, fiber, performance, physiological functions, reviews.

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NAL Call No.: SF95.A55.
Keywords: sows, food restriction, feed rations, fiber, animal behavior, health, nutritional state, pregnancy, performance, hunger, aggressive behavior, feeding, energy intake, nutrient intake, glucose, insulin, volatile fatty acids, fermentation, stress, animal welfare, literature reviews.

Min, T.S.; Kim, J.D.; Hyun, Y.; Sohn, K.S.; Heo, K.N.; Han, I.K. (2001). **Effects of environmentally friendly agents on growth performance, nutrient digestibility, nutrient excretion and carcass characteristics in growing finishing pigs.** *Asian Australasian Journal of Animal Sciences* 14 (4): 540-547, ISSN: 1011- 2367.
NAL Call No.: SF55 A78A7.
Keywords: growing finishing pigs, yucca extract, mineral feed additive, acidifier, nonspecific immunostimulating anionic alkali solution, growth performance, nutrient digestibility, nutrient excretion, carcass characteristics, costs, effects on environment.

Morgan, C.A.; Nielsen, B.L.; Lawrence, A.B.; Mendl, M.T.(1999). **Describing the social environment and its effects on food intake and growth.** In: *A Quantitative Biology of the Pig* I. Kyriazakis (ed.), CAB International Wallingford, UK, ISBN: 0-85199-273-0, pp. 99-125.
NAL Call No.: IPM990717336.
Keywords: reviews, animal welfare, feeding behavior, group effect, stress, performance, growth, feed intake, environmental factors, pig feeding, housing.

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NAL Call No.: SF1.A56.

Abstract: When weaned early, piglets commonly take some time to accept solid food, resulting in a growth check and reduced welfare. The transmission of information about food between animals has been demonstrated in other species and it would be advantageous if this occurred in piglets. This experiment investigated the effects of pairing piglets that were consuming solid food with newly weaned piglets. Six litters of piglets did not receive solid food until weaning. In each litter four piglets (3 plus 1 spare) were weaned at 21 days of age and housed together for 7 days and offered one of two foods (3 litters per food). At 28 days of age the remaining piglets were weaned and four pairs of piglets were formed, such that there were three experienced animals paired with three inexperienced observers, each pair having visual contact and varying degrees of physical contact (1: none, 2: through wire mesh, 3: housed together), and a pair of inexperienced piglets (4: housed together) to act as controls. Food intake and weight gain were recorded over a period of 7 days. There was no effect of food type on food intake or live-weight gain of the pairs but the inexperienced pigs had higher gains on food 1 than food 2. The inexperienced pairs ate less food than the other pairs and the experienced/observer pairs that were housed together had the greatest weight gain. The level of variation between piglets was such that there were no significant effects of pairing treatment on the weight gain of the inexperienced animals. Total time spent feeding increased with time from pair formation. The number of simultaneous feeding events was higher for the experienced/observer pairs housed together than for the inexperienced pairs. This experiment has indicated that food intake is stimulated when an inexperienced piglet is housed with an experienced piglet and, with further work, this could be exploited to alleviate the weaning check.

Keywords: piglets, feeding, pair feeding, feed intake, food type, liveweight gain.

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Keywords: energy value, feeds, fiber content, fiber, nutritive value, ingredients, byproducts, digestibility, lignin, wheat straw, pectins, liveweight, age, methane, digestion, metabolizable energy, energy balance, climatic factors, animal behavior, literature reviews.

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Keywords: growing pigs, crude fat, dietary, crude protein, dietary, nitrogen, diet, energy balance, feed utilization, heat production.

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Keywords: pigs, weaning, performance, animal behavior, feed dispensers, water, feed intake, feed conversion efficiency, growth rate, aggressive behavior, welfare.

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NAL Call No.: S3.A27.

Keywords: sows, dietary supplement, animal feed, digestibility, dried sugar beet pulp, energy metabolism, grass pellets, heat production, oats, wheat bran, pregnancy.

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Keywords: piglets, colostrum, diets, nutrition physiology, feeding, weaning, transition to post-weaning diet,

animal welfare, health, review.

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NAL Call No.: 44.8 J822.
Keywords: piglet, weaned, feeding systems, housing, large groups, meeting abstract.

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NAL Call No.: T223 A21.
Keywords: patent, hog feeder, adjustable gate mechanism, feed hopper, dry hog feed, gravity dispensed, sliding cam arrangement, farm equipment.

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Keywords: adaptation, housing, individual versus group, body weight, energy balance, energy consumption, energy intake, environmental temperature, heat production, physical activity, stocking rate, unrestricted feeding, feed intake, cold exposure.

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NAL Call No.: 44.8 J822.
Keywords: behavior, nutrition, forage crops, buffalo grass, tall fescue, alfalfa, white clover, gestation, grazing, ground cover, manure, rooting, soil erosion, sustainable outdoor pig production, meeting abstract.

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NAL Call No.: 49 J82.
Keywords: fiber, pregnancy, sows, crude fiber, energy intake, mastication, behavior, appetite, feeding behavior, animal welfare.

Rasmussen, H. (2001). **Feeding device for feeding animals.** *Official Gazette of the United States Patent and Trademark Office Patents* 1253 (3): No Pagination, ISSN: 0098-1133.
NAL Call No.: T223 A21.
Keywords: piglets, feeding device, patent, design, pipe mounted on a frame, control bar, flexible material, slide bushing, adjusts to animals of different sizes.

Ratcliff, J. (2001). **Genetically modified organisms in animal feed, a European perspective.** In: *Concepts in*

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Keywords: animal welfare, consumer attitudes, consumer behavior, consumer protection, feed additives, food safety, genetically engineered microorganisms, reviews, world markets, international trade, Europe.

Renaudeau, D.; Noblet, J. (2001). **Effects of exposure to high ambient temperature and dietary protein level on sow milk production and performance of piglets.** *Journal of Animal Science* 79 (6): 1540-1548, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: The effects of high ambient temperature and level of dietary heat increment on sow milk production and piglet performance over a 28-d lactation were determined in 59 multiparous crossbred Large White x Landrace pigs kept at a thermoneutral (20 degrees C) or in a hot (29 degrees C) constant ambient temperature. Experimental diets fed during lactation were a control diet (NP; 17.6% CP) and two low-protein diets obtained by reduction of CP level (LP; 14.2% CP) or both reduction of CP and addition of fat (LPF; 15.2% CP); the NE:ME ratio was 74.3, 75.6, and 75.8% for NP, LP, and LPF diets, respectively. All diets provided 0.82 g of digestible lysine/MJ of NE, and ratios between essential AA and lysine were above recommendations. Creep feed was provided after d 21 of lactation. Reduction of CP level did not influence (P > 0.10) milk production, milk composition, or piglet performance. Despite higher nursing frequency (39 vs 34 sucklings per day), milk production decreased (P < 0.01) from 10.43 to 7.35 kg/d when temperature increased from 20 to 29 degrees C. At d 14, DM (18.6 vs 18.1%) and energy (4.96 vs 4.75 MJ/kg) contents in milk tended (P = 0.09) to be higher in sows kept at 29 degrees C. Over the 28-d lactation, piglet BW gain and BW at weaning decreased (P < 0.01) from 272 to 203 g/d and 9.51 to 7.52 kg, respectively, when temperature increased from 20 to 29 degrees C. Daily creep feed intake over the 4th wk of lactation was higher (P < 0.01) at 29 degrees C than at 20 degrees C (388 vs 232 g/litter, respectively), which was reflected in a greater increase in BW gain between wk 1 to 3 and wk 4 at the higher temperature (147 vs 130%); BW gain between weaning and d 14 postweaning was higher (P < 0.05) for piglets originating from sows kept at 29 degrees C (280 vs 218 g/d). In connection with their lower growth rate, DM (31.2 vs 33.0%), protein (15.5 vs 16.0%), lipid (12.3 vs 13.9%), and energy (8.39 vs 9.09 kJ/g) contents in weaned, slaughtered piglets were lower (P < 0.01) at 29 than at 20 degrees C. In conclusion, modification in the CP:NE ratio in order to decrease dietary heat increment did not affect milk production and piglet performance in thermoneutral or hot climatic conditions. Our results confirm the negative effect of high ambient temperatures on milk yield and emphasize the importance of creep feed supply to improve pre- and postweaning growth of piglets in these conditions, especially when weaning occurs after 3 wk of age.
Keywords: piglets, sows, milk yield, lactation, dietary protein, feeds, air temperature, performance, growth, heat stress, creep feeding, milk composition, energy content, liveweight gain, liveweight, weaning weight, pig feeding.

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NAL Call No.: QL750.A6.
Keywords: gilts, feeding behavior, motivation, operant conditioning tests, pushing a button, food reward, stereotypy, vacuum chewing, chain manipulation, nutrition, diets, feed intake, feeding frequency, number of meals, fiber.

Rosenvold, K.; Andersen, H. J. (2003). **The significance of pre-slaughter stress and diet on colour and colour stability of pork.** *Meat Science* 63 (2): 199-209, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Abstract: The influence of pre-slaughter stress and a diet known to affect post mortem muscle metabolism or a standard diet (control pigs) on colour and colour stability of M. longissimus dorsi, M. biceps femoris and M. semimembranosus from 112 female pigs, free of the Halothane gene, was investigated. Pre-slaughter stress increased the early post mortem temperature in the 3 muscles, as well as the pH decline in control pigs, but not in pigs fed the experimental diet. Colour was measured on sliced samples after 0, 2 and 5 days retail display (1, 3 and 6 days post mortem, respectively) from the 3 muscles aged 1 day before cutting as well as on sliced M.

longissimus dorsi samples aged 8 days before cutting (8, 10 and 13 days post mortem, respectively). Early post mortem pH was not a main determinant of the colour and colour stability, while the degree of pre-slaughter stress and especially its influence on temperature early post mortem was crucial in relation to colour development and colour stability. The discoloration rate was enhanced in M. longissimus dorsi aged for 8 days prior to retail display compared with samples aged for 1 day. However, the extent of the discoloration after 5 days of retail display was not inferior in muscle samples aged for 8 days due to a higher degree of blooming. Finally, present data indicate that 3-4 days ageing of pork prior to retail display results in the optimal colour stability.

Keywords: aging, color, diets, discoloration, exercise, muscles, pig meat, postmortem changes, slaughter, stability, storage, stress, temperature.

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Schulze, V.; Roehe, R.; Looft, H.; Kalm, E. (2001). **Effects of continuous and periodic feeding by electronic feeders on accuracy of measuring feed intake information and their genetic association with growth performances.** *Journal of Animal Breeding and Genetics* 118 (6): 403-416, ISSN: 0931-2668.

NAL Call No.: 442.8 Z35.

Keywords: electronic feeding stations, equipment, continuous feeding regime, periodic feeding regime, growth rate, backfat thickness, feed intake, estimation accuracy, measurement accuracy, feed intake behavior, feeder visits per day, time per day, time per visit.

Shelton, J.L.; Hemann, M.D.; Strode, R.M.; Brashear, G.L.; Ellis, M.; McKeith, F.K.; Bidner, T.D.; Southern, L.L. (2001). **Effect of different protein sources on growth and carcass traits in growing finishing pigs.** *Journal of Animal Science* 79 (9): 2428-2435, ISSN: 0021-8812.

NAL Call No.: 49 J82.

Keywords: animal feed, protein, different protein source effects, soybean meal, carcass trait, growing finishing.

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NAL Call No.: 41.8 IN22.

Keywords: weaner pigs, wheat offal, substitute for maize grain, daily feed intake, daily body weight gain, feed cost per kg body weight gain.

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NAL Call No.: SF1 A56.

Keywords: finishing, aggression, liveweight gain, feed dispensers, feeding, animal housing, lesions, pens, skin, skin lesions, weight gain, animal welfare, fattening performance, group size, feeding behavior.

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NAL Call No.: 389.8 J82.

Abstract: Compromising alterations in gastrointestinal architecture are common during the weaning transition of pigs. The relation between villous atrophy and epithelial barrier function at weaning is not well understood.

This study evaluated in vitro transepithelial transport by Ussing metabolic chambers, local alterations in T-cell subsets and villous architecture at low energy intake level and their relation with lactose/protein ratios in the diet. Pigs (n = 66, 26 d old) were sampled either at weaning (d 0), d 1, 2 or 4 postweaning. Piglets received one of three diets at a low energy intake level, which differed in lactose and protein ratio as follows: low lactose/high protein (LL/HP), control (C), or high lactose/low protein (HL/LP). Mean digestible energy intake was 648 kJ/pig on d 1, 1668 kJ/pig on d 2, 1995 kJ/pig on d 3 and 1990 kJ/pig on d 4 postweaning. The CD4(+)/CD8(+) T-lymphocytes ratio decreased after weaning ($P < 0.05$). Decreased paracellular transport ($P < 0.01$), greater villous height ($P < 0.01$), shallower crypts and lower villus/crypt ratios ($P < 0.01$) were observed on d 2 compared with d 0. Piglets consuming the HL/LP diet tended to have less paracellular transport ($P < 0.10$) and greater villous height ($P < 0.10$) compared with piglets fed the other diets. During the first 4 d postweaning, the effect of diet composition on mucosal integrity was not as important as the sequential effects of low energy intake at weaning. Stress and diminished enteral stimulation seem to compromise mucosal integrity as indicated by increased paracellular transport and altered T-cell subsets.
Keywords: dietary proteins, metabolism, small intestine, physiology, lactose, administration and dosage, metabolism, weaning, dietary proteins, administration and dosage, energy intake, epithelium, physiology, pathology, t-lymphocytes.

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NAL Call No.: SF1.A56.
Keywords: pigs, nipple drinkers, ratios, drinking, water intake, aggressive behavior, group size, lesions, liveweight gain, diurnal variation, feed intake, feed conversion, animal welfare.

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NAL Call No.: SF5 B74 no. 23.
Keywords: animal welfare, livestock, legislation, animal housing, water, drinking, housing.

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NAL Call No.: 382 So12.
Keywords: animal feed, feed scales, accuracies, equipment, animal diets, feed ingredients, correct weighing, feed mills, feed quality, quality feed mixing, cost.

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NAL Call No.: SF1.L5.
Keywords: piglets, weanling, animal feed, feed additive, spray dried animal plasma, feed intake, post weaning diarrhea, review of literature, average daily gain, feed conversion ratio, growth performance, costs.

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Keywords: production, antiinfective agents, food hygiene, health, penicillin, tetracycline, human health, regulation, legislation.

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NAL Call No.: QL750.A6.
Keywords: behaviour, aggression, pens, feeds, litter, housing, management, feeding, social behavior, fiber, straw, sows, molasses, beet pulp, housing, animal welfare.

Whittemore, C.T.; Green, D.M.; Knap, P.W. (2001). **Technical review of the energy and protein requirements of growing pigs: Protein.** *Animal Science: an International Journal of Fundamental and Applied Research* 73 (3): 363-373, ISSN: 1357-7298.
NAL Call No.: SF1 A56.
Keywords: growing pig, review of literature, protein requirements, digestible protein, amino acid requirements, energy, absorption, retention, mathematical methods, algorithms.

Whittemore, E.C.; Kyriazakis, I.; Emmans, G.C.; Tolkamp, B.J. (2001). **Tests of two theories of food intake using growing pigs: 1. The effect of ambient temperature on the intake of foods of differing bulk content.** *Animal Science: an International Journal of Fundamental and Applied Research* 72 (2): 351-360, ISSN: 1357-7298.
NAL Call No.: SF1 A56.
Keywords: growing pigs, ambient temperature, food intake, bulk content, food intake theories, tests.

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NAL Call No.: SF1 A56.
Abstract: The effect of a period of feeding on a high bulk food, upon the subsequent intake of foods of differing bulk content, was investigated in two experiments of the same design. The intention was to provide a severe test of the two current conceptual frameworks available for the prediction and understanding of food intake. In each experiment 40 male Manor Meishan pigs were randomly allocated to one of four treatment groups at weaning. Each experiment was split into two periods, P1 (12 to 18 kg) and P2 (18 to 32 kg). The treatments, all with ad libitum feeding, were: a control food (C) given throughout (treatment CC); a medium bulk food (M) given throughout (treatment MM); a high bulk food (H) given in P1 and then C in P2 (treatment HC); H given in P1 and M in P2 (treatment HM). C was based on micronized wheat with 13.4 MJ digestible energy and 243 g crude protein per kg fresh food. In experiment 1 M contained 350 g/kg and H 560 g/kg of unmolassed sugar-beet pulp and in experiment 2 M contained 500 g/kg and H 700 g/kg of unmolassed sugar-beet pulp. Framework 1 predicted that food intake on the medium bulk food (M) would not be increased, whereas framework 2 predicted that intake on M would be increased after a period of feeding on H, compared with when M was offered continuously. In P1, both food intake ($P<0.01$) and growth ($P<0.001$) were severely limited on H compared with C. In experiment 1 growth was limited on M compared with C during the first 7 days of P1 ($P<0.01$) only. In experiment 2 intake ($P < 0.001$) and growth ($P< 0.001$) on M were limited throughout P1, compared with C but not thereafter. Therefore, in neither experiment did M cause a lower growth rate than C from 18 to 32 kg. In experiment 1 there was full adaptation to M after about 10 days from 12 kg. In experiment 2 adaptation was complete by the end of the first 7 days from 18 kg. In P2, food intake ($P<0.001$) and live-weight gain ($P<0.05$ and $P < 0.001$ in experiments 1 and 2, respectively) were increased on HC compared with CC. By the last 7 days of P2 intake was still higher ($P < 0.01$) but growth rate was no longer different to CC. Intake and gain were increased in P2 on HM compared with MM but, in general, these differences were small and not significant. In the first 7 days of P2, in experiment 1 pigs on HM had higher intakes ($P < 0.001$) and gains ($P < 0.05$) than those on MM, but in experiment 2 only intake was higher ($P < 0.01$) with no difference in gain. By the last 7 days of P2 there was no difference in either intake or gain between these two groups in either experiment. Pigs on HC increased intake by more than those on HM. There was, therefore, a significant interaction for food intake ($P < 0.05$, in experiment 1 and $P < 0.001$, in experiment 2) between prior and present food. The unexpected failure of either M food to limit growth throughout the experimental period meant that the results of these experiments could not be used as a strong test to reject either one of the frameworks. However, the ability of the pigs to compensate on M was less than that on C. The data provide some evidence that under conditions of compensation foods such as M may be limiting. This is in closer agreement with the framework

that predicted that consumption of a limiting food will not increase after a period of feeding on a high bulk food (framework 1).
Keywords: Manor Meishan, breed, feed intake, feeding behavior, growth rate, liveweight gain, feeds, beet pulp, feeding.
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Whittemore, C.T.; Green, D.M.; Knap, P.W. (2001). **Technical review of the energy and protein requirements of growing pigs: food intake.** *Animal Science: an International Journal of Fundamental and Applied Research* 73(Part 1): 3-17, ISSN: 1357-7298.
NAL Call No.: SF1.A56.
Abstract: Food intake in pigs is highly variable across different production circumstances. This report concludes from a critical review of published observations that it was unrealistic to expect from the scientific literature purporting to express nutrient requirement any reasonable prediction of the particular food intake of groups of pigs. None the less, such knowledge is essential for the practical purposes of their day-to-day nutrition. The literature does however yield general principles from which may be derived: (a) the likely forms (but not the parameter values) of intake functions relating food intake to pig live weight; and (b) the likely factors involved in the modulation of food intake at any given live weight. Using these principles two methods for determining on-farm food intake from the use of simple and available records were proposed. The first requires knowledge only of start and final weight, the time elapsed, and total food intake: it involves two steps, the determination of a suitable growth curve followed by the fitting of a suitable food intake curve. The second method is appropriate in the absence of information on total food intake, and requires a minimum number of spot measurements through the growth period. Different functions were tested for the curve of best fit. As a further benefit it appeared that models could be constructed from the information presented that would speculate for diagnostic purposes upon the likely modulators of food intake. Such models could explore the constraints of gut capacity, the energetic requirements of maintenance and potential growth, the influence of excessive or inadequate environmental temperature, the quality of housing and stocking density.
Keywords: energy requirements, protein requirement, growth, feed intake, animal husbandry, nutrient requirements, nutritional state, liveweight, equations, mathematical models, literature reviews.

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NAL Call No.: 290.9 Am32T.
Keywords: piglets, weight, nutrition, feeding, transport, physiology, animal welfare, water, body weight, transport of animals, management.

Xuan, Z.N.; Kim, J.D.; Heo, K.N.; Jung, H.J.; Lee, J.H.; Han, Y.K.; Kim, Y.Y.; Han, I.K. (2001). **Study on the development of a probiotics complex for weaned pigs.** *Asian Australasian Journal of Animal Sciences* 14 (10): 1425-1428, ISSN: 1011-2367.
NAL Call No.: SF55 A78A7.
Keywords: dietary supplement, antibiotic, Ractocom, probiotics complex, diarrhea, avilamycin, average daily feed intake, average daily gain, growth performance, microbial population, nutrient digestibility.

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NAL Call No.: SF55 A78A7.
Keywords: breed, Yorkshire x Landrace x Duroc, feeding methods, small intestine, digestive system, morphology, nutritional method, expanded crumble diet, mash diet, pelleted diet, wet feeding, average daily feed intake, average daily gain, feed conversion ratio, growth performance, nutrient digestibility.

Yin, Y.L.; McEvoy, J.D.; Schulze, H.; McCracken, K.J. (2001). **Effects of xylanase and antibiotic addition on ileal and faecal apparent digestibilities of dietary nutrients and evaluating HCl insoluble ash as a dietary**

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Keywords: growing pigs, xylanase, antibiotic, avoparcin, dietary supplement, crude protein, hydrochloric acid, insoluble ash, biomarker, neutral detergent fiber, non starch polysaccharide, wheat middling based diet, nutrient digestibility.

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Keywords: young pigs, stress, environmental conditions, probiotics, lactic acid producing bacteria, Bacillus, Bifidobacterium, Clostridium, Enterococcus, Escherichia, Eubacterium, Lactobacillus, Saccharomyces, Streptococcus, yeast, digestive system, microbial balance, oligosaccharides, fermentation.

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General

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Bahnson, P.B.; Michalak, M.M.; Miller, G.Y. (2001). **Pork producers' attitudes, knowledge, and production practices that relate to on-farm food safety.** *Journal of Food Protection* 64 (12): 1967-72, ISSN: 0362-028X.
NAL Call No.: 44.8 J824.
Abstract: A survey was distributed by mail to a random selection of Illinois pig farmers marketing 1,000 or more pigs in 1998 to assess their knowledge, attitude and behavior regarding on-farm food safety. Valid responses were received from 353 of the 946 surveys mailed (37.3%). Pork production accounted for more than 50% of gross agricultural revenues among 65.0% of respondents, and 91.2% were classified as "owner-operators." Knowledge of food-borne pathogens was mixed, with correct responses to questions as follows: Trichina, 80.4%; Salmonella, 58.5%; Toxoplasma, 19.9%; and Campylobacter, 12.8%. Producers strongly agreed that food safety was a shared responsibility at every level of the food chain, including the farm level, with an average score for all steps in the pork chain of 4.5 on a scale from 1 (not important) to 5 (very important). When asked whether third party verification of on-farm practices was important, 51.2% agreed and 48.8% either disagreed or neither agreed nor disagreed. Associations between demographic categories and knowledge of and attitudes toward food safety were detected for herd size, proportion of agricultural receipts from pig production, grower versus birth-to-market production, age categories, and whether the respondent owned the pigs or facilities. Many (53.4%) were willing to apply a suggested food safety practice, even if there was no net profit for the practice. Findings suggest that Illinois pork producers accept an important role in pork food safety and express a willingness to participate but have knowledge gaps that should be filled.
Keywords: data collection, food microbiology, knowledge, attitudes, practice, questionnaires, safety record,

Illinois.

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Abstract: The author explores the variations in the domestic livestock populations world-wide between 1961 and 1998, and observes a marked increase in the swine population, as compared to other domestic species. Trends in international trade of live animals over the same period are also analysed; international trade involved 1% of livestock world-wide and the international meat market constituted 10% of total meat production. The various stages of the food chain are analysed, from farm to fork, with emphasis on those elements to which the concept of traceability is applicable; from the composition of bovines, to slaughter, and through the various products and sub-products all the way to the final product consumed. Against this background, the characteristics of identification systems for individual animals and animal products is described, as well as applications to traceback and trace forward. To conclude, the author details the factors which influence the various processes of identification and traceability, and thus must be considered when choosing a system. The wide variability amongst systems world-wide is noted and attributed to the differences in sanitary and economic or socio-cultural criteria. The author therefore recommends that work should begin on international harmonisation of such systems.
Keywords: animal identification systems, commerce, standards, international cooperation, trends, meat, standards, meat products, animal welfare, public health, quality control, safety, veterinary medicine.

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Keywords: animal welfare, husbandry, economics, public demands, applied ethology, animal behavior, knowledge transmission from scientists to farmers, phone interviews, questionnaires, attitude, education, information sources, and contact persons concerning animal behaviour, insufficient transfer of knowledge, improvements, Austria, German language.

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Keywords: animal evaluation courses, animal science curricula, education, novel idea, conformation traits, animal welfare, welfare assessment, competitions, judging teams.

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NAL Call Number: 49 J82.
Abstract: The incorporation of livestock into agricultural systems ensures a more sustainable agriculture. Sustainable swine production systems are defined as those that combine production and management techniques to enhance profit and improve the ecological and socioeconomic surroundings. Over the long term, the systems should maintain or enhance the environment and resource base, the quality of life for the producers and society as a whole, the profit level of producers, and the quality of pork produced. Swine production in the United States is rapidly changing to fewer and larger production units. At the interface of sustainable agriculture and swine production are several levels of issues. Four levels of issues are the farm, the rural community, the society or consuming public, and the ecosystem or environment. By examining each level, long-term sustainability issues for U.S. swine production emerge. Some of these issues include swine care and husbandry, producer health, management and production systems, access to markets, information, technology and genetics, producer entrance requirements, specialization, manure utilization, industry structure, pork quality and leanness, and the impact of modern intensive systems on the environment, farms, and rural communities. The challenge beyond identifying issues is to incorporate sustainable concepts into profitable, ecologically based swine production systems. Several major groups of issues are discussed, including swine industry structure change issues, access and entrance issues, manure, by-product and nuisance issues, and pork quality issues. Many of these issues can be addressed. The solutions often rely on increased education, management, or technology applications. These processes provide broad opportunities for animal scientists. Examples of current solutions are quality assurance programs, segregated age rearing techniques, educational and promotional commodity programs, manure management programs, phase feeding, diet manipulation to alter manure nutrient concentrations, young producer assistance programs, producer networking, and environmental awareness activities. There are many more opportunities for improving the sustainability of U.S. swine production, when a long-term, issue-oriented viewpoint is maintained.

Keywords: pig farming, sustainability, pig manure, agricultural structure, rural economy, meat quality, application to land.

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Abstract: A questionnaire study was performed involving 76 farms with a total of 380,207 pigs to assess the welfare of pigs kept in Hungary based on the animal welfare legislation of the European Union. Most significant deficiencies were found in the fulfillment of the provisions relating to space requirements, the stall microclimate and the behavioural needs of the animals.
Keywords: husbandry, standards, animal welfare, standards, physiology, husbandry, methods,, housing, animal, questionnaires, swine, psychology, European Union, Hungary.

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Abstract: A simulation model was developed to quantify costs and benefits of segregated early weaning (SEW) compared to standard pork production in a vertically integrated system. The computer model considers the farrowing, fattening and slaughtering stage as well as the transportation of pigs between these stages. Input parameters relate to both biological and economic variables which were varied within a normal bandwidth (sensitivity analysis, high and low level). Model output concerns the production costs per slaughter-pig in each stage and for the chain as a whole. With standard pork production the costs per head accounted for 131.72. 28% of the total chain production costs were raised by the farrowing stage, 15% by weaning-to-fattening period (28 kg live weight) and 57% by the fattening stage (> 28 until 115 kg). Despite higher expenses for facilities, transportation and labour, SEW reduced the total chain production cost to 128.02 (low) and 121.32 (high) per head due to higher biological performance, lower medication and reduced fixed costs per unit. N- and P-excretion diminished by 13%. The results indicate that SEW may be an effective and beneficial alternative which meets some of the demands of pig producers and consumers such as effective production, good health and food safety.
Keywords: husbandry, economics, computer simulation, models, physiology, weaning, cost-benefit analysis, time factors.

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Keywords: environmental pollution, prevention and control, manure, refuse disposal, animal welfare, facility design and construction, technology, trends, North Carolina.

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Keywords: organic farming, pig farming, housing, Netherlands.

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Keywords: pig production, housing, piglet-finishing unit, semi-outdoor production, environmental impact, runoff water, drainage water, yards, barns, biochemical oxygen demand, suspended substances, total solids content, chemical oxygen demand, Sweden.

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Keywords: review, scientific, ethical and economic factors, animal welfare, ethical matrix, wellbeing, autonomy, fitness, suffering, husbandry, legislation, free market, quality assurance schemes, quality control, independent audit.

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Keywords: beef, dairy, swine, sheep, poultry, organic livestock farming, organic meat, marketing, health, animal welfare, consumer attitudes, grassland management.

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Swine Health

Aarestrup, F.M. (1999). **Association between the consumption of antimicrobial agents in animal husbandry and the occurrence of resistant bacteria among food animals.** *International Journal of Antimicrobial Agents* 12 (4): 279-85, ISSN: 0924-8579.
Abstract: Antimicrobial agents are used in food animals for therapy and prophylaxis of bacterial infections and in feed to promote growth. The use of antimicrobial agents for food animals may cause problems in the therapy of infections by selecting for resistance among bacteria pathogenic for animals or humans. The emergence of resistant bacteria and resistance genes following the use of antimicrobial agents is relatively well documented

and it seems evident that all antimicrobial agents will select for resistance. However, current knowledge regarding the occurrence of antimicrobial resistance in food animals, the quantitative impact of the use of different antimicrobial agents on selection for resistance and the most appropriate treatment regimens to limit the development of resistance is incomplete. Surveillance programmes monitoring the occurrence and development of resistance and consumption of antimicrobial agents are urgently needed, as is research into the most appropriate ways to use antimicrobial agents in veterinary medicine to limit the emergence and spread of antimicrobial resistance.
Keywords: anti-infective agents, administration and dosage, drug resistance, multiple, meat, microbiology.

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NAL Call No.: 41.8 IN22.
Keywords: piglets, parasitic disease, Schistosoma incognitum, digestive system, intestines, liver, respiratory system, lungs, anaphylactic shock, prenatal sensitization, sudden death.

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NAL Call No.: QP251 A1T5.
Abstract: This trial was conducted in a farrow-to-finish pig unit from November 1999 to February 2000. Since November 1998 an induction-of-parturition program was applied in gilts and sows with PGF2alpha (2 mL Dinolytic, i.m.) 113 d post service, followed by oxytocin (1 mL Intertocine-S, i.m.) 24 h later. This program resulted in a high proportion of animals farrowing within the working hours of the day. At mid December 1999 splay-legs and edematous swelling and reddening of the vulva started to be observed in newborn piglets. A concurrent decline of parameters related to parturition also was noticed. Mycotoxicological analyses of the feeds revealed a co-occurring contamination with deoxynivalenol and zearalenone. For a 4-week period, sows were divided into two groups: (a) an induction-of-parturition and (b) a non-induction-of-parturition group. Significant differences were found between the two groups relating to prevalence of dystocia (<.05) and pregnancy duration (<.05). Moreover, it was found that prevalence of splay-legs and swelling of the vulva were highly correlated (<.05) with reduction of percentage of sows farrowing within the working day and increase of pre-weaning mortality. It was concluded that such an induction-of-parturition program should be avoided during a Fusarium mycotoxicosis.
Keywords: dinoprost, pharmacology, fusarium, mycotoxicosis, labor, induced parturition, oxytocin, disease, physiopathology, animal feed, analysis, fetal death, epidemiology.

Alexopoulos, C.; Karagiannidis, A.; Kritas, S.K.; Boscos, C.; Georgoulakis, I.E.; Kyriakis, S.C. (2001). **Field evaluation of a bioregulator containing live Bacillus cereus spores on health status and performance of sows and their litters.** *Journal of Veterinary Medicine Series A* 48(3): 137-145, ISSN: 0931-184X.
NAL Call No.: 41.8 Z5.
Keywords: sows, piglets, late pregnancy, Paciflor, bioregulator, Bacillus cereus CIP 5832 spores, probiotic, body weight gain, farrowing, feed conversion ratio, growth, lactation, pregnancy.

Bach Knudsen, K.E. (2001). **Development of antibiotic resistance and options to replace antimicrobials in animal diets.** *Proceedings of the Nutrition Society* 60 (3): 291-9, ISSN: 0029-6651.
NAL Call No.: 389.9 N953.
Abstract: As there is a risk of developing antibiotic resistance, a number of commonly used antimicrobial growth promoters have been banned in the EU member states. This decision has put new emphasis on using the diet to control enteric bacterial infections of pigs. Dietary carbohydrates constitute a major proportion of diets for pigs, and the carbohydrate fraction has a diverse composition, with different properties in the gastrointestinal tract, some of which are of importance to gut health. Findings from different studies indicate that dietary carbohydrate composition influences the expression of swine dysentery and infection with nematode worms after experimental challenge with Brachyspira hyodesenteriae and Oesophagostumum dentatum respectively. In both cases the type, amount and physico-chemical properties of the carbohydrates

entering the large intestine played an important role in the infection, and emerging data suggest a synergism between different porcine pathogens. There is also increasing evidence that the feed structure, which relates to the type of plant material in the diet and the way it is processed, can be used to reduce Salmonella prevalence at the herd level. However, it should be stressed that using the diet to manage gut health is not straightforward, since the expression of a pathogen in many cases requires the presence of other components of the commensal biota. (75 Refs.)

Keywords: antibiotics, ban, pharmacology, dietary carbohydrates, metabolism, enterobacteriaceae infections, nematode infections, disease, prevention and control, animal feed, dietary carbohydrates, analysis, drug resistance, drug effects, pathogenicity, European Union.

Barnett, P.V.; Carabin, H. (2002). **A review of emergency foot-and-mouth disease (FMD) vaccines.** *Vaccine* 20 (11-12): 1505-1514, ISSN: 0264-410X.

NAL Call No.: QR189 V32.

Keywords: cattle, pigs, sheep, literature review, emergency foot-and-mouth disease vaccines, viral disease, vaccination, immunization-method, clinical signs, local virus replication, spread of infection.

Bassaganya-Riera, J.; Hontecillsa-Magarzo, R.; Bregendahl, K.; Wannemuehler, M.J.; Zimmerman, D.R. (2001). **Effects of dietary conjugated linoleic acid in nursery pigs of dirty and clean environments on growth, empty body composition, and immune competence.** *Journal of Animal Science* 79 (3) 714-721, ISSN: 0021-8812.

NAL Call No.: 49 J82.

Abstract: Early-weaned pigs (n = 64) averaging 5.3 +/- 0.3 kg and distributed into two environments (dirty and clean) were used to evaluate effects of conjugated linoleic acid (CLA) on growth performance, immune competence, and empty body composition. A factorial (2 x 4) arrangement within a split-plot design, with four littermate pigs as the experimental unit for the environment, pig within litter as the experimental unit for dietary treatment, and d-0 body weight used as covariate, were used in data analysis. Diets were formulated to contain CLA at 0, 0.67, 1.33, or 2% and to exceed the NRC (1988) nutrient needs of pigs. Animals were given ad libitum access to feed for 7 wk in three phases (I, 1 to 2; II, 3 to 5; and III, 6 to 7 wk). Within phases, diets were isocaloric and isonitrogenous. In Phase I, as dietary CLA concentration increased, ADG and ADFI decreased linearly ($P < 0.05$ and $P < 0.02$, respectively). In Phase II, upon adaptation to dietary CLA supplementation, ADG increased quadratically (603, 623, 622, and 548 g/d; $P < 0.01$), ADFI decreased linearly (873, 840, 867, and 717 g/d; $P < 0.02$) and gain:feed ratio tended to increase linearly (691, 742, 715, and 763; $P < 0.07$). In Phase III, no differences in growth performance were attributed to either dietary or environmental treatments. The poor health status associated with the dirty environment induced a growth suppression; pigs in the clean room had a greater cumulative ADG ($P < 0.01$) and ADFI ($P < 0.01$) than pigs in the dirty room. In Phase I, lower plasma urea nitrogen levels observed in pigs found in the dirty room ($P < 0.03$) indicated a lower protein intake caused by a lower ADFI. The effects of dietary CLA on peripheral phenotypic profiles of lymphocytes did not appear until d 42. However, as indicated by the growth suppression of pigs in the dirty room, the negative effects of the environmental challenge on pig health and growth had already appeared during phase I. On d 42, CLA induced a linear increase in percentages of CD8+ lymphocytes (21.7, 22.3, 28.0, and 32.7%, $P < 0.001$). These data suggest that a 42-d dietary CLA supplementation preceding a disease challenge could have prevented disease-associated growth suppression. Also, CLA-mediated amelioration of particular infectious diseases will depend on which CD8+ T cell subset (i.e., CD8alphaalpha immunoregulatory or CD8alphabeta-cytotoxic) is most influenced by dietary CLA supplementation.

Keywords: piglets, linoleic acid, isomers, early weaning, hygiene, body weight, cd8+ lymphocytes, cell mediated immunity, unrestricted feeding, liveweight gain, feed conversion, health, cd4+ lymphocytes, lymphocyte transformation, leukocyte count, body composition, blood plasma, urea, blood composition, glycoproteins.

Cagienard, A.; Regula, G.; Danuser, J. (2002). **The impact of different housing systems on the health and welfare of grower and finisher pigs.** In: *Society for Veterinary Epidemiology and Preventive Medicine. Twentieth Anniversary Proceedings of a Meeting Held at University of Cambridge, UK, April 3-5, 2002*, Menzies, F.D.; Reid, S.W.J. (Eds.), Society for Veterinary Epidemiology and Preventive Medicine Roslin, UK,

pp.120-126, ISBN: 0-948073-54-3.
Keywords: health, housing, husbandry, animal welfare, Switzerland.

Carr, J. (2001). **Porcine respiratory disease syndrome.** *International Pig Topics* 16 (5): 11-13
NAL Call No.: SF391 I58.
Keywords: etiology, air flow, air quality, buildings, curtains, drug therapy, dust, environmental factors, fans, feeds, floors, gases, humidity, hygiene, insulation, litter, pig housing, respiratory diseases, stocking density, temperature, ventilation, water supply.

Carrasco, L.; Ruiz, V.E.; Gomez, V.J.; Salguero, F.J.; Bautista, M.J.; Macia, M.; Quezada, M.; Jover, A. (2001). **Classical swine fever: Morphological and morphometrical study of pulmonary intravascular macrophages.** *Journal of Comparative Pathology* 125 (1): 1-7, ISSN: 0021-9975.
NAL Call No.: 41.8 J82.
Keywords: breed, Large White x Landrace, classical swine fever, hog cholera, pulmonary intravascular macrophages, Golgi complexes, hyperplastic, macrophage, immune system, pulmonary intravascular macrophages, immunohistochemistry.

Carstensen, L.; Vaarst, M.; Roepstorff, A. (2002). **Helminth infections in Danish organic swine herds.** *Veterinary Parasitology* 106 (3): 253-64, ISSN: 0304-4017.
NAL Call No.: SF810.V4.
Abstract: In nine organic swine herds, faecal excretion and pasture contamination by parasite eggs/larvae were studied in a period from March to October 1999. It was shown that the organic pigs were infected with Ascaris suum (28% of weaners, 33% of fatteners, 4% of sows), Trichuris suis (4% of weaners, 13% of fatteners, <1% of sows) and Oesophagostomum spp. (5% of weaners, 14% of fatteners, 20% of sows) whereas no infections with Hyostrongylus rubidus, Metastrongylus spp. or Strongyloides ransomi were detected. Moreover, no pigs showed clinical signs of infestations with scabies or lice. In the soil samples, very few Trichuris eggs were found throughout the season, whereas Ascaris eggs were found in 14% of the soil samples from sow pastures and in 35% from slaughter pig pastures, with the first infective eggs being recorded in July and the maximum number in August. Infective Oesophagostomum larvae were found in the grass samples in increasing numbers from May to October. Single herd cases of exceptionally high parasite infection levels are described in relation to herd management procedures.
Keywords: organic swine herds, disease, parasitology, Helminths, Oesophagostomum larvae, epidemiology, interviews, parasite egg count, seasonal effects, Denmark.

Chianini, F.; Majo, N.; Segales, J.; Dominguez, J.; Domingo, M. (2001). **Immunohistological study of the immune system cells in paraffin embedded tissues of conventional pigs.** *Veterinary Immunology and Immunopathology* 82 (3-4): 245-255, ISSN: 0165-2427.
NAL Call No.: SF757.2 V38.
Keywords: healthy conventionally reared pigs, immune system histology, baseline data, tissue samples, lungs, tonsils, lymph nodes (mediastinal, mesenteric, inguinal and submandibular), pancreas, spleen, liver, kidney, adrenal gland, ileum and stomach, T cells, B cells, polymorphonuclear leukocytes, macrophages, formalin, fixative, paraffin, embedding agent, immunohistochemistry, avidin biotin peroxidase method, analytical method.

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NAL Call No.: SF971 C695 2001.
Keywords: swine medicine, veterinarian's role in swine production, health management techniques,etiology, epidemiology, clinical signs, diagnosis, treatment, prevention, disease control, toxic agents, North America.

Cullen, P.; Chattin, S.E.; Clift, R.E.; Mathew, A.G. (2001). **Effects of environment and management conditions on antibiotic resistance in bacteria associated with swine.** *Abstracts of the General Meeting of the American Society for Microbiology* 101: 750, ISSN: 1060-2011.

NAL Call No.: QR1 A5.
Keywords: pathogens, Escherichia coli, Salmonella enterica, serovar typhimurium, antibacterial drugs, apramycin sulfate, ceftiofur sodium, nalidixic acid, oxytetracycline, sulfamethazine, drug resistance, cold stress, heat stress, overcrowding, intermingling, poor sanitation, meeting abstract.

Davies, Z.E.; Guise, H.J.; Penny, R.H.C.; Sibly, R.M. (2001). **Effects of stone chewing by outdoor sows on their teeth and stomachs.** *The Veterinary Record: Journal of the British Veterinary Association* 149 (1): 9-11, ISSN: 0042-4900.
NAL Call No.: 41.8 V641.
Keywords: sows, stones, animal behavior, teeth, stomach, disorders, injury, England.

De Jong, J.C.; Heinen, P.P.; Loeffen, W.L.; Van Nieuwstadt, A.P.; Claas, E.C.; Bestebroer, T.M.; Bijlsma, K.; Verweij, C.; Osterhaus, A.D.; Rimmelzwaan, G.F.; Fouchier, R.A.; Kimman, T.G. (2001). **Antigenic and molecular heterogeneity in recent swine influenza A(H1N1) virus isolates with possible implications for vaccination policy.** *Vaccine* 19 (31): 4452- 4464, ISSN: 0264-410X.
NAL Call No.: QR189 V32.
Keywords: antigenic drift, swine influenza, antigenic heterogeneity, molecular heterogeneity, strain H1N1, strain H3N2, influenza vaccine, efficacy, swine influenza virus infection, respiratory system disease, viral disease, vaccination.

Dee, S. (2001). **Technologies that improve the health and performance of nursery pigs.** *The Compendium on Continuing Education for the Practicing Veterinarian* 23 (2): S19-S24.ISSN: 0193-1903.
NAL Call No.: SF601.C66.
Keywords: pig farming, animal health, performance, animal husbandry, disease control, production.

Dee, S.A.; Molitor, T.W.; Rossow, K.D. (2000). **Epidemiological and diagnostic observations following the elimination of porcine reproductive and respiratory syndrome virus from a breeding herd of pigs by the test and removal protocol.** *The Veterinary Record: Journal of the British Veterinary Association* 146 (8): 211-213, ISSN: 0042-4900.
NAL Call No.: SF601 I4.
Keywords: diagnosis, porcine reproductive and respiratory syndrome, finishing, pregnancy, lymph nodes, sows, epidemiology, disease control, viral diseases, sow breeding herd.

Dee, S. (2001). **Miscellaneous conditions of nursery pigs.** *The Compendium on Continuing Education for the Practicing Veterinarian* 23 (2): S14-S18, ISSN: 0193-1903.
NAL Call No.: SF601.C66.
Keywords: bacterial diseases, staphylococcus hyicus, mange, scabies, vitamin deficiencies, vitamin E, mineral deficiencies, selenium, mycotoxins, mycotoxicosis, sodium, poisoning, carbadox, behavior problems, tail biting, greasy pig disease, sodium ion toxicosis.

Dewey, C. (2002). **Sows need individual attention.** *Journal of Swine Health and Production* 10 (4): 146.
NAL Call No.: SF971 N472. Available online at http://www.aasv.org/shap.html
Keywords: sows, housing, health, performance, animal welfare.

Dionissopoulos, L.; De Lange, C.F.M.; Dewey, C.E.; MacInnes, J.I.; Friendship, R.M. (2001). **Effect of health management strategy during rearing on grower-finisher pig performance and selected indicators of immune system stimulation.** *Canadian Journal of Animal Science* 81 (2): 179-187, ISSN: 0008-3984.
NAL Call No.: 41.8 C163.
Abstract: The effects of health management strategy during rearing on subsequent growth performance and indicators of immune system stimulation in grower-finisher (G-F) pigs were evaluated. Pigs of approximately 25 kg body weight (BW) were sourced from three different management systems: (1) a farrow-to-finish unit with identified respiratory problems (Conventional), (2) segregated early weaned (SEW; piglets sourced from

multiple sow herds), and (3) a minimal disease farrow-to-finish operation (MD). The pigs were of similar genetic background and were housed under similar conditions until slaughter. During the grower phase, MD had the highest average daily gain (ADG) ($P < 0.05$), while it was similar for SEW and Conventional ($P > 0.10$). Feed to gain (F:G) was similar for MD and SEW ($P > 0.10$), and poorest for Conventional ($P < 0.05$). During the finisher phase, SEW had the lowest ADG, and the poorest F:G ($P < 0.05$), these parameters were similar for Conventional and MD ($P > 0.10$). Over the entire G-F period, performance of MD pigs was better than that of Conventional and SEW pigs. Performance depressions appeared related to the degree of anterior-ventral lung atelectasis, antibody titers to porcine reproductive and respiratory syndrome (PRRS) virus and Mycoplasma hyopneumoniae, thymus size, plasma insulin-like growth factor levels, stomach ulceration, nasal turbinate damage, and microbial burden. The current study shows that the growth depressing effects of exposure to infectious organisms can be substantial in G-F pigs.

Keywords: pigs, immune system, animal husbandry, animal health, growth rate, carcass quality, respiratory diseases, early weaning, insulin-like growth factor, interleukins, IgG.

Docic, A.; Bilkei, G. (2001). **The effect of vaccination against Mycoplasma hyopneumoniae on health and some production parameters in outdoor and indoor units.** *Pig Journal* 47: 23-34, ISSN: 1352-9749.

NAL Call No.: SF971 P5.

Abstract: This trial was conducted to determine the effect of M. hyopneumoniae (MH) vaccination (Respisure) on indoor and outdoor pigs. A total of 430 piglets were randomly allocated to vaccinated or non-vaccinated indoor or outdoor groups (G). The trial was conducted during spring-summer, under pleasant continental weather conditions. The majority of the indoor animals showed positive titres at slaughter against MH, whereas the vaccinated and unvaccinated outdoor piglets showed more than 90% negative results. Unvaccinated indoor piglets presented significantly more lung lesions ($P<0.001$). The MH antibody titres were positively correlated ($P<0.05$) with the severity of lung lesions at slaughter. ADG of the unvaccinated indoor group was significantly different from the other groups ($P< 0.001$). These results suggest that under unfavourable indoor environments, vaccination of pigs against MH is one way to improve production. In outdoor units, MH vaccination, even with high MH prevalence, fails to significantly improve performance of the animals.

Keywords: antibody testing, extensive husbandry, immunization, lesions, liveweight gain, lungs, pig housing, piglets, respiratory diseases, vaccination.

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NAL Call No.: SF396.5 W43 2001.

Keywords: bacterial diseases, digestive system diseases, early weaning, growth promoters, piglets, reference works, respiratory diseases, reviews, risk factors, vaccination, vaccines, viral diseases, wasting disease, weaning.

Edrington, T.S.; Harvey, R.B.; Farrington, L.A.; Nisbet, D.J. (2001). **Evaluation of subtherapeutic use of the antibiotics apramycin and carbadox on the prevalence of antimicrobial resistant Salmonella infection in swine.** *Journal of Food Protection* 64 (12): 2067-2070, ISSN: 0362-028X.

NAL Call No.: 44.8 J824.

Keywords: antibiotics, apramycin carbadox, amikacin, gentamicin, kanamycin, streptomycin, Salmonella, drug resistance.

Fangman, T.J.; Hardin, L.E.; Grellner, G.; Carlson, M.S.; Zulovich, J.M.; Coleman, J.L. Perry, IA (2001). **Performance and disease status of pigs grown in a wean-to-finish facility compared to pigs grown in a conventional nursery and grower-finisher.** *Journal of Swine Health and Production* 9 (2): 71-76. Available online at http://www.aasv.org/shap.html

NAL Call No.: SF971.N472.

Keywords: pigs, performance, growth rate, health, husbandry, rearing techniques, groups.

Fernandez, S; Sarkunas, M; Roepstorff, A (2001). **Survival of infective Ostertagia ostertagi larvae on pasture plots under different simulated grazing conditions.** *Veterinary Parasitology* 96 (4): 291-299, ISSN: 0304-4017.
NAL Call No.: SF810.V4.
Abstract: This study was carried out to examine the survival of infective Ostertagia ostertagi larvae (L(3)) on pasture under different simulated conditions of grazing, i.e. mixed grazing of cattle and nose-ringed sows, or grazing by cattle alone. Standardised pats of cattle faeces containing O. ostertagi eggs were deposited on three types of herbage plots, which were divided into zone 1: faecal pat; zone 2: a circle extending 25cm from the edge of the faecal pat; zone 3: a circle extending 25cm from the edge of zone 2. For “tall herbage” (TH) plots, the herbage in zone 2 was allowed to grow naturally, while the herbage in zone 3 was cut down to 5-7cm fortnightly, imitating a cattle-only pasture. For “short herbage” (SH) plots, the herbage in both zones 2 and 3 were cut down to 5-7cm fortnightly, imitating mixed grazing of cattle and sows. The grass in the “short herbage and scattered faeces” (SH/SF) plots were cut as for SH plots, and the faeces were broken down 3 weeks after deposition and scattered within zone 2, imitating the rooting behaviour of co-grazing sows. Five faecal pats from each plot group were collected on monthly basis, along with the herbage from zones 2 and 3 cut down to the ground. Infective larvae were then recovered from both faeces and herbage. The numbers of L(3) recovered from zone 1 were higher in the TH plots than in the other two groups and, furthermore, the larval counts from SH plots were always higher than from SH/SF plots. The three groups followed a similar pattern during the season regarding numbers of L(3) in zone 2, and no clear patterns between plot types were obtained. The presence of L(3) in zone 3 was almost negligible. Important differences were seen throughout the study from the biological point of view; more L(3) were able to survive in faeces on the TH plots, presumably reflecting a better protection from heat and desiccation compared to those in the other plots. The overall results support the idea that mixed grazing of cattle and pigs favour the reduction of O. ostertagi larval levels in pasture. This reduction is mainly due to the grazing behaviour of pigs, which by grazing up to the very edge of the cattle faeces, will either expose the larvae in faeces to adverse environmental summer conditions or ingest cattle parasite larvae, or both.
Keywords: disease, parasitology, Ostertagiasis transmission, Poaceae, mixed grazing, cattle and swine, feces, weather.

Fukawa, K.; Kusuhara, S. (2001). **The genetic and non genetic aspects of leg weakness and osteochondrosis in pigs.** *Asian Australasian Journal of Animal Sciences* 14 (1): 114-122, ISSN: 1011-2367.
NAL Call No.: SF55 A78A7.
Keywords: leg weakness, culling, breeding pigs, evaluation, subjective scoring systems, osteochondrosis lesions, leg joints, scored optically, radiographically, histologically, heritable traits, confinement, nutrition.

Funk, J.A; Davies, P.R; Gebreyes, W. (2001). **Risk factors associated with Salmonella enterica prevalence in three-site swine production systems in North Carolina, USA.** *Berliner und Munchener tierarztliche Wochenschrift* 114 (9-10): 335-8, ISSN: 0005-9366.
NAL Call No.: 41.8 B45.
Abstract: The goal of this study was to identify risk factors associated with increased fecal shedding of Salmonella enterica (SE) in groups of market swine reared in large three-site production units. We conducted an intensive, long-term investigation of potential management and environmental risk factors operating during the growing phase of pig production. Data regarding finisher site characteristics, biosecurity protocols, group growth performance, medication usage, and environmental temperature were collected. Results indicate that SE infection is common. Risk factors were identified at both the finisher site and group level. Biosecurity and hygiene practices (absence of a toilet, more than 2 people present at a finisher site daily, and other domestic species at the site), environmental temperature (winter and spring seasons, increased temperature variability, and below median high temperature the day of sampling), and production performance (above median feed conversion) were associated with elevated SE prevalence. In addition, an association between the floor space allowances per pig at the time of sampling (a measure of the number of pigs sold prior to sampling) was identified, with greater space allowance associated with decreased prevalence. The results of this study identify potential management practices for evaluation for SE control and suggest caution in interpretation of fecal culture results when sampling from different marketing groups in swine production systems.

Keywords: feed, microbiology, Salmonella infections, etiology, Salmonella enterica, isolation and purification, feces, microbiology, hygiene, infection control, epidemiology, prevalence, North Carolina.

Gareis, M. (2001). **A simple HPLC method for the determination of the mycotoxins ochratoxin A and B in blood serum of swine.** *Food Additives and Contaminants* 18 (7): 635-643, ISSN: 0265-203X.
NAL Call No.: TX553 A3F65.
Keywords: ochratoxins A, ochratoxins B, blood serum, serum acidification, chemical analysis, food residue, mycotoxin, quantitative analysis, high performance liquid chromatography, simple method, analysis, meat.

Garkavenko, O.; Obriadina, A.; Meng, J.; Anderson, D.; Benard, H.J.; Schroeder, B.A.; Khudyakov, Y.E.; Fields, H.A.; Croxson, M.C. (2001). **Detection and characterisation of swine hepatitis E virus in New Zealand.** *Journal of Medical Virology* 65 (3): 525-529, ISSN: 0146-6615.
Keywords: hepatitis E virus, characterization, detection, strain AF 110390, feces, digestive system, RNA fragments, antibody, ELISA serology test, analytical method, New Zealand.

Georgsson, L.; Svendsen, J. (2001). **One or two feeders for groups of 16 growing-finishing pigs: Effects on health and production.** *Acta Agriculturae Scandinavica Section A Animal Science* 51 (4): 257-264, ISSN: 0906-4702.
NAL Call No.: S3.A27.
Keywords: finishing pigs, single-space feeders, multiple feeders, feeder access, health, skin lesions, daily weight gain, feed intake,

Groot, J. de; Jong, I.C. de; Prelle, I.T.; Koolhaas, J.M. (2001). **Immunity in barren and enriched housed pigs differing in baseline cortisol concentration.** *Physiology and Behavior* 71 (3/4): 217-223, ISSN: 0031-9384.
NAL Call No.: QP1.P4.
Abstract: It was shown in a recent study that barren housed pigs (small pens, no substrate) have a blunted circadian rhythm of salivary cortisol, as compared to enriched housed pigs (large pens with daily fresh bedding). In the light period, enriched housed pigs showed significantly higher concentrations of cortisol in saliva than barren housed pigs, whereas in the dark period, cortisol concentrations were low in both enriched and barren housed pigs. In the present study, the immunological consequences of the difference in baseline salivary cortisol concentration in the light period were evaluated. Three successive replicates of 24 pigs were used in the experiment. It appeared that leukocyte and lymphocyte distributions, and in vitro lymphocyte proliferation following ConcanavalineA (ConA) stimulation in the assay using purified lymphocytes were not affected. However, barren and enriched housed pigs, did show a different proliferation response to ConA in the whole blood assay. At day 2 of culture, proliferation was higher in barren housed pigs than in enriched housed pigs, whereas day 4 of culture, proliferation was higher in enriched housed pigs than in barren housed pigs. Lymphocyte proliferation at day 2 of culture in the whole blood assay, correlated negatively with plasma cortisol levels, which might thus explain the higher proliferation in barren housed pigs at day 2 of culture. The in vivo humoral and cellular (delayed type hypersensitivity, DTH) immune response to KLH was not affected by housing conditions. We conclude that, although baseline salivary cortisol concentrations differ between enriched and barren housed pigs, immune function appears to be relatively unaffected.
Keywords: Dutch Landrace, Dutch Yorkshire, breed, circadian rhythm, concanavalin A, delayed type hypersensitivity, hydrocortisone, immune response, immunity, leukocytes, lymphocyte transformation, lymphocytes, housing, saliva.
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Groot, J. de; Ruis, M.A.W.; Scholten, J.W.; Koolhaas, J.M.; Boersma, W.J.A. (2001). **Long-term effects of social stress on antiviral immunity in pigs.** *Physiology and Behavior* 73 (1/2): 145-158, ISSN: 0031-9384.
NAL Call No.: QP1.P4.
Abstract: Mixing of unfamiliar pigs is common practice in intensive pig husbandry. Since pigs maintain a dominance hierarchy, mixing often leads to vigorous fighting. Apart from the negative impact that fighting has on welfare, there is evidence that the social stress associated with fighting suppresses immune function. In the present experiment, we investigated the impact of mixing on specific long term immune responses and

protection against challenge infection after vaccination with pseudorabies virus (PRV). Specific pathogen-free (SPF) pigs were mixed pairwise with an unfamiliar same-gender conspecific or left undisturbed with a same-gender littermate at 3 days after vaccination with PRV. Half of the pigs were females (gilts) and half were castrated males (barrows). Mixing increased agonistic behaviour to the same degree in gilts and barrows. Cortisol concentrations in saliva and catecholamine excretion in urine were increased in mixed pigs, and these effects were independent of dominance status and gender. Subsequently, the effects of mixing, gender, dominance status and interactions between these factors on immune response parameters were studied. The main result was that mixed barrows showed suppressed immune responses after vaccination and increased clinical symptoms after challenge infection compared to control barrows. Mixed gilts however did not differ from control gilts. It also appeared that mixed dominants were more seriously affected than mixed subordinates were. We conclude that, in some pigs, social stress after mixing suppresses the immune response to a viral vaccine and consequently impairs protection against challenge infection. 59 ref.
Keywords: agonistic behavior, antiviral properties, catecholamines, gender relations, gilts, hydrocortisone, immune response, immunity, stress, vaccination, vaccines, Aujeszky virus, porcine herpesvirus.
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Hameenoja, P. (2001). **Animal health and welfare, pig production.** *Acta Veterinaria Scandinavica, Supplementum* (Suppl. 95): 33-36. ISSN: 0065-1699.
Keywords: behavior, health, production, animal welfare, organic farming, roughage, space requirements.

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NAL Call No.: SF601 V44.
Keywords: piglets, weaned pigs, vaccination, classical swine fever virus, naked plasmid DNA, gp55/E2 gene, preventative method, prime boost vaccination strategy.

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NAL Call No.: 49 J82.
Keywords, pathogen, Campylobacter, antibacterial drugs, amikacin, ampicillin, ciprofloxacin, clindamycin, erythromycin, gentamicin, lincomycin, neomycin, tetracycline, antibiotic resistance, antibiotic sensitivity, meeting abstract.

Heinonen, M.; Grohn, Y.T.; Saloniemi, H.; Eskola, E.; Tuovinen, V.K. (2001). **The effects of health classification and housing and management of feeder pigs on performance and meat inspection findings of all-in-all-out swine-finishing herds.** *Preventive Veterinary Medicine* 49 (1/2): 41-54. ISSN: 0167-5877.
NAL Call No.: SF601.P7.
Keywords: finishing, herds, health, pig housing, animal husbandry, performance, meat quality, pork, mortality, abscesses, pneumonia, arthritis.

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NAL Call No.: SF1 A56.
Keywords: selective breeding, breeding value, disease resistance, genetic variation, heritability diarrhea, digestive system disease, lameness, bone disease, muscle disease, respiratory diseases.

Herpin, P.; Hulin, J.C.; Le Dividich, J.; Fillaut, M. (2001). **Effect of oxygen inhalation at birth on the reduction of early postnatal mortality in pigs.** *Journal of Animal Science* 79 (1): 5-10, ISSN: 0021-8812.
NAL Call No.: 49 J82.

Keywords: piglets, newborn, breed, Pietrain X Large White, farrowing, asphyxia, stillbirths, oxygen inhalation, survival, birth, early postnatal mortality, metabolism, oxygen supply.

Hurd, H.S; Gailey, J.K.; McKean, J.D.; Rostagno, M.H. (2001). **Experimental rapid infection in market swine following exposure to a Salmonella contaminated environment.** *American Journal of Veterinary Research* 62 (8): 1194-7, ISSN: 0002-9645.
Keywords: salmonella infections, animal, transmission, growth and development, disease, microbiology, abattoirs, feces, gastrointestinal system, lymph nodes.

Jank, B.; Rath, J. (2002). **Antibiotic-resistance management on the farm.** *Trends in Microbiology* 10 (1): 11-2, ISSN: 0966-842X.
NAL Call No.: QR1 T74.
Keywords: swine, cattle, chickens, husbandry, drug resistance, microbial, genetics, drug resistance, bacterial, genetics, antibiotics, glycopeptide, adverse effects, kanamycin kinase, genetics, plants, genetically modified, vancomycin, therapeutic use, European Union.

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NAL Call No.: SF810.V4.
Keywords: helminthoses, animal parasitic nematodes, ascaris suum, oesophagostomum, trichuris, strongylidae, disease prevalence, feces, helminth ova, seasonal variation, pig farming, finishing, pig housing, barns, pens, floor type, flubendazole, chemoprophylaxis, fecal egg count, barn age, Germany.

Jones, P.H.; Roe, J.M.; Miller, B.G. (2001). **Effects of stressors on immune parameters and on the faecal shedding of enterotoxigenic Escherichia coli in piglets following experimental inoculation.** *Research in Veterinary Science*.70 (1): 9-17. ISSN: 0034-5288.
NAL Call No.: 41.8 R312.
Abstract: The study examined the effects of stressors on the responses of 3 and a half-week old piglets that had been given an oral dose of enterotoxigenic Escherichia coli (ETEC) and a novel harmless antigen (ovalbumin). Removal from the sow (WEAN), a short-term cold stressor (12 degrees C for 48 hours) (TEMP) and mixing with non-littermates (MIX) were assessed in terms of the effects on faecal shedding of ETEC, immune responses, weight gain and an ACTH stimulation test. WEAN and TEMP reduced weight gain and all stressors increased faecal shedding of ETEC. All stressors increased the IgG responses to F4(K88)ac antigens and WEAN and TEMP increased the IgA responses to the same antigens, probably as a result of increased intestinal proliferation of ETEC. None of the stressors, however, had significant effects on antibody responses to ovalbumin or on lymphocyte proliferation assays. The results indicate that stressors influence the faecal shedding of ETEC in young piglets by a mechanism that may not involve modulation of immune responses.
Keywords: piglets, escherichia coli, experimental infections, stress, shedding, feces, immune response, liveweight gain, weaning, cold stress, mixing.

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NAL Call No.: 448.3 Ac85.
Keywords: vaccination, classical swine fever, oral immunization, preventative method.

Kalita, G.; Roychoudhury, R.; Goswami, R.N. (2002). **Causes of pre-weaning mortality in piglets.** *Indian Veterinary Journal* 79 (1): 82-83, ISSN: 0019-6479.
NAL Call No.: 41.8 IN2.
Keywords: abscesses, colostrum, foot and mouth disease, gastroenteritis, intestinal obstruction, mortality, pericarditis, piglets, pneumonia, preweaning period, stroke, trauma, husbandry practices, hygiene, supplemental heating.

Kavanagh, N.T. (1998). **Swine practice: planning for the 21st century.** *Swine Health and Production* 6 (4): 165-169, ISSN: 1066-4963.
NAL Call No.: SF971 N472.
Keywords: pig farming, veterinarians, meat production, pig meat, health, food safety, animal welfare, environment, laboratory diagnosis, vaccines, drugs, veterinary education, veterinary services, disease.

Kelly, H.R.C.; Bruce, J.M.; Edwards, S.A.; English, P.R.; Fowler, V.R. (2000). **Limb injuries, immune response and growth performance of early-weaned pigs in different housing systems.** *Animal Science: An International Journal of Fundamental and Applied Research* 70(1):73-83, ISSN: 0003-3561.
NAL Call No.: SF1 A56.
Keywords: housing, immune response, trauma, antibody formation, bursitis, feet, immunoglobulins, indicators, pens, pig housing, animal welfare, legs, lameness, growth, feed intake, feed conversion efficiency, fattening performance.

Kraglund, H.O.; Roepstorff, A.; Gronvold, J. (2001). **The impact of season and vegetation on the survival and development of Oesophagostomum dentatum larvae in pasture plots.** *Parasitology* 123 (4): 415-23, ISSN: 0031-1820.
NAL Call No.: 448.8 P21.
Abstract: Pats of pig faeces containing known numbers of Oesophagostomum dentatum eggs were placed on plots with bare soil, short or tall herbage on 8 occasions during 1 year. The number of eggs and larvae and the relative distribution of larvae in faeces, soil and herbage was monitored for 1 year after deposition. On 2 occasions soil from 8 selected plots was given to pigs, which were later slaughtered and examined for the presence of adult O. dentatum. Less than 1% of the deposited eggs could be recovered as infective larvae. The highest recoveries were generally made on tall herbage plots. The majority of infective larvae was found within the faecal pats, which indicates that infective O. dentatum larvae, to a large extent, do not disperse onto the herbage or into soil. The infective larval stage was reached only when the mean temperature in the weeks post-deposition was above 10 degrees C. This stage was reached within 1 week when the mean weekly temperature was above 13 degrees C. After the winter period no infective larvae could be recovered from any plots and no parasitic worms could be isolated from pigs fed soil from 8 selected plots.
Keywords: disease, parasitology, Oesophagostomum larvae, feces, parasite egg count, plants, seasonal variation, soil, temperature.

Kelly, J.A.; Amass, S.F.; Ragland, D.; Spicer, P.M.; Alvarez, R.M. (2001). **BioClean tests for assessment of sanitation levels in pork production facilities.** *Journal of Swine Health and Production* 9 (5): 207-213.
NAL Call No.: SF971.N472.
Keywords: disinfection, pig housing, testing, accuracy, pig feeders, floors, walls.

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NAL Call No.: 389.9 N953.
Keywords: antibiotic resistance, antimicrobial growth promoters, ban, enteric bacterial infections Oesophagostumum dentatum, Brachyspira hyodesenteriae, nematode infection, parasitic disease, dysentery, gut health, carbohydrates, dietary intake, feed structure, United Kingdom.

Kraglund, H.O.; Roepstorff, A.; Gronvold, J. (2001). **The impact of season and vegetation on the survival and development of Oesophagostomum dentatum larvae in pasture plots.** *Parasitology* 123 (4): 415-23, ISSN: 0031-1820.
NAL Call No.: 448.8 P21.
Abstract: Pats of pig faeces containing known numbers of Oesophagostomum dentatum eggs were placed on plots with bare soil, short or tall herbage on 8 occasions during 1 year. The number of eggs and larvae and the relative distribution of larvae in faeces, soil and herbage was monitored for 1 year after deposition. On 2 occasions soil from 8 selected plots was given to pigs, which were later slaughtered and examined for the

presence of adult O. dentatum. Less than 1% of the deposited eggs could be recovered as infective larvae. The highest recoveries were generally made on tall herbage plots. The majority of infective larvae was found within the faecal pats, which indicates that infective O. dentatum larvae, to a large extent, do not disperse onto the herbage or into soil. The infective larval stage was reached only when the mean temperature in the weeks post-deposition was above 10 degrees C. This stage was reached within 1 week when the mean weekly temperature was above 13 degrees C. After the winter period no infective larvae could be recovered from any plots and no parasitic worms could be isolated from pigs fed soil from 8 selected plots.
Keywords: disease, parasitology, Oesophagostomum larvae, feces, parasite egg count, plants, seasonal variation, soil, temperature.

Kugelberg, C.; Johansson, G.; Sjogren, U.; Bornstein, S.; Wallgren, P. (2001). **Infectious diseases and ectoparasites of (outdoor) slaughter pigs. [Infektionssjukdomar och ektoparasiter hos slaktsvin.]** *Svensk Veterinartidning* 53 (4):197-204, ISSN: 0346-2250.
NAL Call No.: 41.9 SV23.
Abstract: Two organic pig herds, 50 sows on each with piglets reared to slaughter weight, were studied and health status recorded over a 3-month period. One herd (herd A) had experienced carcass condemnations because of arthritis caused by erysipelas, but this had been controlled by vaccination. The general health status of the pigs was considered good. Blood samples showed higher protein levels than in conventionally reared pigs, but this did not appear to be related to disease. During the period there were 4 (1.4%) condemnations for respiratory diseases (pneumonia and pleurisy). Serology indicated that Mycoplasma hyopneumoniae and Actinobacillus pleuropneumoniae (serotypes 2 and 3) were present, but at low levels, in the herds. The level of condemnations for arthritis and other joint disease was 1.2% in herd A and 10.4% in herd B. The condemnations were linked to the presence of Erysipelothrix rhusiopathiae. It is recommended that outdoor pigs should be vaccinated against erysipelas. The herds did not take routine measures against parasites. There was no clinical evidence of mange despite the presence of antibodies to Sarcoptes scabiei in both herds (4% in herd B and 25% in herd A). It is recommended that herds should be cleared of mange before switching to an organic production system.
Keywords: organic production, husbandry, carcass condemnation, epidemiology, organic farming, disease, outdoor husbandry, vaccine programs, Actinobacillus pleuropneumoniae, Erysipelothrix rhusiopathiae, Mycoplasma hyopneumoniae, Swedish language.
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Lamontagne, L.; Page, C.; Larochelle, R.; Longtin, D.; Magar, R. (2001). **Polyclonal activation of B cells occurs in lymphoid organs from porcine reproductive and respiratory syndrome virus (PRRSV) infected pigs.** *Veterinary Immunology and Immunopathology* 82 (3 4): 165-181, ISSN: 0165-2427.
NAL Call No.: SF757.2 V38.
Keywords: specific pathogen free pigs, experimental infection, viral disease, porcine reproductive and respiratory syndrome virus, antibodies, serum, viral RNA, ELISA assay, detection method, ELISPOT assay, analytical method, reverse transcriptase polymerase chain reaction, polymerase chain reaction, cytofluorometry, cell sorting method, humoral immune response.

Leeb, B.; Leeb, C.; Troxler, J.; Schuh, M. (2001). **Skin lesions and callosities in group-housed pregnant sows: animal-related welfare indicators.** *Acta Agriculturae Scandinavica. Section A, Animal Science* 51 (Supplementum 30): 82-87, ISSN: 0906-4702.
NAL Call No.: S3.A27.
Abstract: An on-farm investigation of 55 herds of pregnant sows housed in various group- housing systems was carried out. Management factors, pen design and abnormalities of the integument of 1177 pregnant sows were examined. The arithmetic mean of injured body regions was 1.49 as a total value per sow, 0.94 on the front part of the body and 0.56 on the rear part of the body. Group size, the design of the feeding place and area per sow (within stable groups) showed a significant influence on the extent of lesions. The limbs displayed 3.53 callosities on average per sow. In littered systems the prevalence of callosities was significantly lower. Callosities were positively correlated with decubital lesions. This investigation showed that lesion patterns on the skin do act as indicators of welfare. An adequately designed feeding area, good management and the

maintenance of groups with established social ranks can minimize fighting. A smooth lying area and the opportunity to move around reduce the incidence of callosities. 21 ref.
Keywords: sows, housing, animal welfare, floor litter, skin lesions, trauma, injury, management, behavior, feeding area, fighting.
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Leon E.A.; Madec, F.; Taylor, N.M.; Kobisch, M. (2001). **Seroepidemiology of Mycoplasma hyopneumoniae in pigs from farrow-to-finish farms.** *Veterinary Microbiology* 78 (4): 331-41, ISSN: 0378-1135.
NAL Call No.: SF601 V44.
Abstract: A prospective study was carried out on three intensive farrow-to-finish farms. The aims were to estimate the incidence of Mycoplasma hyopneumoniae infection, to determine when pigs become infected and the pattern of transmission of infection and to verify the relationship between seroconversion and clinical signs. One batch of pigs per farm was followed from farrowing-to-slaughter. Blood samples were taken at 10, 27, 70, 94, 125 and 147 days of age, from 44, 48 and 44 pigs per farm. Colostrum and blood samples were also taken from the sows. Animals were checked clinically once a week and coughing rates were recorded. Antibodies against M. hyopneumoniae were detected by a blocking ELISA. At 27, 70 and 94 days of age most pigs on the three farms were seronegative, suggesting that no circulation of M. hyopneumoniae occurred during the growing period. Thereafter, a high proportion of pigs seroconverted, indicating that infection occurred soon after the transfer of the animals to the finishing houses. Differences were detected between farms in the incidence of seroconversion. Seropositive pigs were widely distributed among the finishing pens, suggesting that in addition to direct contact, other methods of transmission, such as indirect or airborne transmission, may have been important. Coughing started at around the same time as seroconversion. The results showed that the critical period for the transmission of M. hyopneumoniae is around the beginning of the finishing period, when pigs have low concentrations of antibodies against the agent.
Keywords: mycoplasma, isolation and purification, pneumonia, epidemiology, disease, transmission, antibodies, bacterial, blood, colostrum, immunology, cough, etiology, enzyme-linked immunosorbent assay, incidence, seroepidemiologic studies, France.

Letellier, A.; Messier, S.; Lessard, L.; Chenier, S.; Quessy, S. (2001). **Host response to various treatments to reduce Salmonella infections in swine.** *Canadian Journal of Veterinary Research* 65 (3): 168-172, ISSN: 0830-9000.
NAL Call No.: SF601 C24.
Keywords: evaluation, probiotics, prebiotics, vaccination, Salmonella, typhimurium, goblet cell, ileum mucus, small intestine, villus, whole blood phagocytes, immunoglobulin A, flow cytometry, cytophotometry, histopathology, host response, local immunity, phagocytosis, rate, vaccination.

Lim, Y.K.; Takada, A.; Tanizaki, T.; Ozaki, H.; Okazaki, K.; Kida, H. (2001). **Mucosal vaccination against influenza: Protection of pigs immunized with inactivated virus and ether split vaccine.** *Japanese Journal of Veterinary Research* 48 (4): 197-203, ISSN: 0047-1917.
NAL Call No.: 41.8 V6446.
Keywords: immunoglobulin G, immunoglobulin M, ether split vaccine, mucosal vaccination, preventative method, immunity, antibody response, virus emergence.

MacKenzie, K.; Bishop, S.C. (2001). **Developing stochastic epidemiological models to quantify the dynamics of infectious diseases in domestic livestock.** *Journal of Animal Science* 79 (8): 2047-2056, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: stochastic model, disease transmission, microparasitic infection, hypothetical epidemics, pig farm, decision making, control strategies, probability of an epidemic, mathematical model, disease dynamics, disease quantification, disease resistance, model development.

Maes, D.G.; Deluyker, H.; Verdonck, M.; Castryck, F.; Miry, C.; Vrijens, B.; Ducatelle, R.; De Kruif, A. (2001). **Non-infectious factors associated with macroscopic and microscopic lung lesions in slaughter pigs from**

farrow-to-finish herds. *Veterinary Record: Journal of the British Veterinary Association* 148 (2): 41-6, ISSN: 0042-4900.
NAL Call No.: 41.8 V641.
Abstract: A cross-sectional epidemiological study was conducted in 150 randomly selected farrow-to-finish herds to investigate which non-infectious factors might act as risk indicators for the prevalence and severity of macroscopic and microscopic lung lesions in slaughter pigs. Data were collected during herd visits through inspections of the pigs and through interviews with the farmers. Macroscopic lung lesions of pneumonia and pleuritis were recorded at slaughter from 25 pigs per herd, and microscopic lung lesions of lymphohistiocytic infiltration were recorded from 10 pigs per herd. The median herd level prevalences were 24 per cent for pneumonia, 16 per cent for pleuritis and 60 per cent for lymphohistiocytic infiltration. Pneumonia lesions were negatively associated with pleuritis lesions and positively associated with lymphohistiocytic infiltration. Pleuritis lesions were negatively associated with lymphohistiocytic infiltration. The prevalence and the severity of pneumonia lesions were increased by a high frequency of purchasing gilts and by a slaughter date in January to February. The presence of a growing unit also increased the severity of pneumonia. The prevalence and the severity of pleuritis lesions were higher when there were more pig herds in the municipality, and when there were poor biosecurity measures, and their prevalence was increased by a slaughter date in January to February, and their severity by a slaughter date in March to April. An increase in the airspace stocking density in the finishing unit also increased the prevalence of pleuritis. The prevalence and the severity of lymphohistiocytic infiltration in the lung tissue were higher in herds purchasing gilts. Pigs raised in pens with slatted floors were also at higher risk of more severe lesions of lymphohistiocytic infiltration.
Keywords: lung, pathology, pleurisy, pneumonia, disease, epidemiology, cross-sectional studies, epidemiologic studies, prevalence, risk factors, seasons.

Martinez, G.R.; Pradal, R.P.; Castrejon, F.P.; Herradora, M.; Galvan, E.; Mercado, C. (2001). **Persistence of Escherichia coli, Salmonella choleraesuis, Aujeszky's Disease virus and Blue Eye Disease virus in ensilages based on the solid fraction of pig faeces.** *Journal of Applied Microbiology* 91 (4): 750-758, ISSN: 1364-5072.
NAL Call No.: QR1 J687.
Keywords: Escherichia coli, Salmonella choleraesuis, Aujeszky's Disease, Blue Eye Disease, ensilages based on solid fraction of pig feces, disease transmission mechanisms, analysis, preparation, microbial persistence studies, microsilos.

McDonald, L.C.; Chen, M.T.; Lauderdale, T.L.; Ho, M.. (2001). **The use of antibiotics critical to human medicine in food producing animals in Taiwan.** *Journal of Microbiology Immunology and Infection* 34 (2): 97-102, ISSN: 1684-1182.
Keywords: swine, poultry, antibiotics, avilomycin, avoparcin, enrofloxacin, kanamycin, vancomycin, virginiamycin, ziracin, public health concerns, resistance in human pathogens, Taiwan.

Mendoza, M.M.; Ramirez, H.M.; Duenas, J.J.; Duenas, J.S. (2001). **Pig paramyxovirus of the blue eye disease binding to a 116 kDa glycoprotein expressed in pig neuronal membranes.** *Journal of Veterinary Medicine Series B* 48 (7): 489-499, ISSN: 0931-1793.
NAL Call No.: 41.8 Z52.
Keywords: pig paramyxovirus, blue eye disease, neonatal pigs, adult pigs, reproductive function, pigs, neurological damage, nervous system, brainstem, cerebellum, frontal cortex, hippocampus, neuronal membrane, olfactory bulb, parietal cortex, temporal cortex, F protein, beta galactosidase, carbohydrate, glycoprotein receptor, expression, hemagglutinin neuraminidase protein, mannosidase, neuraminidase, polyclonal antibodies, trypsin.

Mouttotou, N.; Hatchell, F.M.; Green, L.E. (1999). **Foot lesions in finishing pigs and their associations with the type of floor.** *Veterinary Record: Journal of the British Veterinary Association* 144(23):629-632, ISSN: 0042-4900.
NAL Call No.: 41.8 V641.
Keywords: floors, floor coverings, foot injuries, hoof and claw injuries, prevention and control, abattoirs, animal

husbandry, animal welfare.

Nath, D.R.; Deka, D.; Saikia, S.; Mili, D.C. (2001). **Studies on preweaning mortality of piglets in an organized farm.** *Indian Journal of Animal Health* 40 (2):.133-136, ISSN: 0019-5057.
NAL Call No.: SF1 I4.
Keywords: piglets, causes of death, disease surveys, preweaning period, mortality, gastroenteritis, pneumonia, debility and inanition, agalactia, foot-and-mouth, seasonal variation, Assam, India.

Nishida, A.; Ogawa, T.; Kikuchi, Y.; Wakoh, K.; Suzuki, K.; Shibata, T.; Kadowaki, H.; Shinohara, H.; Ohtomo, Y. (2001). **A hopeful prospect for genetic improvement of chronic disease resistance in swine.** *Asian Australasian Journal of Animal Sciences* 14 (Special Issue): 106-110, ISSN: 1011-2367.
NAL Call No.: SF55 A78A7.
Keywords: disease resistance, genetic improvement, atrophic rhinitis, respiratory system disease, chronic infectious diseases, mycoplasma pneumonia, bacterial disease, antibody productivity, back fat thickness, daily body weight gain, delayed type hypersensitivity, phagocytic activity, phenotype, selection.

Orgeur, P.; Hay, M.; Mormede, P.; Salmon, H.; Le Dividich, J.; Nowak, R.; Schaal, B.; Levy, F. (2001). **Behavioural, growth and immune consequences of early weaning in one week old Large-White piglets.** *Reproduction, Nutrition, Development* 41 (4): 321-32, ISSN: 0926-5287.
NAL Call No.: QL1 R35
Abstract: Genetic improvement in sows' prolificity is limited by their milk capacities, which do not allow all piglets to survive or grow normally. This experiment compared the behaviour, growth and immune responses of piglets that were weaned early at 6 days of age (EW) vs. control Large White piglets' (C) suckled by their mothers. Behaviour of 9 litters of 5 to 8 piglets in each group were observed from d5 to d20. All piglets were weighed from birth to d74. Three piglets from each group were slaughtered on d36 for immunological analysis. Until they began to eat dry food, EW piglets walked and vocalised more than C piglets. After that time, when resting, they were less often lying down and more frequently in contact with littermates under the heater. Aggressive behaviour and belly-nosing were more frequent. They displayed a more marked growth check after weaning than did C piglets until 28 days of age. In EW piglets, at 36 days of age, there was a higher density of T- and B-lymphocytes in the gut epithelium and lamina propria, fespectively, in relation to the size of lymphoid follicles of Peyer's patches. The results indicate great behavioural adaptation capacities of very early-weaned piglets, together with earlier maturation of their gut immune system.
Keywords: physiology, aging, drinking behavior, feeding behavior, intestinal mucosa, immunology, growth and development, weaning, adaptation, newborn, growth and development, suckling, b-lymphocytes, t-lymphocytes, body weight, litter size, motor activity.

Osterberg, J; Ekwall, S.J.; Nilsson, I.; Stampe, M.; Engvall, A.; Wallgren, P. (2001). **Eradication of Salmonella Yoruba in an integrated pig herd.** *Berliner und Munchener tierarztliche Wochenschrift* 114 (9-10): 331-334, ISSN: 0005-9366.
NAL Call No.: 41.8 B45.
Abstract: An integrated SPF herd with 320 sows was found infected with Salmonella Yoruba during an annual control among sows, aiming to verify freedom from Salmonella infections. It is believed that the infection was introduced to the herd by purchase of feed. The herd performed an age segregated rearing system. Sows and piglets were reared at a central farm, while growers (25-100 kg body weight) were reared at sub-estates. The growers were free from the infection, and as a consequence a specially designed eradication program was designed. Farrowing and weaning were defined as periods of risk for sows and piglets, respectively. Consequently sows were isolated and individually tested for presence of Salmonella one week before and one week after farrowing. The offspring were tested one week post weaning. To verify freedom from disease among piglets they were also tested another time before transfer to the uninfected sub-estates. Piglets with undefined status regarding Salmonella were denoted animals at risk and not transferred to the sub-estates. Instead they were transferred to a third estate, rented to house pigs at risk. The program was successful. It allowed full production during performance, and the herd was declared free from S. Yoruba seven and a half months after the initial diagnosis.

Keywords: salmonella infections, prevention and control, disease, feed, microbiology, isolation and purification, specific pathogen-free

Otake, S.; Dee, S.A.; Rossow, K.D.; Deen, J.; Joo, H.S.; Molitor, T.W.; Pijoan, C. (2002). **Transmission of porcine reproductive and respiratory syndrome virus by fomites (boots and coveralls).** *Journal of Swine Health and Production* 10 (2): 59-65, ISSN: 1066-4963.
NAL Call No.: SF971 N472.
Keywords: disease transmission, porcine reproductive and respiratory syndrome, experimental infection, contaminated fomites, boots, coveralls, contaminated hands, showering, sanitation.

Otten, W.; Kanitz, E.; Tuchscherer, M. (2001). **Prenatal stress in pigs: effects on growth, physiological stress reactions and immune function.** *Archiv fur Tierzucht* 43 (Special): 159-164, ISSN: 0003-9438.
NAL Call No.: 49 AR23.
Abstract: The effects of a daily restraint of sows during the last third of pregnancy on endocrine stress reactions, immune responses and growth of offspring were examined. Stress and immune reactions of piglets were tested using an immobilization and ACTH test at 3, 7, 21 and 35 days of age. Lower basal plasma cortisol and increased basal cortisol binding globulin concentrations at 3 days of age were found in piglets exposed to prenatal stress compared with the control piglets. Prenatal stress caused a decrease in the number of glucocorticoid receptors in the hypothalamus, enlargement of adrenal cortex and reduction in thymus weight one day after birth. Prenatal stress also suppressed immune functions on day 1 of life as shown by lower IgG levels and decreased in vitro lymphocyte response to T and B cell mitogens. In addition, piglets that were exposed to prenatal stress had a higher mortality after birth and a tendency for lower birth weights. Morphological, endocrine and immune effects of prenatal stress were observed only on the first days after birth. It is suggested that prenatal stress during late pregnancy in pigs affects the ontogeny of fetal neuroendocrine system via increased maternal stress hormone concentrations.
Keywords: piglets, fetal development, growth, immune response, mortality, pregnancy, stress.
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Otten, W.; Kanitz, E.; Tuchscherer, M.; Nurnberg, G. (2001). **Effects of prenatal restraint stress on hypothalamic-pituitary-adrenocortical and sympatho-adrenomedullary axis in neonatal pigs.** *Animal Science: an International Journal of Fundamental and Applied Research* 73 (2): 279-287, ISSN: 1357-7298.
NAL Call No.: SF1.A56.
Abstract: Studies in rodents and primates strongly indicate that prenatal stress affects the survival, behaviour and physiology of the offspring. Stressful stimuli during gestation may have a direct or hormone mediated effect on the development of stress systems in the fetal organism, resulting in an altered coping during stressful situations. The present study was conducted to elucidate prenatal stress effects in domestic pigs on the responses of the hypothalamic-pituitary- adrenocortical (HPA) axis and the sympatho-adrenomedullary (SAM) system as well as on morbidity, mortality and growth of the offspring. Pregnant sows were subjected to a restraint stress for five minutes daily during the last five weeks of gestation. Endocrine reactions of the piglets were tested at 3, 7, 21 and 35 days of age using an immobilization test and an ACTH challenge test. Prenatally stressed piglets showed lower basal plasma cortisol and increased corticosteroid binding globulin (CBG) concentrations at 3 days of age, indicating decreased free cortisol concentrations after birth. Cortisol levels after ACTH stimulation and catecholamine levels after immobilization were not affected by the stress treatment of the sows. Piglets from stressed sows tended to have lower noradrenaline: adrenaline ratios at three days of age compared with the control piglets. In addition, stressed sows tended to have lower litter weights after birth. The morbidity and mortality during the suckling period was higher in the prenatally stressed litters, as shown by a higher frequency of diseased and perished piglets per litter. We suppose that prenatal stress during late gestation in pigs alters the development of the HPA system and impairs the vitality of the offspring.
Keywords: sows, piglets, hypothalamic releasing hormones, stress, stress response, litter weights, morbidity, mortality.
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Predicala, B.Z.; Maghirang, R.G.; Jerez, S.B.; Urban, J.E.; Goodband, R.D. (2001). **Dust and bioaerosol**

concentrations in two swine-finishing buildings in Kansas. *Transactions of the ASAE* 44 (5): 1291-1298, ISSN: 0001-2351.
NAL Call No.: 290.9 Am32T.
Keywords: housing, air quality, air temperature, ammonia, artificial ventilation, carbon dioxide, dust, natural ventilation, particle size distribution, relative humidity.

Rautiainen, E.; Wallgren, P. (2001). **Aspects of the transmission of protection against Mycoplasma hyopneumoniae from sow to offspring.** *Journal of Veterinary Medicine Series B* 48 (1): 55-65, ISSN: 0931-1793.
NAL Call No.: 41.8 Z52.
Keywords: sows, piglets, passive immunity, Mycoplasma hyopneumoniae, colostrum, antibody concentration variation, farrowing, offspring transmission, transmission of protection.

Rizvi, S.; Nicol, C.J.; Green, L.E. (2000). **A descriptive survey of the range of injuries sustained and farmers' attitudes to vulva biting in breeding sows in south-west England**. *Animal Welfare* 9(3): 273-280, ISSN: 0962-7286.
NAL Call Number: HV4701.A557.
Keywords: sows, vices, pig farmers, farm surveys, farmers' attitudes, bites, vulva, incidence, dry period, aggressive behavior, floor pens, competition for food.

Rodriguez Vivas, L.; Ortega Pacheco, A.; Machain Williams, C.Y.; Santos Ricalde, R.(2001). **Gastrointestinal parasites in sows kept in two production systems (indoor and outdoor) in the Mexican tropics.[Parasitos gastrointestinales en marranas mantenidas en dos sistemas de produccion (interior y exterior) en el tropico mexicano.]** *Livestock Research for Rural Development* 13 (5):1-9, ISSN: 0121-3784. Available online at http://www.cipav.org.co/lrrd/
NAL Call No.: SF55 D44L582.
Abstract: In many countries, there is an increasing interest in outdoor pig production. However, gastrointestinal parasitism (GIP) is a problem, because they reduce the productive performance of the animals. The research reported in this paper compared the egg and oocyst excretion from GIP, weight changes during pregnancy and lactation, and litter performance of sows kept in two production systems (outdoor vs. indoor). Eighteen primiparous sows of similar origin were divided in two groups: six were kept in an indoor system and twelve in an outdoor system. Samples of faeces were taken from each sow according to the following scheme: sample one (at mating), sample two to seven (at 15, 30, 45, 60, 75 and 90 days of gestation), sample eight (at farrowing) and sample nine (15 days after farrowing). The samples were analysed using the centrifuge flotation and McMaster technique. Isospora were prevalent in 94 and 41% of the sows in the outdoor and indoor systems, respectively. The sows in the outdoor system had a higher excretion of oocysts from Isospora (1224) than sows kept indoors (206). There was no effect of production system on weight changes of the sows during pregnancy and lactation, and on litter performance. Trichuris and Strongylidae showed prevalences less than or equal to 33% and they did not have a defined excretion.
Keywords: disease prevalence, epidemiology, faeces, farrowing, helminthoses, lactation, litter performance, liveweight, pig farming, pregnancy, sows, surveys, Isospora, Strongylidae, Trichuris Mexico, Spanish language.
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Roepstorff, A.; Murrell, K.D.; Boes, J.; Petkevicius, S. (2001). **Ecological influences on transmission rates of Ascaris suum to pigs on pastures.** *Veterinary Parasitology* 101 (2): 143-153. ISSN: 0304-4017.
NAL Call No.: SF810.V4.
Keywords: parasitic nematodes, ascaris suum, helminth ova, oesophagostomum dentatum, nematode larvae, spatial distribution, soil, deposition site, disease transmission, sentinel animals, temporal variation, pig housing, pastures, animal husbandry, outdoor rearing, Denmark.

Seidler, T.; Alter, T.; Kruger, M.; Fehlhaber, K. (2001). **Transport stress, consequences for bacterial translocation, endogenous contamination and bactericidal activity of serum of slaughter pigs.** *Berliner und Munchener tierarztliche Wochenschrift* 114 (9-10): 375-7, ISSN: 0005-9366.
NAL Call No.: 41.8 B45.
Abstract: On transport and at the abattoir animals are confronted with a lot of stressors, such as sound/noise, crowding/mixing, pollutants and infectious agents that act on the organism. After transport stress an endogenous contamination is often seen in slaughter carcasses and presents a hazard for the consumer. These events are often correlated with a rise in endotoxin level (Misawa et al., 1995; Morales et al., 1992) and a modified immune response. Previous own investigations confirm this hypothesis (Zucker and Kruger, 1998, Seidler et al., 2000). The attempt was made to investigate the impact of selected stressors (short term transport (1 h), long term transport (7-8 hrs), high temperature, high humidity and intense handling/moving) on bacterial translocation, endogenous contamination, endotoxin levels and bactericidal activity of body fluids.
Keywords: bacterial infections, bacterial translocation, physiology, endotoxins, blood, stress, disease transmission, abattoirs, husbandry methods, humidity, stress.

Stark, K.D.C.; Boyd, H.B.; Mousing, J. (2002). **Risk assessment following the hypothetical import of dioxin contaminated feed for pigs: An example of quantitative decision support under emergency conditions.** *Food Control* 13 (1): 1-11, ISSN: 0956-7135.
NAL Call No.: TP372.7 F66.
Keywords: pig feeds, dioxin contaminated, food residue, emergency conditions, food control, food toxicology, hypothetical import, risk assessments, chemical analysis, human health risks, meat product, toxic chemical residues, quantitative decision support, risk models, applications, Europe, Belgium, Denmark.

Stark, K.D. (2001). **Veterinary epidemiology, a key to sustainable pig production in Switzerland.** *Archiv fur Tierheilkunde* 143 (2): 63-8, ISSN: 0036-7281.
Keywords: enzootic pneumonia, epidemiology, animal welfare, models, theoretical, prevention and control, eradication program, risk assessment, Switzerland.

Stege, H.; Christensen, J.; Nielsen, J.P.; Willeberg, P. (2001). **Data quality issues and alternative variable screening methods in a questionnaire based study on subclinical Salmonella enterica infection in Danish pig herds.** *Preventive Veterinary Medicine* 48 (1): 35-54, ISSN: 0167-5877.
NAL Call No.: SF601 P7.
Keywords: finishing pigs, risk factors, Salmonella enterica, bacteria, herd prevalence, Danish Salmonella Control program, blood samples, seroprevalence, data analysis, questionnaire based study, assessment method, serological analysis, screening method.

Swanenburg, M.; Urlings, H.A.P.; Keuzenkamp, D.A.; Snijders, J.M.A. (2001). **Salmonella in the lairage of pig slaughterhouses.** *Journal of Food Protection* 64 (1): 12-16, ISSN: 0362-028X.
NAL Call No.: 44.8 J824.
Abstract: The purpose of this study was to determine if lairages of pig slaughterhouses can act as a source of contamination of slaughtered pigs with Salmonella. The prevalence and variety of serotypes of Salmonella in the lairages of two pig slaughterhouses in Netherlands (date not given) were determined, and the efficacy of the usual cleaning and disinfection on the presence of Salmonella was estimated. Lairages of two pig slaughterhouses were sampled three times when pigs were present. Furthermore, these lairages were sampled after the usual cleaning and disinfection, whereas the lairage of one slaughterhouse was sampled an additional time after improved cleaning and disinfection. Samples were collected by swabbing floor and wall surfaces and collecting the residing fluids on the floor throughout the lairage. Salmonella was isolated in 70 to 90% of the samples when pigs were present. The usual cleaning and disinfection reduced the level of contamination with Salmonella to 25% positive samples, whereas improved cleaning and disinfection reduced this level to 10% positive samples. It is concluded that the waiting period in the lairage of at least 2 hours contains a substantial risk for slaughter pigs to become infected with Salmonella, especially for pigs originating from Salmonella-free herds. The usual cleaning and disinfection of the lairage were not sufficient to eliminate this risk, whereas an improved procedure for cleaning and disinfection still was unsatisfactory.

Keywords: abattoirs, cleaning and sterilizing, disinfection, microbial contamination, bacteria, serotypes, stress, salmonella, Netherlands.
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Thomsen, L.E.; Mejer, H.; Wendt, S.; Roepstorff, A.; Hindsbo, O. (2001). **The influence of stocking rate on transmission of helminth parasites in pigs on permanent pasture during two consecutive summers.** *Veterinary Parasitology* 99 (2): 129-46, ISSN: 0304-4017
NAL Call No.: SF810 V4.
Abstract: This study was made to elucidate the transmission of nematode infections in outdoor pigs at different stocking rates during two consecutive seasons. Five pigs (Group 1A) inoculated with low doses of Oesophagostomum dentatum, Ascaris suum, and Trichuris suis and five helminth-naive pigs (Group 1B) were turned out together in June 1996 on each of four pastures at stocking rates of 100, 240 (two pastures) and 576m(2) per pig, respectively. The pigs were slaughtered in early October, and pasture infectivity was subsequently measured using helminth-naive tracer pigs (Tracer). In 1997, 10 helminth-naive pigs were turned out on each pasture in May (Group 2) and again in August (Group 3), and allowed to graze for 12 weeks. The percentage of grass cover was reduced considerably at the high stocking rate in comparison to the other stocking rates. Transmission of all three helminths was observed on all pastures. In 1996, the O. dentatum faecal egg counts and worm burdens were significantly higher in pigs at the high stocking rate compared to pigs at the other stocking rates. O. dentatum did not survive the winter and pigs of Group 2 were inoculated with 3000 larvae each to reintroduce this parasite. Ascaris suum ELISA values and worm counts were highest at the high stocking rate in 1997 (Group 3). Transmission of T. suis was not significantly influenced by stocking rate. The results indicate that transmission of O. dentatum, and to some extent A. suum is influenced by stocking rate. However, both A. suum and T. suis eggs are still expected to constitute a high risk of infection on intensively used pastures where eggs may accumulate for years. The relationship between host density and helminth transmission seems more complex for grazing/rooting pigs than for grazing ruminants. This may be due to the differences in behaviour of the animals and the resulting differences in microclimate of the developing eggs/larvae.
Keywords: Helminthiasis, transmission, growth and development, body weight, epidemiology, feces, parasitology, parasite egg count, Denmark.

Tsiloyiannis, V.K.; Kyriakis, S.C.; Vlemmas, J.; Sarris, K. (2001). **The effect of organic acids on the control of porcine post weaning diarrhoea.** *Research in Veterinary Science* 70 (3): 287-293, ISSN: 0034-5288.
NAL Call No.: 41.8 R312.
Keywords: piglets, disease, post weaning diarrhoea syndrome, Enterotoxigenic Escherichia coli (ETEC) strains, organic acids, efficacy, antibacterial drug, dietary supplement, citric acid, formic acid, fumaric acid, lactic acid, lincomycin, malic acid, propionic acid, spectinomycin, lincospectin, feed conversion, mortality, weight gain.

Van, N.A. (2001). **Mathematical modelling of pseudorabies virus (syn. Aujeszky's disease virus) outbreaks aids eradication programmes: A review.** *Veterinary Quarterly* 23 (1): 21-26, ISSN: 0165-2176.
NAL Call No.: SF601.V46.
Keywords: pseudorabies virus, Aujeszky’s disease virus, viral disease, susceptible infectious recovered model, mathematical model, eradication program, vaccination, Netherlands.

Van, N.A.; De Jong, M.C.; Kersten, A.J.; Kimman, T.G.; Verheijden, J.H. (2001). **An analysis of a presumed major outbreak of pseudorabies virus in a vaccinated sow herd.** *Epidemiology and Infection* 126 (1): 119-128, ISSN: 0950-2688.
NAL Call No.: RA651 A1E74.
Keywords: sows, pseudorabies virus, outbreak, viral disease, vaccination, immunization method, Monte Carlo simulation, mathematical model.

Van, N.A.; De Jong, M.C.; Schoevers, E.J.; Van Oirschot, J.T.; Verheijden, J.H. (2001). **Pseudorabies virus is transmitted among vaccinated conventional pigs, but not among vaccinated SPF pigs.** *Veterinary Microbiology* 80 (4): 303-12, ISSN: 0378-1135.

NAL Call No.: SF601 V44.

Abstract: Whereas the reproduction ratio (R) of pseudorabies virus (PRV) in vaccinated specific pathogen free (SPF) pigs without maternally derived antibodies under experimental conditions has repeatedly been shown to be significantly below 1, R in vaccinated conventional pigs in the field with maternally derived antibodies was significantly above 1. To exclude the difference in husbandry conditions as a cause for this discrepancy, we quantified and compared the transmission of PRV in both groups under identical experimental conditions. Whereas none of the SPF sentinel pigs became infected (R=0, significantly<1), all conventional sentinel pigs did become infected (R=2.5, significantly>1). Moreover, only one SPF pigs shed virus in saliva, the mean cumulative titre being almost a 100-fold less than in conventional pigs (17 pigs, P=0.003). In addition, the mean proliferation of peripheral blood lymphocytes in response to PRV antigens was significantly higher in SPF pigs than in conventional pigs at all points studied (P<0.0001). Moreover, the virus-neutralising antibody titre after vaccination was significantly higher in SPF pigs than in conventional pigs. We conclude that the discrepancy in transmission between vaccinated SPF pigs and vaccinated conventional pigs cannot be attributed to the experimental conditions.

Keywords: Herpesvirus 1, pseudorabies, transmission, specific pathogen-free organisms, immunology, disease, vaccination, antibodies, viral, biosynthesis, immunity, maternally-acquired, lymphocyte transformation, prevention and control, virus replication.

Van, R.K.; Labarque, G.; De Clercq, S.; Pensaert, M.. (2001). **Efficacy of vaccination of pigs with different H1N1 swine influenza viruses using a recent challenge strain and different parameters of protection.** *Vaccine* 19 (31): 4479-4486, ISSN: 0264-410X.

NAL Call No.: QR189 V32.

Keywords: vaccination, viruses, swine influenza, strain H1N1, strain H3N2, efficacy, swine influenza virus infection, protective immunity.

Visscher, A.H.; Janss, L.L.G; Niewold, T.A.; de Greef, K.H. (2002). **Disease incidence and immunological traits for the selection of healthy pigs. A review.** *Veterinary Quarterly* 24 (1): 29-34, ISSN: 0165-2176.

NAL Call No.: SF601.V46.

Abstract: Disease is a major issue in animal production systems and society demands that the use of medicines and vaccines be reduced. This review describes the breeding approaches that could be used to improve disease resistance and focuses especially on their application to pigs. Disease reduction by genetic means has certain advantages through cumulative and permanent effects, and direct and indirect selection methods are available. Direct selection for disease incidence requires, besides a unique pig identification and disease registration system, challenge routines that are inconvenient in intensive pig production. Indirect selection for the expression of immune capacity may be an alternative but requires detailed knowledge of the different components of the immune system. There is ample opportunity for genetic improvement of the immune capacity because immune traits show substantial genetic variation between pigs. We therefore conclude that indirect selection via immune traits is very interesting, also for practical implementation, and that there is an urgent need for knowledge, within lines, about the genetic relationships between immune capacity traits and resistance to specific diseases or to disease incidence in general. Furthermore, knowledge about the relationship between immune system traits and production traits is needed as well as knowledge about the effect of selection on the epidemiology of disease at a farm/population level and on the host-pathogen interaction and coevolution.

Keywords: genetic selection, disease resistance, immune capacity traits, direct and indirect selection, variation.

Wallgren, P.; Melin, L. (2001). **Weaning systems in relation to disease.** In: *The Weaner Pig: Nutrition and Management*, Varley, M.A.; Wiseman, J. (Eds.), CABI Publishing: Wallingford, UK, pp.309-316, ISBN: 0-85199-532-2.

NAL Call No.: SF396.5 W43 2001.

Keywords: piglets, early weaning, digestive system, production technology, hygiene, environmental conditions, health, husbandry, disease resistance, early weaning, susceptibility, Escherichia coli, Sweden.

Walton, J.R. (2001). **Benefits of antibiotics in animal feed.** In: *Recent Developments in Pig Nutrition* No. 3, Garnsworthy, P. C.; Wiseman, J. (Eds.), Nottingham University Press: Nottingham, UK, pp.11-37, ISBN: 1-

897676-44-1.
Keywords: production, antiinfective agents, food hygiene, health, penicillin, tetracycline, human health, regulation, legislation.

Wee, S.H.; Lee, C.G.; Joo, H.D.; Kang, Y.B. (2001). **Enzyme linked immunosorbent assay for detection of Trichinella spiralis antibodies and the surveillance of selected pig breeding farms in the Republic of Korea.** *Korean Journal of Parasitology* 39 (3): 261-264. ISSN: 0368-6809.
Keywords: Trichinellosis, parasitic disease, zoonosis, larval excretory secretory product antigens, ELISA, detection method, labeling, Western blot analysis, detection method, pig breeding farm, surveillance, public health importance.

Wierup, M. (2001). **The Swedish experience of the 1986 year ban of antimicrobial growth promoters, with special reference to animal health, disease prevention, productivity, and usage of antimicrobials.** *Microbial Drug Resistance* 7 (2): 183-190, ISSN: 1076-6294.
Keywords: pigs, beef, poultry, health, disease, ban, antimicrobial growth promoters, zinc oxide, improved management practices, disease prevention, antimicrobial resistance, health, productivity, Sweden.

Wolf, P.J. van der.; Wolbers, W.B.; Elbers, A.R.W.; Heijden, H.M.J.F. van der.; Koppen, J.M.C.C.; Hunneman, W.A.; Schie, F.W. van.; Tielen, M.J.M. (2001). **Herd level husbandry factors associated with the serological Salmonella prevalence in finishing pig herds in the Netherlands.** *Veterinary Microbiology* 78 (3): 205-219, ISSN: 0378-1135.
NAL Call No.: SF601.V44.
Keywords: pigs, salmonella, infections, disease prevalence, finishing, animal husbandry, serological surveys, pork, risk factors, risk assessment, elisa, antigens, calibration, questionnaires, fermentation, disinfection, diagnosis, tylosin, growth promoters, liver, seroprevalence, Netherlands.

Yoo, H.S.; Lee, B.J.; Chang, B.S.; Lee, Y.S.; Park, B.K. (2001). **Effect of enrofloxacin Na against pathogens related to the respiratory and alimentary diseases in suckling and weanling piglets.** *Journal of Veterinary Medical Science* 63 (1): 67- 72, ISSN: 0916-7250.
NAL Call No.: SF604 J342.
Keywords: piglet, suckling, weanling, Clostridium perfringens, Escherichia coli, pathogen, bacteria, enrofloxacin sodium, antibacterial drug, dosage, feed additive, intramuscular injection, diarrhea., disease prevention, disease therapy.

Yu, I.T.; Lin, J.; Wu, J.F.; Yen, H.T.; Lee, S.L.; Yang, T.S. (2002). **Reevaluation of the necessity of iron injection to newborn piglets.** *Asian Australasian Journal of Animal Sciences* 15 (1): 79-83, ISSN: 1011-2367.
NAL Call No.: SF55 A78A7.
Keywords: piglets, iron dextran, injection, creep feed, supplemented with iron, immune response, endotoxin lipopolysaccharide (LPS), tumor necrosis factor alpha, average daily gain, iron injection does not contribute to performance, unnecessary practice.

Zhang, J.; Osborne, V.; Fan, M.; Hacker, R. (2001). **Improving the viability of piglets with oxygen.** *Journal of Dairy Science* 84 (Supplement 1): 276, Joint Meeting of the American Dairy Science Association, American Meat Science Association, American Society of Animal Science and the Poultry Science Association, Indianapolis, Indiana, USA, July 24-28, 2001, ISSN: 0022-0302.
NAL Call No.: 44.8 J822.
Keywords: oxygen therapy, therapeutic method, growth, mortality, movement, postnatal period, temperature, viability, weight gain, meeting abstract.

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Farm Worker Health

Ahman, M.; Holmstrom, M.; Kolmodin-Hedman, B.; Thelin, A. (2001). **Nasal symptoms and pathophysiology in farmers.** *International Archives of Occupational and Environmental Health* 74(4): 279-84, ISSN: 0340-0131.

Abstract: Increased morbidity and mortality in lower airway diseases have been reported among farmers. The aim of this study was to assess upper airway problems in farmers. Twenty-five dairy farmers, 20 pig farmers, 21 grain farmers and 19 control subjects were studied, by use of questionnaire, skin-prick test, dynamic spirometry, nasal inspection, acoustic rhinometry (before and after a decongestant) as well as by determinations of the olfactory threshold and nasal lavage (NAL) concentrations of eosinophil cationic protein (ECP), myeloperoxidase (MPO) and albumin. RESULTS: Compared with the control group, farmers had more complaints of work-related symptoms from the lower airways, and symptoms of smell impairment, and more often had nasal polyps and hyperaemia of the nasal mucosa. They also had higher levels of MPO in NAL (especially dairy farmers and pig farmers), and a tendency to more swollen nasal mucosa and lower olfactory threshold (especially grain farmers). CONCLUSIONS: The farmers had more pathological findings in their nasal mucosa, possibly indicating effects of allergens and irritants in their work environment.More studies are needed to evaluate work environment factors causing these pathological findings in farmers.

Keywords: farm workers, nasal polyps, diagnosis, respiratory hypersensitivity, etiology, age, questionnaires, respiratory function tests.

Asmar, S.; Pickrell, J.A.; Oehme, F.W. (2001). **Pulmonary diseases caused by airborne contaminants in swine confinement buildings.** *Veterinary and Human Toxicology* 43 (1): 48-53, ISSN: 0145-6296.

NAL Call No.: SF601 A47.

Abstract: Exposure to toxic gases and particles or dusts while working or living in confinement animal systems pose a pulmonary health hazard. The severity of lung impairment from exposure to such environment is investigated using intratracheal instillation, intratracheal nebulization, and inhalation procedures. Ability to deliver particles with intratracheal instillation that are evenly distributed throughout the lung depends on the material used for injection. Pulmonary histopathology reflects anatomic changes following inhalation or instillation of chemicals or particles. Endobronchial saline washings of bronchioles and alveoli allow measurement of markers of pulmonary inflammation such as total nucleated cell (leukocyte) counts and those of macrophages, neutrophils and lymphocytes; TNF-alpha, and collagen concentration are used to further evaluate pulmonary response to endotoxin or dust exposure. Alveolar epithelial cells have an important role in clearing pulmonary fluid and maintaining the structure of lung tissue. After repeated exposure, damage to epithelial cells may result in their death, causing edema and collagen deposition that may lead to fibrosis.

Keywords: swine health, farm worker health, air pollutants, environmental toxicity, dust, housing, lung diseases, pulmonary inflammation, macrophages, neutrophils, lymphocytes.

Chang, C.W.; Chung, H.; Huang, C.F.; Su, H.J.J. (2001). **Exposure of workers to airborne microorganisms in open-air swine houses.** *Applied and Environmental Microbiology* 67 (1) : 155-161, ISSN: 0099-2240.

NAL Call No.: 448.3 Ap5.

Keywords: housing, farrowing houses, human health, air microbiology, microbial flora, air spora, bacteria, fungi, gram negative bacteria, bacterial count, microbial contamination, pig farming, sanitation, hygiene, Taiwan.

Djuricic, S.; Zlatkovic, M.; Babic, D.D.; Gligorijevic, D.; Plamenac, P. (2001). **Sputum cytopathological findings in pig farmers.** *Pathology, Research and Practice*. 197(3):145-55, ISSN: 0344-0338.

Abstract: The purpose of this study is to compare the cytological changes in the respiratory tracts of pig farmers exposed to an environment of swine confinement buildings with control, non-exposed subjects living in the same geographical area. Spontaneously produced sputum specimens were obtained from 133 pig farmers and 120 control subjects, all clinically healthy, and grouped according to smoking habits and sex. The findings of siderophages, eosinophils, abnormal columnar cells and respiratory spirals were significantly more frequent in

the pig farmers. Siderophages were noted in 25.6% of pig farmers and in 5% of control subjects. By logistic regression analysis, pig farming is the single predictive factor for siderophages and eosinophils. For other cytological abnormalities, except Creola bodies and granular debris, smoking is the most significant predictive variable, but pig farming, age and male sex also correlate with smoking. Atypical squamous metaplasia was observed in 11.3% of pig farmers and in 5.8% of control subjects. These findings are in concordance with previous epidemiological and clinical studies and also reveal a new aspect of the harmful effect of pig farming exposure to the vascular and epithelial structures of the respiratory tract. It also demonstrates the usefulness of the simple method of sputum cytological analysis.

Keywords: occupational health, pig farmers, smoking, non-smoking, confinement buildings, respiratory tract disorders, siderophages, eosinophils, atypical squamous metaplasia, sputum cytological analysis.

Drobeniuc, J.; Favorov, M.O.; Shapiro, C.N.; Bell, B.P.; Mast, E.E.; Dadu, A.; Culver, D.; Iarovoi, P.; Robertson, B.H.; Margolis, H.S. (2001). **Hepatitis E virus antibody prevalence among persons who work with swine.** *Journal of Infectious Diseases* 184(12):1594-7, ISSN: 0022-1899.

NAL Call No.: 448.8 J821.

Abstract: Prevalence of antibody and risk factors to hepatitis E virus (HEV) infection were determined in a cross-sectional study of 2 group-matched populations: swine farmers (n=264) and persons without occupational exposure to swine (n=255) in Moldova, a country without reported cases of hepatitis E. The prevalence of HEV infection was higher among swine farmers than among the comparison group (51.1% vs. 24.7%; prevalence ratio, 2.07; 95% confidence interval [CI], 1.62-2.64). In multivariate analysis, HEV infection was associated with an occupational history of cleaning barns or assisting sows at birth (odds ratio [OR], 2.46; 95% CI, 1.52-4.01), years of occupational exposure (OR, 1.04 per year; 95% CI, 1.01-1.07), and a history of drinking raw milk (OR, 1.61; 95% CI, 1.08-2.40). HEV infection was not associated with civilian travel abroad or having piped water in the household. The increased prevalence of HEV infection among persons with occupational exposure to swine suggests animal-to-human transmission of this infection.

Keywords: occupational health, pig farmers, hepatitis E virus, zoonosis, cleaning barns, assisting with farrowing, Moldova.

Muller-Suur, C.; Larsson, P.H.; Larsson, K.; Grunewald, J. (2002). **Lymphocyte activation after exposure to swine dust: a role of humoral mediators and phagocytic cells.** *European Respiratory Journal* 19 (1): 104-7, ISSN: 0903-1936.

Abstract: Exposure to swine dust causes intense airway inflammation with multifold increase in inflammatory cells and secretion of pro-inflammatory cytokines. This in vitro study focuses on the swine-dust activation of lymphocytes in whole blood, in phagocyte-depleted whole blood and in peripheral blood mononuclear cells (PBMC), in order to investigate whether phagocytic cells and/or soluble mediators are involved in the activation of T-cells following exposure to organic dust from a swine confinement house. T-cell activation was analysed by flow cytometry with double staining for CD3 and the activation marker CD69. Swine dust (50 microg) incubated (24 h) with heparinized whole blood was shown to activate 27.6% of the T-cells, while swine dust incubated with whole blood depleted from phagocytic cells or PBMC only activated 4.5%, and 4.8% of the T-cells, respectively. Plasma separated from whole blood preincubated with swine dust for 24 h stimulated as much as 32.4% of PBMC T-cells and contained high levels of interleukin (IL)-12 (14 pg x mL) and interferon (IFN)-gamma (2284 pg x mL(-1)), while plasma from PBMC incubated with swine dust contained low levels of IL-12 (2 pg x mL(-1)) and IFN-gamma (196 pg x mL(-1)). This study demonstrates that activation of T-cells by organic dust from a swine confinement building seems to require phagocytic cells, most likely acting through the release of soluble mediators. Also, conditioned plasma from swine-dust exposed whole blood, which was capable of activating T-cells, contained high concentrations of interleukin-12 and interferon-y.

Keywords: farm workers, exposure to swine dust, swine confinement house, airway inflammation, cytokines, phagocytic cells, T-cell activation.

Radon, K.; Danuser, B.; Iversen, M.; Jorres, R.; Monso, E.; Opravil, U.; Weber, C.; Donham, K.J.; Nowak, D. (2001). **Respiratory symptoms in European animal farmers.** *European Respiratory Journal* 17 (4): 747-54, ISSN: 0903-1936.

Keywords: pig farmers, occupational airway disease, respiratory hypersensitivity, dose-response relationship,

hours worked, etiology, wheezing, shortness of breath, asthma, nasal allergies, chronic phlegm, questionnaire, European Community Respiratory Health Survey (ECRHS), Denmark, Germany, Switzerland, Spain.

Withers, M.R.; Correa, M.T.; Morrow, M.; Stebbins, M.E., Seriwatana, J.; Webster, W.D.; Boak, M.B.; Vaughn, D.W. (2002). **Antibody levels to hepatitis E virus in North Carolina swine workers, non-swine workers, swine, and murids.** *American Journal of Tropical Medicine and Hygiene* 66(4):384-8, ISSN: 0002-9637.
NAL Call No.: 448.8 Am326.
Abstract: In a cross-sectional serosurvey, eastern North Carolina swine workers (n = 165) were compared with non-swine workers (127) for the presence of antibodies to hepatitis E virus as measured by a quantitative immunoglobulin enzyme-linked immunosorbent assay. Using a cutoff of 20 Walter Reed U/ml, swine-exposed subjects had a 4.5-fold higher antibody prevalence (10.9%) than unexposed subjects (2.4%). No evidence of past clinical hepatitis E or unexplained jaundice could be elicited. Swine (84) and mice (61), from farm sites in the same region as exposed subjects, were also tested. Antibody prevalence in swine (overall = 34.5%) varied widely (10.0-91.7%) according to site, but no antibody was detected in mice. Our data contribute to the accumulating evidence that hepatitis E may be a zoonosis and specifically to the concept of it as an occupational infection of livestock workers.
Keywords: occupational health, pig farmers, hepatitis E virus, zoonosis, antibody prevalence, serosurvey, North Carolina.

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Housing

American Society of Agricultural Engineers (2000). ***Swine Housing: Proceedings of the First International Conference: October 9-11, 2000, Des Moines, Iowa***, American Society of Agricultural Engineers, St. Joseph, Michigan, ASAE publication 701P0001, 401 p., ISBN: 1-892769-10-7.
NAL Call No.: SF396.3 S952 2000.
Keywords: swine housing, production, new and traditional systems for farrowing, wean-to-finish, finishing facilities, animal welfare, environment.

Andresen, N.; Ciszuk, P.; Ohlander, L. (2001). **Pigs on grassland: Animal growth rate, tillage work and effects in the following winter wheat crop.** *Biological Agriculture and Horticulture* 18 (4): 327-343, ISSN: 0144-8765.
NAL Call No.: S605.5 B5.
Keywords: growing pigs, stocking rate, winter wheat, growth rate, feed conversion, pig tillage work, high soil moisture content, dry conditions, nitrogen fertilization, soil management method.

Anil, L.; Anil, S; Deen, J. (2002). **Relationship between postural behaviour and gestation stall dimensions in relation to sow size.** *Applied Animal Behaviour Science* 77 (3): 173-181, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Abstract: The extent to which the size of the gestation stall, relative to the size of the sow, affects the normal basic postural behavioural needs of sows like standing, sitting and lying was assessed using 25 sows randomly selected from four farms. The postural behaviour of the animals was recorded using a time-lapse video recorder. The relationships of duration of postures, time taken for various postural changes and frequency of postural changes with stall measurements in relation to sow measurements were analysed. Negative correlations ($P<0.01$) were found between stall length relative to sow length and the duration of time for which the sows were standing. The relationships between the duration of postures and stall width relative to animal breadth were not different ($P>0.05$). The time taken to change from a standing to lying posture was negatively correlated ($P<0.05$) with stall length relative to animal length. Similar correlations ($P<0.05$) were noted between

stall width relative animal breadth and the duration of postural change from standing to sitting and from sitting to standing. Stall width relative to animal breadth was negatively related to the frequency of postural change from standing to sitting (P<0.05). The results suggested that the freedom of movement of pregnant sows in stalls could be improved by a little increase in the space allowance within the stall.
Keywords: gestation, housing, movement, postural behavior, pregnancy, stall dimensions.

Anonymous (2001). **Scientists' assessment of the impact of housing and management on animal welfare.** *Journal of Applied Animal Welfare Science: JAAWS* 4 (1) 3-52.ISSN: 1088-8705.
NAL Call No.: HV4701.J68.
Keywords: dairy cows, bulls, veal calves, pigs, chickens, animal welfare, emotions, abnormal behavior, animal housing, stocking density, space requirements, floor type, diet, animal behavior, animal health, intensive livestock farming, sows, pregnancy, piglets, weaning, broilers, battery husbandry, feather pecking, restricted feeding, mortality, hens, Netherlands, consensus between scientists, conceptual framework.

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NAL Call No.: 23 Au783.
Keywords: sows, piglets, housing, animal husbandry, farrowing, farrowing pens, animal welfare, farming, literature reviews.

Bauer, L. (1999). **Hogs, hoop houses, and holistic management: a diversified crop/livestock farm.** In: *Small Farming Systems for the Midwest and Reintegrating Agriculture and Community in the Midwest. Proceedings of a Two-Part Seminar Series, University of Nebraska-Lincoln, Fall 1998 and Spring 1999*, R. Olson and L. Bauer (eds.), Center for Sustainable Agricultural Systems: Lincoln, USA, pp.23-28.
NAL Call No.: S494.4 A65 S63 1999.
Keywords: pig farming, animal welfare, environmental protection, alternative farming, environmental impact, social impact, economic impact, case studies, small farms, family farms.

Beattie, V.E.; Sneddon, I.A.; Walker, N.; Weatherup, R.N. (2001). **Environmental enrichment of intensive pig housing using spent mushroom compost.** *Animal Science: an International Journal of Fundamental and Applied Research* 72 (1): 35-42, ISSN: 1357-7298.
NAL Call No.: SF1.A56.
Abstract: In a comparative study which examined the effect of having access to mushroom compost in an otherwise barren environment there were three treatments and six replicates. The three treatments were (T1) control barren pen providing 0.7 m2 per pig with fully slatted floor, (T2) empty horizontal rack suspended above the pigs' heads and (T3) mushroom compost on rack as in treatment 2. Pigs released particles of compost from the rack by nosing the metal grid from below. Almost twice as many pigs with access to mushroom compost (T3) nosed the rack (P < 0.001) and the ground below the rack (P < 0.001) as pigs which had a rack with no mushroom compost (T2). Fewer pigs with mushroom compost were involved in behaviours directed at penmates such as nosing, biting and chewing penmates than pigs in treatments 1 and 2 (P < 0.001). In addition fewer pigs in T3 were involved in feeding behaviour than in T1 and T2 (P < 0.05). Percentages of tail-bitten animals which had to be removed were 11 and 24 for T1 and T2 respectively while T3 had < 1% removed because of tail biting (P < 0.05). Apparent food intake was higher (P < 0.05) and food conversion ratio tended to be poorer in T1 (P = 0.1). It is suggested that pigs will redirect rooting behaviour towards penmates and the feeder in the absence of any rooting substrate. Adding substrate to commercial finishing pens reduces this redirection of behaviour and improves welfare by minimizing injury through tail biting.
Keywords: housing, enrichment, mushroom compost, physical activity, aggressive behavior, tail biting, animal behavior, feed intake, feed conversion, animal welfare, rooting behavior.

Borell, E. von; Bockisch, F.J.; Buscher, W.; Hoy, S.; Krieter, J.; Muller, C.; Parvizi, N.; Richter, T.; Rudovsky, A.; Sundrum, A.; Weghe, H. (2001). **Critical control points for on-farm assessment of pig housing.** *Livestock Production Science* 72 (1/2):177-184, ISSN: 0301-6226.

NAL Call No.: SF1.L5.

Abstract: Animal and environmental care, health, product safety and consumer acceptance are factors that are becoming increasingly important for the assessment of pig housing. It can be foreseen that housing conditions will undergo a documentation and certification process as part of a quality assurance scheme according to international standards (ISO-9000 Series, Quality Management and Quality Assurance Standards, 1994). As already implemented for the food processing industry, critical control points (CCP, based on the Hazard Analysis of Critical Control Point concept) have to be defined in order to objectively assess animal housing based on sound scientific data. The German working group "Animal Husbandry and Animal Welfare" of the German Society of Animal Production (DGFZ) has proposed a concept for the "Assessment of Animal Housing and Management according to Welfare and Environmental Criteria". Based on this concept, CCP and critical management points (CMP) have been developed for the categories health, behaviour, management and environmental impact. These criteria are intended to be used primarily by the farmer as an internal on farm assessment scheme. In the long run this concept of housing assessment through critical control and management points, measurable parameters and tolerance limits can be further developed and utilized by government agencies, consumer organizations and commodity groups that have an interest to evaluate, monitor and licence housing systems.

Keywords: health, husbandry, animal welfare, farming, pig housing, quality assurance schemes, international standards, product safety, consumer acceptance, reviews.

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Boyle, L.A.; Leonard, F.C.; Lynch, P.B.; Brophy, P. (2002). **Effect of gestation housing on behaviour and skin lesions of sows in farrowing crates.** *Applied Animal Behaviour Science* 76 (2): 119-134, ISSN: 0168-1591.

NAL Call No.: QL750.A6.

Abstract: Group housing systems for pregnant sows are set to become more popular, but there is evidence that this development could influence the welfare of sows in farrowing crates. A study was designed to assess the effect of gestation accommodation on behaviour, welfare and farrowing performance of sows in farrowing crates. Multiparous sows were housed loose (L) in groups of four with feeding stalls (n=24) or individually in gestation stalls (S) (n=24) from one month postservice. On day 110 of pregnancy, sows were moved to farrowing crates where they remained until 28 days postpartum. Behaviour was recorded on the first day in the crate and on day 10 of lactation. Posture changing frequency was recorded for 2 h prior to and for the duration of farrowing. Skin lesions were scored from 0 to 6 at 34 locations on the body the day before and the day after entry to the crate, postfarrowing, during weeks 2 and 3 of lactation and at weaning. On the first day in the crate, S sows made significantly more attempts to lay down per lay down event than L sows ($P<0.05$). They also spent more time standing inactively ($P<0.01$) and less time lying laterally ($P<0.05$). During parturition, L sows changed posture more often than S sows ($P< 0.05$) and they showed a higher frequency of ventral and lateral lying as well as dog- sitting on day 10 of lactation ($P<0.05$). The forelimb lesion score of S sows was significantly higher than L sows the day after entry to the crate and postfarrowing ($P<0.01$). Loose housing during gestation resulted in improved manoeuvering ability and comfort of sows in the farrowing crate with beneficial implications for skin health. However, L sows were more restless during parturition and in early lactation suggesting that loose housing may have a negative influence on sow welfare in farrowing crates at these times.

Keywords: animal behavior, animal welfare, farrowing houses, farrowing pens, loose housing, pregnancy, skin lesions, sows, wounds, group size, posture, physical activity, farrowing, skin lesions, animal welfare, sow lactation, litter size, piglets, perinatal mortality, birth weight, weaning weight.

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Boyle, L.A.; Regan, D.; Leonard, F.C.; Lynch, P.B.; Brophy, P. (2000). **The effect of mats on the welfare of sows and piglets in the farrowing house.** *Animal Welfare* 9(1):39-48, ISSN: 0962-7286.

NAL Call No.: HV4701.A557.

Keywords: farrowing, piglets, sows, feet, floors, skin lesions, slipping, slatted floors, weaning, pig housing, animal welfare.

Boyle, L.A.; Leonard, F.C.; Lynch, P.B.; Brophy, P. (2000). **Influence of housing system during gestation on the behaviour and welfare of gilts in farrowing crates.** *Animal Science: an International Journal of Fundamental and Applied Research* 71 (3): 561-570, ISSN: 1357-7298.
NAL Call No.: SF1.A56.
Keywords: gilts, pig housing, farrowing pens, stalls, loose housing, litter, European Union, group size, animal welfare, physical activity, posture, skin lesions, heart rate, litter size, piglets, birth weight, fetal death, floor type.

Bracke, M.B.M.; Metz, J.H.M.; Spruijt, B.M.; Schouten, W.G.P. (2002). **Decision support system for overall welfare assessment in pregnant sows B: validation by expert opinion.** *Journal of Animal Science* 80 (7):1835-1845, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: This paper examines the validity of a model that is embedded in a computer-based decision support system to assess the welfare status of pregnant sows in housing and management systems. The so-called SOWEL (SOw WELfare) model was constructed using a formalized procedure to identify and weight welfare-relevant attributes of housing systems in relation to the animal's needs, and evidenced by scientific statements collected in a database. The model's predictions about welfare scores for 15 different housing systems and weighting factors for 20 attributes were compared with expert opinion, which was solicited using a written questionnaire for pig-welfare scientists. The experts identified tethering and individual housing in stalls as low welfare systems. The group of mid-welfare systems contained indoor group-housing systems and an individual-housing system with additional space and substrate. The five best systems were all systems with outdoor access and the provision of some kind of substrate such as straw. The highest weighting factors were given for the attributes “social contact,” “health and hygiene status,” “water availability,” “space per pen,” “foraging and bulk,” “food agonism,” “rooting substrate,” “social stability,” and “movement comfort.” The degree of concordance among the experts was reasonable for welfare scores of housing systems, but low for weighting factors of attributes. Both for welfare scores and weighting factors the model correlated significantly with expert opinion (Spearman's Rho: 0.92, $P<0.001$, and 0.72, $P<0.01$, respectively). The results support the validity of the model and its underlying procedure to assess farm animal welfare in an explicit and systematic way based on available scientific knowledge.
Keywords: sows, pregnant, behavior, health, housing, husbandry, animal welfare, computer techniques, foraging, hygiene, prediction, water availability.
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Bracke, M.B.M.; Metz, J.H.M.; Dijkhuizen, A.A.; Spruijt, B.M. (2001). **Development of a decision support system for assessing farm animal welfare in relation to husbandry systems: strategy and prototype.** *Journal of Agricultural and Environmental Ethics* 14 (3): 321-337, ISSN: 1187-7863.
NAL Call No.: BJ52.5 J68.
Keywords: swine, farm animal welfare, decision making strategy, scientific knowledge, Evolutionary Prototyping Method, housing system, biological needs of the animals, welfare model, weighting factors, heuristic rules, mathematical models.

Bracke, M.B.M.; Metz, J.H.M.; Spruijt, B.M.; Dijkhuizen, A.A. (1999). **Overall welfare assessment of pregnant sow housing systems based on interviews with experts.** *Netherlands Journal of Agricultural Science* 47(2):93-104, ISSN: 0028-2928.
NAL Call No.: 12 N3892.
Keywords: animal welfare, feeding, group size, models, sows, stalls, tethering, housing, decision making.

Bradshaw, R.H.; Skyrme, J.; Brenninkmeijer, E.E.; Broom, D.M. (2000). **Consistency of measurement of social status in dry-sows group-housed in indoor and outdoor systems.** *Animal Welfare* 9(1):75-79, ISSN: 0962-7286.
NAL Call No.: HV4701.A557.
Keywords: dominance, gilts, social behavior, animal behaviour, sows, animal welfare, housing.

Bremermann, N. (2001). ***Comparing studies in regard of health, fattening efficiency and meat quality of pigs in the indoor and outdoor keeping respectively. [Vergleichende Untersuchungen zur Gesundheit, Mastleistung und Fleischqualitat von Schweinen in der Stall- bzw. Freilandhaltung.]*** Klinik fur Klauentiere des Fachbereiches Veterinarmedizin der Freien Universitat Berlin: Berlin, Germany,116 p. Publication Year: 2001

Abstract: The aim of the study is to examine indoor, outdoor and mixed kinds of keeping pigs and their influences on animal health, fattening efficiency and meat quality. Considering prevention of cruelty to animals and from a veterinarian and ethological point of view, exclusive outdoor keeping is the most profitable for pig health and well being. However, the outdoor keeping of pigs has its drawbacks such as the need for much space, a high expenditure of work, a high feed consumption and a low level of lean meat.

Keywords: crossbreds, thesis, animal health, animal welfare, feed conversion efficiency, feed intake, finishing, meat quality, morbidity, piglets, seasons, Germany, German language.

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Brumm, M.C.; Ellis, M.; Johnston, L.J.; Rozeboom, D.W; Zimmerman, D.R. (2001). **Interaction of swine nursery and grow-finish space allocations on performance.** *Journal of Animal Science* 79 (8): 1967-72, ISSN: 0021-8812.

NAL Call No.: 49 J82.

Abstract: Two experiments were conducted to evaluate the possible interaction of nursery space allocations and grow-finish space allocations in swine. In Exp. 1, crowding was achieved by varying the number of pigs per pen. During the nursery phase, decreasing the space allocation (0.16 m2/pig vs 0.25 m2/pig; 8 and 12 pens per treatment, respectively) by increasing the number of pigs per pen (18 vs 12) resulted in a decrease in daily feed intake (0.609 vs 0.683 kg/d; P < 0.001) and daily gain (0.364 vs 0.408 kg/d; P < 0.001). Pigs were mixed within nursery treatment groups and reassigned to grow-finish pens (6 pens per treatment) at the end of the 35-d nursery period providing either 0.56 m2/pig (14 pigs/pen) or 0.78 m2/pig (10 pigs/pen). Crowding during the grow-finish phase decreased daily feed intake (P < 0.003) and daily gain (P < 0.001). In Exp. 2, space allocations of 0.16 m2/pig vs 0.23 m2/pig during the nursery phase (24 pens per treatment) resulted in a decrease in daily feed intake (0.612 vs 0.654 kg/d; P < 0.005) and daily gain (0.403 vs 0.430 kg/d; P < 0.001). Pigs remained in the same (social) groups when moved to the grow-finish phase. Unlike Exp. 1, there was no effect of crowding during the grow-finish phase (0.60 m2/pig vs 0. 74 m2/pig) on daily feed intake or daily gain. The difference in results between experiments suggests that the response to crowding during the grow-finish phase may depend in part on whether pigs are mixed and sorted following movement from the nursery.

Keywords: housing, growth, development, body weight record.

Burne, T.H.J.; Murfitt, P.J.E.; Johnston, A.N.B. (2001). **PGF2 alpha, induced nest building and choice behaviour in female domestic pigs.** *Applied Animal Behaviour Science* 73 (4): 267-279, ISSN: 0168-1591.

NAL Call No.: QL750.A6.

Abstract: The domestic pig, Sus scrofa, builds a maternal nest in the day before parturition. A model for porcine nest building has been established, in which exogenously administered prostaglandin (PG)F2 alpha is used to induce nesting behaviour in cyclic, pseudopregnant and pregnant pigs. This experiment was designed to examine the effect of PGF2 alpha on the preferences of non-pregnant gilts for pens bedded with straw compared with bare pens. Ten 6-month-old nulliparous female pigs (gilts) were tested in an arena, which consisted of four pens (1.8 m x 1.7 m), a neutral area (1.5 m x 3.4 m) and a start area (1.5 m x 3.4 m). Two of the pens contained 2 kg of fresh straw and the remainder of the testing arena was devoid of straw. On the first day of testing half of the pigs were given a control intramuscular injection of 3 ml 0.9% saline and the remainder were given an intramuscular injection of 15 mg PGF2 alpha and their behaviour scored for 1 h after treatment. On the following day the treatments were reversed, such that each pig was given both treatments (saline or PGF2 alpha). There was no significant effect of the order of treatment on behaviour. After saline-treatment the pigs spent most of their time in the pens containing straw (59%) and the least amount of time in bare pens (5%). In the straw pens, saline-treatment induced bouts of oronasal contact with straw of a relatively long duration (11-100 s), which we interpret as foraging. In the hour after PGF2 alpha, treatment the pigs also spent most of their time in the pens containing straw (44%) and the least amount of time in bare pens (10%), but they interacted with the straw in a markedly different way. PGF2 alpha, treated pigs displayed bouts of oronasal

contact with straw of a relatively short duration (2-10 s) which, together with high frequencies of pawing at straw, lifting and carrying straw in the mouth, we interpret as nest building behaviour. Superimposed on this is the finding that gilts spend more time in the neutral areas after PGF2 alpha, treatment than they did after saline-treatment. PGF2 alpha, treated pigs spent most of their time engaged in nesting behaviour within the straw pens but they also gathered and deposited straw in different areas of the test arena (neutral and start areas); behaviours not seen after saline-treatment. We conclude that pigs generally prefer a pen containing straw bedding to a bare pen but that PGF2 alpha alters the way they interact with straw, inducing behaviour similar to prepartum nest building.
Keywords: behavior, gilts, litter, nesting, pregnancy, prostaglandins.
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Buscher, W.; Kluge, J.; Frosch, W. (2001). **Comparison of room- and floor heating in piglet houses.** *Agrartechnische Forschung* 7 (1/3): E1-E5, ISSN: 0948-7298.
Abstract: After two years of investigations, different ventilation- and heating systems for piglet houses can now be evaluated comprehensively. In addition to the economic viability of the variants, the lying behaviour, indoor air quality, and the emission of noxious gases have been taken into account. As compared with standard fans, low-energy “EC fans” allow electricity consumption to be reduced by an average of more than 50%. With regard to heating energy, gas burners instead of hot-water floor heating with gas boilers also enabled consumption to be reduced by more than 50%. Floor heating, however, is advantageous for the lying behaviour of young piglets and the air quality parameters.
Keywords: piglets, housing, air quality, boilers, electrical energy, emission, energy requirements, floors, heating, thermal energy, toxic gases, ventilation.
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Cagienard, A.; Regula, G.; Danuser, J. (2002). **The impact of different housing systems on the health and welfare of grower and finisher pigs.** In: *Society for Veterinary Epidemiology and Preventive Medicine. Twentieth Anniversary Proceedings of a Meeting Held at University of Cambridge, UK, April 3-5, 2002*, Menzies, F.D.; Reid, S.W.J. (Eds.), Society for Veterinary Epidemiology and Preventive Medicine Roslin, UK, pp.120-126, ISBN: 0-948073-54-3.
NAL Call No.: SF780.9 S63.
Keywords: health,, housing, husbandry, animal welfare, Switzerland.

Carroll, J.A.; Matteri, R.L.; Dyer, C.J.; Beausang, L.A.; Zannelli, M.E. (2001). **Impact of environmental temperature on response of neonatal pigs to an endotoxin challenge.** *American Journal of Veterinary Research* 62 (4): 561-566, ISSN: 0002-9645.
NAL Call No.: 41.8 Am3A.
Keywords: piglets, environmental temperature, cold, endotoxins, lipopolysaccharides, newborn animals, immune response, stress response, hypothermia, body temperature, prolactin, blood serum, tumor necrosis factor, interleukin 1, interleukin 6, immune therapeutic agents.

Chiu, S.T. (2001). **Pigsty with an excretion area.** *Official Gazette of the United States Patent and Trademark Office Patents* 1249 (4): No Pagination, ISSN: 0098-1133.
NAL Call No.: T223 A21.
Keywords: patent, housing design, excretion area, prevents lying down in excretion area.

Cox, L.N.; Cooper, J.J. (2001). **Observations on the pre-and post-weaning behaviour of piglets reared in commercial indoor and outdoor environments.** *Animal Science: an International Journal of Fundamental and Applied Research* 72 (1): 75-86, ISSN: 1357-7298.
NAL Call No.: SF1.A56.
Abstract: A number of behavioural problems are associated with weaning piglets including belly nosing, ear and tail biting, and low intake of solid food. These appear to be less pronounced in piglets reared on outdoor systems, which initially consume more solid food and show less belly nosing and aggression than comparable indoor-reared piglets. The objective of this study was to investigate how these differences in post-weaning

behaviour relate to the piglets' pre-weaning behaviour in the two rearing environments. The study was carried out at a commercial pig unit, where piglets of the same genotype are born into conventional indoor or outdoor farrowing systems. In the intensive system, sows were singly housed prior to farrowing in crates and their piglets received a solid "creep" food prior to weaning. On the outdoor system, sows were allowed to build straw nests in arks for farrowing and both sow and piglets had access to pasture. Indoor and outdoor piglets were weaned at 24 (+/-3) days of age and mixed in straw-yard housing with access to a solid food. Prior to weaning, teat-directed activity was more common in indoor piglets than outdoor piglets. Outdoor piglets performed more rooting, standing and locomotion and were seen chewing the sows' roll-nuts. Following weaning, outdoor-reared piglets performed more feeding and rooting, and less fighting than indoor-reared piglets. This study supports previous findings that undesirable activities such as fighting are less common in piglets weaned from outdoor systems, even when mixed with indoor piglets. In addition, outdoor-reared piglets were more likely to exploit solid food even though they did not have access to creep food prior to weaning.

Keywords: piglets, weaning, pig housing, farrowing pens, creep feeding, animal behavior, floor pens, agonistic behavior, tail biting, physical activity, age differences, teats, animal welfare, farrowing crates, farrowing arks.

Day, J.E.L.; Burfoot, A.; Docking, C.M.; Whittaker, X.; Spoolder, H.A.M.; Edwards, S.A. (2002). **The effects of prior experience of straw and the level of straw provision on the behaviour of growing pigs.** *Applied Animal Behaviour Science* 76 (3): 189-202, ISSN: 0168-1591.

NAL Call No.: QL750.A6.

Keywords: breed, Large White x Landrace, behavior, aggression, housing, animal welfare, belly nosing, biting, ear chewing, finishing period, growing period, licking, pen mate directed behavior, play fighting, ploughing, prior straw experience, rooting, straw bed depth, straw directed behavior, tail biting.

Day, J.E.L.; Spoolder, H.A.M.; Burfoot, A.; Chamberlain, H.L.; Edwards, S.A. (2002). **The separate and interactive effects of handling and environmental enrichment on the behaviour and welfare of growing pigs.** *Applied Animal Behaviour Science* 75 (3):177-192, ISSN: 0168-1591.

NAL Call No.: QL750.A6.

Abstract: The aim of this experiment was to determine the interactive effects of handling and environmental enrichment on the behaviour, performance and welfare of the growing/finishing pigs. Groups of pigs were exposed to one of eight treatments arranged in a 2 x 4 factorial design with two levels of handling (M: minimal and P: pleasant), and four levels of environmental enrichment (B: barren, C: chain, S: chopped straw, or T: destructible toy). Daily food intake was significantly affected by handling during 1-6 weeks with the P groups eating slightly more food than the M groups (1.88 vs. 1.75 kg/day; S.E.D.=0.077; P<0.05), however, this increased intake was not reflected in daily liveweight gain or food conversion ratio during the same period. The time taken for a group of pigs to exit their pen during a routine handling test was significantly affected by the handling treatments (46.2 vs. 37.8 s for P and M groups, respectively; S.E.D.=3.38; P<0.05). Behavioural time budgets, and postmortem muscle pH and stomach lesion scores were unaffected by treatment. These results suggest that pleasantly handled pigs are more difficult to move during routine husbandry tasks which may be mediated through their reduced fear of humans. 27 ref.

Keywords: behavior, animal welfare, environmental impact, feed conversion efficiency, feed intake, finishing, live weight gain.

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Docic, A.; Bilkei, G. (2001). **The effect of vaccination against Mycoplasma hyopneumoniae on health and some production parameters in outdoor and indoor units.** *Pig Journal* 47: 23-34, ISSN: 1352-9749.

NAL Call No.: SF971 P5.

Abstract: This trial was conducted to determine the effect of M. hyopneumoniae (MH) vaccination (Respisure) on indoor and outdoor pigs. A total of 430 piglets were randomly allocated to vaccinated or non-vaccinated indoor or outdoor groups (G). The trial was conducted during spring-summer, under pleasant continental weather conditions. The majority of the indoor animals showed positive titres at slaughter against MH, whereas the vaccinated and unvaccinated outdoor piglets showed more than 90% negative results. Unvaccinated indoor piglets presented significantly more lung lesions (P<0.001). The MH antibody titres were positively correlated (P<0.05) with the severity of lung lesions at slaughter. ADG of the unvaccinated indoor group was significantly

different from the other groups (P< 0.001). These results suggest that under unfavourable indoor environments, vaccination of pigs against MH is one way to improve production. In outdoor units, MH vaccination, even with high MH prevalence, fails to significantly improve performance of the animals.
Keywords: antibody testing, extensive husbandry, immunization, lesions, liveweight gain, lungs, pig housing, piglets, respiratory diseases, vaccination.
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Dong, H.; Tao, X.; Lin, J.; Li, Y.; Xin, H. (2001). **Comparative evaluation of cooling systems for farrowing sows.** *Applied Engineering in Agriculture* 17 (1): 91-96, ISSN: 0883-8542.
NAL Call No.: S671.A66.
Abstract: The field studies reported here compare the performance of three cooling systems for relieving farrowing/lactating sows of heat stress under the warm and humid production climate in southern China. The comparative systems included (1) tunnel ventilation (TV) with vertical head-zone ventilation (HZV) vs. TV with HZV and drip cooling (DC), (2) TV only vs. TV with DC, and (3) horizontal air mixing (HAM) only vs. HAM and DC. For the HZV, a perforated overhead air duct was used to create an air velocity of 0.6 to 0.8 m/s (118 to 157 ft/min) in the head zone of the sow. The paired tests were conducted successively in an experimental commercial farrowing barn housing 42 sows. Body temperature (T(b)) and respiration rate (RR) of the sows were used to evaluate the efficacy of the systems. The results indicate that sows under TV + DC or TV + HZV + DC had significantly lower T(b) than those under TV only or TV + HZV (P < 0.01 and P < 0.001, respectively). DC under HAM was less effective for T(b) reduction (P > 0.05). DC reduced RR in all cases, 42% under TV (P < 0.01), 41% under TV + HZV (P < 0.01), and 22% under HAM (P > 0.05). It was concluded that TV with DC provides the most cost-effective cooling scheme.
Keywords: sows, farrowing, farrowing houses, artificial ventilation, tunnel ventilation, vertical head-zone ventilation, drip cooling, horizontal air mixing evaporative cooling, air flow, velocity, mixing, body temperature, respiration rate, Hubei, Southern China.

Dybkjaer, L.; Olsen, A.N.W.; Moller, F.; Jensen, K.H. (2001). **Effects of farrowing conditions on behaviour in multi-suckling pens for pigs.** *Acta Agriculturae Scandinavica. Section A, Animal Science* 51 (2):134-141, ISSN: 0906-4702.
NAL Call No.: S3.A27.
Abstract: This study investigated the effects of housing farrowing sows in either crates (C-sows) or a get-away system (G-sows) until day 11 after farrowing on the subsequent behaviour in multi-suckling pens. Emphases were placed on nursing behaviour patterns of relevance for the piglets' growth and survival in the multi-suckling pens. Ten groups of six sows were used. Behaviour was recorded for 24 h on days 1, 8 and 15 after the introduction to the multi-suckling pen. When the sows had farrowed in the get-away system, significantly more nursings were initiated in the multi-suckling pen. Furthermore, the G-sows terminated a significantly smaller percentage of the nursings in the multi-suckling pens and there was significantly less cross-suckling compared with pens with C-sows. G- sows also tended (P=0.08) to lose fewer piglets in the multi-suckling pens than C-sows. In conclusion, these results suggest that nursing behaviour in multi- suckling pens may be improved when the sows farrow in get-away systems as compared with crates.
Keywords: farrowing pens, growth, maternal behaviour, pig housing, piglets, preweaning period, sows, suckling, survival.
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Edmonds, M.S.; Baker, D.H. (2001). **Effect of protein fluctuations and space allocation on performance of growing-finishing pigs.** *Journal of Dairy Science* 84 (Supplement 1): 475, Joint Meeting of the American Dairy Science Association, American Meat Science Association, American Society of Animal Science and the Poultry Science Association, Indianapolis, Indiana, USA, July 24-28, 2001, ISSN: 0022-0302.
NAL Call No.: 44.8 J822.
Keywords: finishing, growing, protein, feed content, housing, space allocation, meeting abstract.

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307, ISBN: 0-85199-532-2.
NAL Call No.: SF396.5 W43 2001.
Keywords: piglets, early weaning, husbandry, production, nutrition, housing, feeding.

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NAL Call No.: SF1 A56.
Keywords: body protein, feed conversion efficiency, feed intake, floor space, single feeder bin, growth, lipids, live weight gain, lysine, nutrient requirements, protein retention, stocking density.

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NAL Call No.: 49 J82.
Keywords: behavior, animal well-being, farrowing, hut design, effect, hoop structure, housing, lactation, lactation performance, meeting abstract.

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NAL Call No.: TD420 A1P7.
Abstract: The odor emissions from two different housing systems were determined during three fattening periods from October 1999 to November 2000 by analyzing weekly samples by means of dynamic olfactometry. The objects of the investigations were a standard housing system with fully slatted floor and forced ventilation (FF) compared with a kennel housing system with natural shaft ventilation (KN) in parallel operation. Only little data but with a wide range of odor emission values are available from the literature and these are difficult to compare and interpret, because of missing standards in presenting the results and experimental conditions. Therefore minimum requirements for measuring odor emissions from livestock buildings have been derived. In the scope of the measurements during the first two fattening periods (October 1999 to June 2000), no differences in odor emissions could be determined with mean values related to the livestock units (1 LU = 500 kg life weight) of 85 (FF) /87 (KN) in period A and 60 (FF) / 61 (KN) (OU/s)LU(-1) in period B. The overall range of the results of all measurements in periods A and B was 4 to 355 (OU/s)LU(-1). In period C (August-November 2000), the system FF showed higher odor emissions with 193 (28-550) compared to system KN with 105 (25-218) (OU/s)LU(-1). The air flow rates and odor concentrations at the three different naturally ventilated exhaust shafts of system KN differed considerably from each other. Odor measurement techniques with a higher temporal resolution than olfactometry are necessary to give evidence for the main factors influencing the odor formation and release.
Keywords: air pollution, prevention and control, housing, odors, air movements, environmental monitoring, facility design, construction, ventilation.

Geverink, N.A.; de Jong, I.C.; Lambooij, E.; Blokhuis, H.J.; Wiegant, V.M. (1999). **Influence of housing conditions on responses of pigs to preslaughter treatment and consequences for meat quality.** *Canadian Journal of Animal Science* 79(3):285-291, ISSN: 0008-3984.
NAL Call No.: 41.8 C163.
Keywords: pig housing, meat quality, hydrocortisone, farrowing, finishing, handling, pens, stress, straw, litter, transport of animals, animal welfare.

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NAL Call No.: 23 N4892.
Keywords: animal welfare, farrowing, buildings, pens, pregnancy, sows, weaning, pig housing.

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NAL Call No.: QP1.P4.

Abstract: It was shown in a recent study that barren housed pigs (small pens, no substrate) have a blunted circadian rhythm of salivary cortisol, as compared to enriched housed pigs (large pens with daily fresh bedding). In the light period, enriched housed pigs showed significantly higher concentrations of cortisol in saliva than barren housed pigs, whereas in the dark period, cortisol concentrations were low in both enriched and barren housed pigs. In the present study, the immunological consequences of the difference in baseline salivary cortisol concentration in the light period were evaluated. Three successive replicates of 24 pigs were used in the experiment. It appeared that leukocyte and lymphocyte distributions, and in vitro lymphocyte proliferation following ConcanavalineA (ConA) stimulation in the assay using purified lymphocytes were not affected. However, barren and enriched housed pigs, did show a different proliferation response to ConA in the whole blood assay. At day 2 of culture, proliferation was higher in barren housed pigs than in enriched housed pigs, whereas day 4 of culture, proliferation was higher in enriched housed pigs than in barren housed pigs. Lymphocyte proliferation at day 2 of culture in the whole blood assay, correlated negatively with plasma cortisol levels, which might thus explain the higher proliferation in barren housed pigs at day 2 of culture. The in vivo humoral and cellular (delayed type hypersensitivity, DTH) immune response to KLH was not affected by housing conditions. We conclude that, although baseline salivary cortisol concentrations differ between enriched and barren housed pigs, immune function appears to be relatively unaffected. 28 ref.

Keywords: Dutch Landrace, Dutch Yorkshire, breed, circadian rhythm, concanavalin A, delayed type hypersensitivity, hydrocortisone, immune response, immunity, leukocytes, lymphocyte transformation, lymphocytes, housing, saliva.

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Guy, J.H.; Rowlinson, P.; Chadwick, J.P.; Ellis, M.(2002). **Behaviour of two genotypes of growing-finishing pig in three different housing systems.** *Applied Animal Behaviour Science* 75 (3):193-206, ISSN: 0168-1591.
NAL Call No.: QL750.A6.

Abstract: This trial compared the behaviour of 720 growing-finishing pigs, progeny of either indoor (Large White x Landrace) or outdoor (part-Meishan or part-Duroc) sows mated to Large White boars, when housed in either outdoor paddocks, straw yards or fully-slatted pens. Space allowance per pig in outdoor paddocks, straw yards and fully-slatted pens was 19.98, 1.63 and 0.55 m2, respectively with a group size of 20. Pigs were fed ad libitum from an average of 30-80 kg liveweight. Pig behaviour was observed during daylight for a total of 6 h, using both individual (focal) and group (scan) sampling. There were relatively few differences in behaviour between genotypes, although the outdoor genotype spent a higher proportion of observations in straw yards and fully-slatted pens engaged in social activity ($P<0.05$) compared to the indoor genotype. Pigs housed in straw yards spent significantly more time examining the floor and moving ($P< 0.001$), and significantly less time tail-biting ($P<0.01$) compared to those housed in fully-slatted pens, where a larger proportion of observation time was spent lying inactive ($P<0.001$). Pigs in outdoor paddocks spent a large proportion of observation time inside the shelter hut (0.69), where it was not possible to determine their behaviour, although rooting and exploring the floor was the most frequently observed behaviour when the pigs were outside. Interaction between genotype and housing system did not occur to any major degree. It is concluded that, for the housing systems used in this study, pig behaviour was enriched and welfare enhanced in straw yards compared to fully-slatted pens. Further research is needed, however, before any conclusions can be made regarding the behaviour of pigs in outdoor paddocks.

Keywords: Duroc, Landrace, Large White, Meishan, pig breeds, progeny animal behavior, housing, finishing, genotypes, slatted floors, tail biting.

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Halverson, M.K.; Honeyman, M.S. (1997). **Humane, sustainable feeder pig production: transferring a technology developed in Sweden to Midwestern hog farms.** In: *Livestock Environment 5, Volume 2. Proceedings of the Fifth International Symposium, Bloomington, Minnesota, USA, 29-31 May, 1997*, Bottcher, R.W.; Hoff, S.J. (eds.), American Society of Agricultural Engineers (ASAE), St Joseph, Michigan, pp. 401-408, ISBN: 0-929355-84-9.

Keywords: cooperative project, housing, production, animal welfare, deep litter housing, farm models, humane, sustainable, feeder pig production, Swedish farm model, regulations, management intensive, deep-bedded, group housing system, pregnant, farrowing, and nursing sows and litters, animal welfare, maternal behavior, semi-natural, Iowa State University, Armstrong Research and Demonstration Farm, Minnesota, Iowa.

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NAL Call No.: TX373.M4.
Keywords: barrow, breed, Duroc, Landrace, Large White, Pietrain, gilt, sire lines, longissimus muscle, slaughter, production method, carcass quality, crowded environment, dressing percentage, environmental conditions, genetic differences, pork meat, drip loss, marbling fat content, meat product, pH, paleness, quality, softness, progeny, rearing environment, spacious environment.

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NAL Call No.: SF395 H297 2000.
Keywords: isowean, disease control, housing, policy decision making, immunity, breeding stock production, performance.

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NAL Call No.: 290.9 Am32T.
Keywords: air filters, biofilters, air flow, air pollution, air quality, ammonia, housing, environmental control, long term experiments, odor emission, odor reduction, pollution control, Germany.

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NAL Call No.: SF601.P7.
Keywords: finishing, herds, health, pig housing, animal husbandry, performance, meat quality, pork, mortality, abscesses, pneumonia, arthritis.

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NAL Call No.: aHV4701.A952.
Keywords: pigs, animal welfare, pig housing, floor space, social dominance, stress factors, extensive livestock farming.

Honeyman, M.S.; Koenig, F.W.; Harmon, J.D., Lay, D.C. Jr.; Kliebenstein, J.B.; Richard, T.L.; Brumm, M.C. (1999). **Managing market pigs in hoop structures.** In: *Pork Industry Handbook*, Cooperative Extension Service, Oklahoma State University: Stillwater, Oklahoma, PIH 138, August 1999, 8p.,
NAL Call No.: SF391 P6.
Keywords: growing finishing pigs, housing, hoop structures, lower cost structures, disadvantages, planning details, ventilation, cooling, feeding, feeders, pig performance, manure management, bedding, health.

Honeyman, M.S.; Harmon, J.D.; Larson, M.E.; Penner, A.D. (2001) **A two year summary of finishing-pigs' performance in hoop structures and confinement during winter and summer in Iowa.** *Journal of Animal Science* 79 (Supplement 2): 46, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: housing, bedded-hoop-structures, confinement, feed efficiency, finishing pig performance, leanness, summer, weaning, winter, extension, Iowa, meeting abstract.

Honeyman, M.S.; Roush, W.B. (2002). **The effects of outdoor farrrowing hut type on prewean piglet mortality in Iowa.** *American Journal of Alternative Agriculture* 17(2): 92-95, ISSN: 0889-1893.
NAL Call No.: S605.5 A43.
Keywords: outdoor pig production, housing, farrowing hut design, floorless farrowing huts, arc-style hut, wooden modified A frame hut, steel inverted U frame hut, plastic igloo-style hut, blunt-top hut, piglet prewean mortality, crushing, bedding, oat straw, recycled newsprint, Iowa.

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NAL Call No.: S671 A66.
Keywords: alternative swine production, housing, hoop structures, bedding, corn stalks, straw, wood shavings, manure management, pig performance, average daily gain, environmental monitoring, economics.

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NAL Call No.: S605.5.A43.
Abstract: At the Iowa State University Armstrong Research and Demonstration Farm in southwestern Iowa, a Swedish feeder pig production system was studied and demonstrated for 2-1/2 years. The system is based mainly on straw bedding, simple buildings, and intensive management. The system was designed to minimize pig stress and use of subtherapeutic antibiotics in the feed. Gestating and breeding sows were group-housed in a hooped structure with individual feeding stalls. Large round bales of cornstalks were used for bedding. Farrowing, lactation, and nursery phases were housed in a remodeled hog house. Cubicles with rollers and oat straw bedding were used for farrowing. Two groups of Yorkshire x Landrace sows bred to Hampshire boars produced feeder pigs in the system. Conception rates averaged 95%, and litter size averaged 11.3 live pigs/litter. Sows were allowed to select their own bedded farrowing cubicle. Prewean pig mortality, mostly from crushing, was high (29%), occurring primarily in the first 3 days. At 2 weeks of age the cubicles were removed and group lactation occurred. After group lactation the average pig weaning weight was 10.4 kg at 33.9 days of age. At weaning the sows were removed, and the pigs remained in the bedded farrowing/lactation room for 24 additional days. The pigs weighed 24.8 kg at 60 days of age, and overall nursery phase average daily weight gain was 549 g/day. Overall pig health was excellent with no major clinical diseases confirmed. The demonstration exceeded reproductive performance measures of typical small- and mid-sized Iowa farms.
Keywords: pigs, deep litter housing, performance, alternative farming, animal husbandry, straw, sustainability, pig housing, intensive production, stress, medicated feeds, pregnancy, farrowing, lactation, litter size, conception rate, mortality, weaning weight, liveweight gain, reproductive performance, Iowa.

Honeyman, M.S.; McGlone, J.J.; Kliebenstein, J.B.; Larson, B.E. (2001). **Outdoor pig production.** In: *Pork Industry Handbook*, Cooperative Extension Service, Oklahoma State University: Stillwater, Oklahoma, PIH 145, September 2001, 9p.,
NAL Call No.: SF391 P6.
Keywords: sow, gilts, production systems, intensive outdoor pig production, housing, floorless huts, intensive management, bedding, soil erosion control, feeding, behavior, fencing, health, parasitic infections, breeding, genetics, economics.

Hornauer, N.; Haidn, B.; Schon, H. (2001). **Outdoor climate kennel housing: functional areas and their frequentation by fattening pigs.** *Agrartechnische Forschung* 7 (1/3): E37-E42, ISSN: 0948-7298.Abstract: Animal behaviour was analysed under practical conditions in an outdoor-climate kennel house with a partially slatted floor, an outdoor climate stall with a littered dung area, and a conventional warm stall. No fundamental differences were found. However, influences of the outdoor- and stall climate, the animal weight, and the functional areas were shown. Good of the kennel in the summer is decisive for success. In comparison with the conventional warm stall, the percentage of the different modes of behaviour is similar.
Keywords: behavior, housing, ventilation, climate, farmyard manure, kennels, slatted floors.
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Jensen, H.F.; Andersen, B.H. (1999). **Outdoor ecological production of pigs in climate tents.** In: *Organic Agriculture, the Credible Solution for the 21st Century. Proceedings of the 12th International IFOAM Scientific Conference, Mar Del Plata, Argentina, November 15-19, 1998*, D. Foguelmanand and W. Lockeretz (eds.), IFOAM: Tholey-Theley, Germany, pp.242-244, ISBN: 3-934055-03-6.
NAL Call No.: S605.5 I45 1998.
Keywords: climate, extensive production, extensive husbandry, organic farming, housing, animal welfare, pigs.

Johnson, A.K.; Morrow-Tesch, J.L.; McGlone, J.J. (2001). **Behavior and performance of lactating sows and piglets reared indoors or outdoors.** *Journal of Animal Science* 79(10): 2571-2579, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: Two hundred eighty-seven lactating Newsham sows and their litters were used to determine the effects of intensive indoor (n = 147) and intensive outdoor (n = 140) production systems on sow and litter productivity and behavior. All sows were of contemporary age and fed a completely balanced sorghum-based diet. Behavior data were collected by live observation on 40 sows and litters (20 indoor and 20 outdoor) using a 5-min scan sample over a 4-h period in the afternoon (1400 to 1800). The durations of lying (90.0 vs 72.1 +/- 2.76% of time observed) and drinking (4.42 vs 1.41 +/- 0.6% of time observed) were higher (P < 0.01) among indoor than among outdoor lactating sows. Nursing interval and feeding and sitting behaviors were not different (P > 0.05) between production systems. Piglets spent more (P < 0.05) time walking (10.1 vs 5.2 +/- 1.72% of time observed) and engaged in play activity (5.0 vs 1.7 +/- 1.26% of time observed) when housed outdoors than indoors. Outdoor piglets had more (P < 0.05) nursing behaviors directed toward the sow (27.5 vs 20.3 +/- 2.02% of time observed) but time spent in contact with the sow did not differ between environments (38.8 vs 39.2 +/- 2.78% of time observed). Treatments did not influence (P > 0.05) any of the sow or piglet production parameters. In conclusion, outdoor-kept Newsham sows and their piglets showed a richer behavioral repertoire, but the diverse environments did not influence production parameters.
Keywords: sows, piglets, performance, animal behavior, animal housing, intensive production, duration, nursing, growth.

Jones, J.B.; Wathes, C.M.; Persaud, K.C.; White, R.P.; Jones, R.B. (2001). **Acute and chronic exposure to ammonia and olfactory acuity for n-butanol in the pig.** *Applied Animal Behaviour Science* 71 (1): 13-28, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Abstract: An associative learning method (using a food reward) was developed to measure pigs' olfactory acuity for n-butanol, a standard odourant in human olfactometry. Six of 8 intact Duroc x Landrace crossbred male pigs were used for the study. The pigs could press two operant paddles but it only received a food reward when it pressed the one over which n-butanol was released. Once each pig had reached a training criterion (10 consecutive roots on the correct paddle on each of two consecutive sessions) this method was used to assess the impact of acute and chronic exposure to an atmosphere containing approximately 40 parts per million (ppm) ammonia gas, compared to fresh air, on its ability to perceive different concentrations of n-butanol. These were presented using a staircase pattern, i.e. if the pig gained or failed to gain a food reward on two consecutive occasions the concentration was reduced or increased, respectively. Acute exposure for approximately 45 minutes to about 40 ppm ammonia had no effect (P>0.05) on the lowest detected concentration (LDC) of n-butanol in six pigs. The geometric mean LDC was 1.23 parts per trillion (ppt) in approximately 40 ppm ammonia and 2.09 ppt in fresh air. The LDC of three pigs increased, i.e. acuity fell, from 5.1 to 175.5 ppt over 24 days of exposure to approx equal to 40 ppm ammonia. Ammonia had no effect on one of the other pigs and the high variability in the LDC for the remaining two pigs produced no meaningful assessment of its impact. Subsequent removal to fresh air for a further 24 days led to partial recovery of acuity in one of the three pigs that had shown evidence of olfactory impairment but not in the other two. Collectively our findings suggest that chronic, but not acute, exposure to approx equal to 40 ppm ammonia can interfere with olfactory perception in some pigs (50% of our sample) and that this loss of acuity is not necessarily reversible.
Keywords: ammonia, butanol, smell, air pollution, housing, olfactory stimulation.
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Jonsall, A.; Johansson, L.; Lundstrom, K. (2001). **Sensory quality and cooking loss of ham muscle (M. biceps femoris) from pigs reared indoors and outdoors.** *Meat Science* 57 (3): 245-250. ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: ham, meat quality, flavor, tastes, odors, water content, cooking quality, cooking losses, tenderness, farming, housing, pens, free range husbandry, pigs, alleles, genotypes, juiciness, outdoor rearing, acidulous taste, genetics.

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Keywords: animal behavior, chains, performance, straw, pig housing, animal welfare, equipment, housing, toys.

Kelly, H.R.C.; Bruce, J.M.; Edwards, S.A.; English, P.R.; Fowler, V.R. (2000). **Limb injuries, immune response and growth performance of early-weaned pigs in different housing systems.** *Animal Science: An International Journal of Fundamental and Applied Research* 70(1):73-83, ISSN: 0003-3561.
NAL Call No.: SF1 A56.
Keywords: housing, immune response, trauma, antibody formation, bursitis, feet, immunoglobulins, indicators, pens, pig housing, animal welfare, legs, lameness, growth, feed intake, feed conversion efficiency, fattening performance.

Klont, R.E.; Hulsegge, B.; Hoving-Bolink, A.H.; Gerritzen, M.A.; Kurt, E.; Winkelman-Goedhart, H.A.; de Jong, I.C. (2001). **Relationships between behavioral and meat quality characteristics of pigs raised under barren and enriched housing conditions.** *Journal of Animal Science* 79 (11): 2835-43, ISSN: 0021-8812.
NAL Call No.: 49 J82
Abstract: In this study the effects of barren vs enriched housing conditions of pigs on their behavior during the lairage period (2-h holding period before slaughter), carcass characteristics, postmortem muscle metabolism, and meat quality were studied. The barren housing system was defined by common intensive housing conditions (i.e., with slatted floors and recommended space allowances), whereas the enriched environment incorporated extra space and straw for manipulation. Salivary cortisol concentrations were measured before transport and at the end of the lairage period. During the lairage period the percentage of time spent walking and fighting by the pigs was registered. Carcass characteristics such as weight, meat percentage, and backfat thickness were determined. At 5 min, 45 min, 4 h, and 24 h postmortem, pH, temperature, and lactate concentrations were determined in the longissimus lumborum (LL) and biceps femoris (BF) muscles. Capillarization of the muscle, mean muscle fiber area, and color and drip loss after 2 and 5 d of storage were determined for both muscle types. Pigs from the barren environment had a significantly higher increase in cortisol from farm to slaughter, but no differences in behavior were observed during the lairage period. Carcass characteristics did not differ between pigs from barren and those from enriched housing conditions. Postmortem lactate formation was significantly lower in LL muscles of enriched pigs at 4 and 24 h postmortem. Capillary density and mean muscle fiber area did not differ between the groups of pigs. The percentage of drip loss at 2 and 5 d after storage of LL muscle samples from enriched-housed pigs was significantly lower than that of the barren-housed pigs. Similar tendencies were found for the BF muscle from pigs kept in an enriched environment, but these were not statistically significant. The housing system did not affect meat color. It is concluded that on-farm improvement of animal welfare by environmental enrichment can also lead to beneficial economic effects after slaughter by improving the water-holding capacity of pork.
Keywords: husbandry, handling, housing, meat standards, physiology, abattoirs, animal welfare, behavior, psychology, hydrocortisone, blood, hydrogen-ion concentration, lactic acid, metabolism, skeletal muscle chemistry.

Kouba, M.; Hermier, D.; Le Dividich, J. (2001). **Influence of a high ambient temperature on lipid metabolism in the growing pig.** *Journal of Animal Science* 79 (1): 81-7, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: Large White x Landrace, breed, castrated male pigs, ad libitum fed, restricted fed, heat, housing, lipids, metabolism, growth and development, adipose tissue, anatomy, histology, analysis of variance,

castration, chylomicrons, blood, lipids, blood, lipoprotein lipase.

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NAL Call No.: 49 AR23.
Keywords: sows, animal welfare, computer simulation, economic analysis, environment, excretion, farming systems, farrowing, finishing, nitrogen metabolism, phosphorus, waste management, pig farming, housing, slatted floors, straw, group size, production costs, simulation models, slaughter, weaning.

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NAL Call No.: 49 J82.
Keywords: early weaned piglets, growth, performance, hoop structures, housing, mechanically ventilated, confinement, nursery, physical environment, post-weaning pig performance, meeting abstract.

Larsen, V.A.; Kongsted, A.G. (2001). ***Outdoor pig production: production, feeding, reflections on grass cover. [Frilandssohold: produktion, foderforbrug, udsaetningsarsager og graesdaekke.]*** DJF Rapport, Husdyrbrug (No.30), Danmarks JordbrugsForskning: Tjele, Denmark, 46p, ISSN: 1397-9892.
Abstract: In 1996, the Danish Institute of Agricultural Sciences initiated the project “Outdoor pig production.” The project included identification and evaluation of different outdoor production systems on pig farms in Denmark and the implications for animal health and welfare, as well as environmental impact. In addition, the project focused on specific subjects such as piglet mortality, maintenance of pasture, feed consumption and requirements, nutrient balances, reproduction and management of the production in a broad sense. This report is based on the production results obtained in the 3rd year (1999), and also describes feed intake, health and culling of sows, and the level of grass cover. The production systems included single and group farrowing paddocks, dynamic and stable groups, natural service and artificial insemination, as well as outdoor and indoor facilities for serving and gestation. Arable land varied from 56 to 100 ha, and herd size varied from 117 to 391 sows. Three farms kept some weaned pigs for finishing. Production results varied considerably (8.3-10.3 weaned piglets/litter), and so did feed consumption (1542-1800 SFU/sow/year). Differences in production systems, stocking rates, and production levels resulted in significant variation in the nutrient surplus for nitrogen (114-306 kg N/ha) and phosphorus (9-60 kg P/ha). Outdoor piglet production required special attention with regard to feeding and grass maintenance in order to obtain an acceptable level of environmental pollution. During periods with unfavourable climatic conditions for grass growth, a higher level of grass cover can be maintained by increasing the area available per sow or moving sows to well-established pasture. Experiences with different grass mixtures indicated that a mixture of miniturf and white clover (Trifolium repens) was very suitable, providing a low dense cover. Feed intake was on average 20% higher than theoretical requirements of sows. Possible explanations include the waste of or the fact that feeds are supplied to groups of animals. It is important to consider the requirements of nutrients/energy unit to limit feed costs and environmental impact. In addition, the potential development of individual feeding systems should be considered. 31 ref.
Keywords: health, housing, production, animal welfare, environmental impact, feed intake, grassland management, grasslands, nutrient requirements, pastures, pig farming, feeding, piglet feeding, production costs, sows, Poaceae, Trifolium repens, Denmark, Danish language.
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NAL Call No.: HV4701.J68.
Keywords: housing, litter, stocking density, behavior, play, winter, abnormal behavior, summer, lameness, wounds, physical activity, blood plasma, hydrocortisone, respiration rate, liveweight gain, feed conversion, animal welfare.

Lemay, S.P.; Guo, H.; Barber, E.M.; Chenard, L. (2001). **Performance and carcass quality of growing-**

finishing pigs submitted to reduced nocturnal temperature. *Transactions of the ASAE* 44 (4): 957-965, ISSN: 0001-2351.
NAL Call No.: 290.9 Am32T.
Abstract: During summer months, elevated barn temperature reduces pig growth rate by decreasing feed intake. Two trials were conducted over two summers to evaluate the effect of reduced nocturnal temperature on the performance and carcass quality of growing-finishing pigs. Control rooms had a typical temperature setpoint while the temperature setpoint for treatment rooms was 6 deg C lower. In Saskatchewan, a reduced temperature setpoint resulted in a lower nocturnal room temperature (1.6 deg C cooler over eight weeks), while it had no influence on room daytime temperature. The average daily temperature fluctuation in treatment rooms was increased by 2.1 deg C. The lower nocturnal temperature also resulted in a higher relative humidity (+3%) and lower CO2 and NH3 concentrations. During trial 1, pig average daily gain (ADG) in the treatment room was increased by 5.2%. For trial 2, feed intake was 3.2% higher in treatment rooms, which increased ADG by 2.1% on average over eight weeks. The ADG increase averaged 3.6% during the last four weeks of trial 2. However, no statistical differences were found for pig performance, feed conversion, and backfat thickness (P>0.05). The results suggest that healthy pigs are not negatively affected by a large daily temperature fluctuation (up to 14.8 deg C) as long as this fluctuation is progressively achieved. 18 ref.
Keywords: backfat, carcass quality, diurnal variation, fattening performance, feed conversion efficiency, feed intake, heating, liveweight gain, nocturnal activity, housing, temperature.
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Linden, A.; Andersson, K.; Oskarsson, A. (2001). **Cadmium in organic and conventional pig production.** *Archives of Environmental Contamination and Toxicology* 40 (3): 425-431, ISSN: 0090-4341.
NAL Call No.: TD172 A7.
Keywords: growing/finishing pigs, organic versus conventionally raised, outdoor versus indoor, cadmium, soil content, water content, liver, kidney,graphite furnace atomic absorption spectrometry, analytical method, toxicology.

Marchant, J.N.; Broom, D.M.; Corning, S. (2001). **The influence of sow behaviour on piglet mortality due to crushing in an open farrowing system.** *Animal Science: an International Journal of Fundamental and Applied Research*. 72 (1): 19-28, ISSN: 1357-7298.
NAL Call No.: SF1.A56.
Abstract: The objectives of this study were to establish what changes in posture by sows carried a high risk of piglet crushing in a group farrowing system during early lactation and also to determine what factors influenced the risk of crushing during lying down. A total of 24 Large White X Landrace sows were studied during the first 7 days of lactation in a group farrowing system. Cross-fostering was not carried out so as not to influence behaviour. Dead piglets were removed and cause of death ascertained from external observation and post-mortem examination. Sow and piglet behaviour was video-recorded continuously. A total of 268 piglets were born alive, with 67 liveborn piglets subsequently dying during the 7-day experimental period, 50 as a result of crushing. A total of 7425 posture changes were analysed and 11 types of posture change were identified, the most dangerous being lying down from standing and those involving swapping sides, or rolling over, whilst lying. Dangerous events during lying down were more likely to occur (1) in the first 24 h after farrowing, (2) when the sow lay down in the middle of the pen, (3) when the sow lay down without carrying out much piglet-directed pre-lying behaviour and (4) when the piglets were spread out but near to the sow. The amount of pre-lying behaviour decreased over time and crushing mortality also decreased. The results confirm that the piglets are most vulnerable to crushing during the first 24 h of life, when they are spending much of their time near the udder and have relatively poor mobility. Co-ordination of behaviour between the sow and her litter is important to reduce the risk of crushing. It is also important that the design of open farrowing systems incorporates knowledge about how crushing deaths occur in order to improve piglet welfare.
Keywords: sows, maternal behavior, posture, behavior patterns, perinatal mortality, age differences, puerperium, farrowing houses, farrowing pens, piglets.

Marchant, J.N.; Rudd, A.R.; Mendl, M.T.; Broom, D.M.; Meredith, M.J.; Corning, S.; Simmins, P.H. (2000). **Timing and causes of piglet mortality in alternative and conventional farrowing systems.** *Veterinary*

Record: Journal of the British Veterinary Association 147 (8): 209-214, ISSN: 0042-4900.
NAL Call No.: 41.8 V641.
Abstract: The causes and timing of piglet mortality were studied in different farrowing systems. In the first experiment 198 litters were observed in 3 systems, 2 of which allowed the sows to move freely, and one restricted sows in conventional crates. More piglets were weaned from the conventional crates than from the open systems and they grew more quickly. More than half liveborn mortality occurred during the first 4 days after parturition. In the open systems, 17 and 14% of the piglets born alive were crushed, compared with only 8% in the crates. In the second experiment, 29 sows and litters were studied in detail in a communal pen system during the first 7 days of lactation. Three-quarters of the liveborn mortality was due to crushing. The total number of piglets dying per litter, including stillbirths, was significantly associated with the total litter size and the sow's parity. The percentage liveborn mortality was significantly associated with the parity and body length of the sows and with the within-litter variation in the birth weight of the piglets. Individual birth weight was closely associated with percentage survival. Only 28% of piglets weighing less than 1.1 kg at birth survived to 7 days. 38 ref.
Keywords: farrowing, mortality, piglets, birth weight, body length, litter size, parturition, sows, stillbirths, survival, farrowing pens, farrowing houses. gain.
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Maw, S.J.; Fowler, V.R.; Hamilton, M.; Petchey, A.M. (2001). **Effect of husbandry and housing of pigs on the organoleptic properties of bacon.** *Livestock Production Science* 68 (2/3): 119-130. ISSN: 0301-6226,
NAL Call No.: SF1.L5.
Keywords: husbandry, housing, bacon, organoleptic traits, food quality, sensory evaluation, feeds, genotypes, ammonia, hygiene, dust, male animals, female animals, taste panels, straw, Scotland.

Mayland, A.P.; Sibly, R.M.; Guise, H.J. (1999). **Pen sizes allowing heavily pregnant sows to turn without difficulty.** *Veterinary Record: Journal of the British Veterinary Association* 145(13):373-374, ISSN: 0042-4900.
NAL Call No.: 41.8 V641.
Keywords: pregnancy, sows, legislation, pens, animal housing, animal welfare, gilts, housing, farrowing houses, farrowing pens, size.

McGlone, J.J.; Borell, E.H. von; Deen, J.; Johnson, A.K.; Levis, D.G.; Meunier-Salaun, M.; Morrow, J.; Reeves, D.; Salak-Johnson, J.L.; Sundberg, P.L. (2004). **Review: compilation of the scientific literature comparing housing systems for gestating sows and gilts using measures of physiology, behavior, performance, and health.** *Professional Animal Scientists* 20(2): 105-107, ISSN: 1080-7446.
NAL Call No.: SF51.P76
Keywords: literature review, pregnant gilts, gestating sows, housing systems, tether, group housing, outdoor housing, comparisons, health, physiology, performance, behavior, oral-nasal-facial behaviors (ONF), blood cortisol, heart rate, meta-analyses.

McGlone, J.J.; Fullwood, S.D. (2001). **Behavior, reproduction, and immunity of crated pregnant gilts: effects of high dietary fiber and rearing environment.** *Journal of Animal Science* 79 (6): 1466-1474, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: The objective of this study was to examine effects of increased gut fill and diverse developing environments on pregnant gilts' behavior and physiology. Gilts were cross-fostered at 1 d of age and transferred to either an indoor or outdoor production unit. Littermate gilts remained in their different environments during development and were moved into individual gestation crates in an indoor gestation unit. Of the 42 gilts, 19 were fed a control diet of fortified sorghum-soybean meal and 23 were fed the same diet with 25% beet pulp (high fiber). Control sows ate 2.0 kg/d and high-fiber sows ate 2.67 kg/d in a large pellet (thus resulting in approximately equal energy intake and differing total dietary intakes). Pregnant gilts had behavior and immune measures sampled at 30, 60, and 90 d of gestation. The day x diet interaction was significant (P = 0.01) for duration of standing: sows fed high-fiber diets stood less on d 30, but on d 60 and 90 they and the control sows

stood for a similar duration. Sham chewing duration and frequency showed significant (P < 0.05) effects of gestation stage x diet x environment. Gilts reared outdoors and fed high fiber increased sham chewing over gestation, whereas all other treatment groups decreased this behavior over time. Outdoor-reared gilts had greater (P < 0.05) frequency and duration of drinking behavior than indoor-reared gilts. White blood cell numbers were higher (P < 0.05) for gilts fed high-fiber diets than for gilts fed the control diet. Immune (humoral and cellular systems) and reproductive measures (farrowing rate and litter size) and plasma cortisol concentrations were generally not influenced (P > 0.10) by diets and rearing environments, suggesting that in spite of significant changes in behavior and feed intake gilts' immune systems were not suppressed or enhanced. Behavioral data alone suggested that indoor-reared gilts showed fewer behavioral adaptations to the crates than outdoor-reared gilts. However, immune measures did not indicate that any treatments resulted in physiological effects indicative of stress.

Keywords: gilts, pregnancy, animal behavior, sexual reproduction, fiber, digesta, litters, feed rations, feeds, feed intake, duration, stress, animal welfare.

Moeller, S.J.; Irvin, K.M.; Black, K.R.; Neal, S.M. (2001). **The impact of farrowing crate design on litter performance traits in swine.** *Journal of Dairy Science* 84 (Supplement 1): 276-277, Joint Meeting of the American Dairy Science Association, American Meat Science Association, American Society of Animal Science and the Poultry Science Association, Indianapolis, Indiana, USA, July 24-28, 2001, ISSN: 0022-0302.

NAL Call No.: 44.8 J822.

Keywords: piglet, sow, farrowing crate design, lactation, litter performance, mortality, parity, meeting abstract.

Mouttotou, N.; Hatchell, F.M;. Green, L.E. (1999). **Foot lesions in finishing pigs and their associations with the type of floor.** *Veterinary Record: Journal of the British Veterinary Association* 144(23):629-632, ISSN: 0042-4900.

NAL Call No.: 41.8 V641.

Keywords: floors, floor coverings, foot injuries, hoof and claw injuries, prevention and control, abattoirs, animal husbandry, animal welfare.

Nilzen, V.; Babol, J.; Dutta, P.C.; Lundeheim, N.; Enfalt, A.C.; Lundstrom, K. (2001). **Free range rearing of pigs with access to pasture grazing: effect on fatty acid composition and lipid oxidation products.** *Meat Science* 58 (3): 267-285, ISSN: 0309-1740.

NAL Call No.: TX373.M4.

Abstract: The influence of free-range rearing, RN genotype and sex on different pig meat quality traits, including intramuscular fatty acid composition and levels of lipid oxidation products, were studied. A total of 60 Hampshire crossbred pigs were reared outdoors for two months with access to green feed, while 60 others were kept indoors, in a 120-m2-large pen, throughout the rearing period. From these 120 animals a subsample of 44 animals was chosen for meat quality analysis. Of the three factors studied, the RN genotype had the largest influence on basic technological meat quality traits, whereas the rearing conditions and sex had limited effects. However, outdoor rearing resulted in higher levels of polyunsaturated fatty acids in the intramuscular fat (P = 0.026) and in an increased level of vitamin E (P = 0.030) compared with the pigs that had been reared indoors. The sex and RN genotype of the animals also had an effect on the fatty acid profile: females had higher levels of unsaturated fatty acids (P = 0.003) as well as lower levels of saturated fatty acids (P = 0.011) than castrated males. Carriers of the RN(-) allele expressed a higher sum of omega-3 fatty acids (P = 0.047) and C22:5 (P = 0.012) than did the non-carriers. In a storage study where meat from free-range and indoor reared pigs was stored for 3 months at, 20 degrees C, it was shown that the lipid oxidation product malondialdehyde was formed at increased levels in animals that had a higher lean meat percentage than others, i.e. females that were carriers of the RN(-) gene and that were reared outdoors.

Keywords: free range husbandry, grazing, pastures, pig farming, pens, body fat, polyenoic fatty acids, long chain fatty acids, vitamin content, alpha-tocopherol, halothane susceptibility, genotypes, sex differences, pork, storage quality, lipids, oxidation, aldehydes, meat quality, water holding capacity, protein content, intramuscular fat, malondialdehyde, RN genotype.

O'Connell, N.E; Beattie, V.E.(1999). **Influence of environmental enrichment on aggressive behaviour and**

dominance relationships in growing pigs. *Animal Welfare* 8(3): 269-279, ISSN: 0962-7286.
NAL Call No.: HV4701.A557.
Keywords: aggressive behavior, animal behavior, dominance, environment, aggression, pig housing, suckling, body weight, social behaviour, animal welfare, age differences, husbandry.

Olsen, A.W.; Simonsen, H.B.; Dybkjaer, L. (2002). **Effect of access to roughage and shelter on selected behavioural indicators of welfare in pigs housed in a complex environment.** *Animal Welfare* 11(1): 75-87, ISSN: 0962-7286.
NAL Call No.: HV4701.A557
Abstract: The aim of this study was to examine the effects of roughage and shelter on certain welfare indicators in growing pigs that have access to ample straw and space. The effects of the two treatments were evaluated both by recording the pigs' use of the various areas of the pen and by measuring the frequency of two specific behaviours, "aggression" and "play" that are considered to be significant indicators of welfare in pigs. Seven replicates were used, each involving 96 pigs. The pigs were randomly allocated to eight experimental pens at 10 weeks of age and were observed from 13 to 22 weeks of age. The two treatments, roughage and shelter, were distributed according to a 2x2 design in the pigs' outdoor runs, four of which were located on each side of the barn (north side versus south side). The pigs spent most of their time in the straw- provided areas and the frequency of their aggressive behaviour was also the highest in these areas, suggesting that these locations were the most attractive to the pigs. The pigs with access to roughage showed a lower frequency of aggression ($P<0.05$) and spent more time in the outdoor area where the roughage was placed than those pigs with no access to roughage ($P<0.05$). No other effects of treatment were found on the length of time spent in the different pen locations. Play frequency decreased with age ($P<0.05$) and with increasing temperature ($P<0.01$). Moreover, when housed on the south side of the building, the pigs with access to shelter played more than those without (2.0 versus 1.0 events per hour ($E=0.3$); $P<0.05$); this suggests that the opportunity to regulate the body temperature by use of shade results in improved welfare. In conclusion, the pigs' behaviour indicated that their welfare was improved by free access to roughage and shelter.
Keywords: growing pigs, age differences, aggression, behavior, play, animal welfare, environmental temperature, physical activity, housing, roughage, straw, shelters.
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Olsen, A.W. (2001). **Behaviour of growing pigs kept in pens with outdoor runs. I. Effect of access to roughage and shelter on oral activities.** *Livestock Production Science* 69 (3): 255-264, ISSN: 0301-6226.
NAL Call No.: SF1.L5.
Keywords: behavior, pig housing, straw, shelter, aggressive behavior, roughage, silage, lesions, animal welfare.

Olsen, A.W.; Dybkjaer, L.; Simonsen, H.B. (2001). **Behaviour of growing pigs kept in pens with outdoor runs. II. Temperature regulatory behaviour, comfort behaviour and dunging preferences.** *Livestock Production Science* 69 (3): 265-278, ISSN: 0301-6226,
NAL Call No.: SF1.L5.
Keywords: housing, animal behavior, body temperature, thermoregulation, shelter, excretion, orientation, roughage, duration, air temperature.

Pajor, E.A.; Weary, D.M., Fraser, D., Kramer D.L. (1999). **Alternative housing for sows and litters. 1. Effects of sow-controlled housing on responses to weaning.** *Applied Animal Behaviour Science* 65(2):105-121, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: sows, piglets, weaning, pig housing, piglet feeding, floor pens, animal behavior, vocalization, responses, weight losses, bites, liveweight gain, feed intake, litter weight, temperament, maternal behavior, animal welfare.

Phillips, P.A.; Fraser, D.; Pawluczuk, B. (2000). **Floor temperature preference of sows at farrowing.** *Applied Animal Behaviour Science* 67(1-2):59-65, ISSN: 0168-1591.
NAL Call No.: QL750.A6.

Keywords: management, animal welfare, environmental preference, equipment design, farrowing pen, floor temperature preference, selection, parturition, thermal environment, preference, selection, thermoregulation.

Quiniou, N.; Noblet, J.; Milgen, J. van.; Dubois, S. (2001). **Modelling heat production and energy balance in group-housed growing pigs exposed to low or high ambient temperatures.** *The British Journal of Nutrition* 85 (1): 97-106. ISSN: 0007-1145.
NAL Call No.: 389.8 B773.
Abstract: The effects of ambient temperature (T; 12-29 degrees C), body weight (BW; 30-90 kg) and metabolisable energy intake (ME) on components of energy balance were studied in seven groups of Pietrain X Large White barrows kept in a respiratory chamber. In Expt 1 (groups 1, 2 and 3), T varied in a cyclic way from 22 degrees C to 12 degrees C and then from 12 degrees C to 22 degrees C with three or four consecutive days at each of 22, 19, 16, 14 and 12 degrees C. Similarly, in Expt 2 (groups 4, 5 and 6), T varied from 19 to 29 degrees C and then from 29 to 19 degrees C with three or four consecutive days at each of 19, 22, 25, 27 and 29 degrees C. In both experiments, pigs were offered feed ad libitum. In Expt 3, pigs (group 7) were exposed to the thermic conditions of Expt 1 but their feed allowance was adjusted on a BW basis to the ad libitum intake recorded at 19 and 22 degrees C in Expt 1. Groups 1, 2, 4, 5 and 7 were used over two successive cycles with initial average BW of 37 kg at cycle 1 (four pigs per group) and 63 kg at cycle 2 (three pigs per group). Groups 3 and 6 were studied at an intermeDairy stage of growth; their initial BW was 45 kg. The O2 and CO2 concentrations, physical activity and feed intake were continuously and simultaneously measured and used to calculate total heat production (HP; HP(tot)), HP due to physical activity (HP(act)), activity-free HP (HP0), and thermic effect of feed. HP was modelled as a non-linear function with T, BW and ME as predictors. Results indicate that all components of HP were proportional to BW0.60. Physical activity was minimal between 19 and 27 degrees C (8% ME). The estimated lower critical temperature was 24 degrees C. Between 24 and 12 degrees C, total thermic effect of feed decreased from 31 to 16% ME, but the short-term thermic effect of feed (5.1% ME) remained constant. Equations for prediction of HP(tot), HP(act) and HP0 according to BW, T and ME are proposed and evaluated according to literature values; values for the feed cost of thermoregulation in pigs are proposed.
Keywords: heat production, energy balance, pig housing, environmental temperature, cyclic fluctuations, body weight, metabolizable energy, energy intake, energy metabolism, feed intake, physical activity, equations, mathematical models, specific dynamic action, oxygen consumption, carbon dioxide, gas production, body temperature regulation.

Quiniou, N.; Noblet, J.; Milgen, J. van; Dubois, S. (2001). **Influence of low ambient temperatures on heat production and energy balance of single-housed growing pigs fed ad libitum: a comparison with group-housed pigs.** *Animal Research* 50 (4): 325-333, ISSN: 1627-3583.
Keywords: adaptation, housing, individual versus group, body weight, energy balance, energy consumption, energy intake, environmental temperature, heat production, physical activity, stocking rate, unrestricted feeding, feed intake, cold exposure.

Ramesh, V.; Saseendran, P.C.; Thomas, C.K. (2001). **Effect of housing systems on the reproductive performance of sows.** *Indian Journal of Animal Sciences* 71 (4): 378-380, ISSN: 0367-8318.
NAL Call No.: 41.8 IN22.
Abstract: An experiment was conducted to find out the effect of 3 types of housing systems namely, conventional house with wallowing tank (Control T1), conventional house with sprinklers (T2) and range system (T3) on the reproductive performance of sows wherein 18 were reared under each system. A significantly lower (P<0.01) air temperature was observed in sprinkler system (33.0 deg C) and range (34.35 deg C). There was no significant difference in relative humidity between the groups. The weight of sows at the time of breeding, one week after farrowing and at weaning were significantly lower (P<0.05) in treatment group T2 (95.55 plus or minus 2.38, 116.58 plus or minus 4.5 and 110.27 plus or minus 4.43 kg, respectively) when compared to T3(111.58 plus or minus 7.48, 138.97 plus or minus 8.32 and 129.54 plus or minus 8.22 kg, respectively) and T1 (114.44 plus or minus 4.56, 141.14 plus or minus 6.67 and 137.36 plus or minus 6.41 kg, respectively). Significantly higher (P<0.01) percentage of oestrus occurrence, breeding success and intensity of oestrus were observed in T2 and T3 groups than T1 group. The gestation length and postweaning oestrus period

were similar. The litter size at birth and weaning in T3(9.38 plus or minus 0.33 and 6.92 plus or minus 0.05) and T2(9.11 plus or minus 0.31 and 6.44 plus or minus 0.34) sows were significantly (P<0.01) higher than T1(7.09 plus or minus 0.68 and 4.63 plus or minus 0.70, respectively). Between T2 and T3 there was no significant difference. The litter weight at birth and weaning (14.35 plus or minus 0.52 kg and 63.84 plus or minus 4.04kg), respectively, in T3 group of sows were found to be significantly (P<0.01) higher than T1. In the present study the reproductive performance of pigs maintained under sprinkler under conventional system. 13 ref.

Keywords: sows, housing, relative humidity, temperature, comparisons, conventional house with wallowing tank, conventional house with sprinklers, range system, reproductive performance, litter size, litter weight, estrus, pregnancy, weaning weight.

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Ramesh, V.; Saseendran, P.C.; Thomas, C.K. (2001). **Effect of housing systems on the reproductive performance of gilts.** *Indian Veterinary Journal* 78 (6): 509-512, ISSN: 0019-6479.

NAL Call No.: 41.8 IN22.

Abstract: In the present study the reproductive performance of pigs maintained under sprinkler system (T2) was found to be better than the pigs maintained under conventional system with wallows and almost at par with the range system. In fact, in certain cases like improvement of microclimate and age at puberty, the sprinkler system appeared to give better results than the range.

Keywords: birth weight, conception rate, environmental temperature, gilts, litter size, mortality, estrus, pig housing, puberty, relative humidity, reproductive performance, sprinklers, weaning weight.

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Rantzer, D.; Svendsen, J. (2001). **Slatted versus solid floors in the dung area: comparison of pig production system (moved versus not moved) and effects on hygiene and pig performance, weaning to four weeks after weaning.** *Acta Agriculturae Scandinavica. Section A, Animal Science* 51 (3): 175-183, ISSN:: 0906-4702.

NAL Call No.: S3.A27.

Abstract: The effect of weaning pigs in pens with slatted versus solid floor dung alleys, and of moving at weaning, was studied on pigs from 201 litters. Weaning was at 5 weeks and no litters were mixed. Four treatments were performed: slatted+moved, slatted+not moved, solid+moved and solid+not moved. Pen hygiene was significantly better in the slatted floor pens and morbidity significantly lower. There were no significant differences in mortality or in daily weight gain. Escherichia coli-associated diarrhoea was the major cause of disease and death and joint inflammation was also of importance. It was concluded that slatted flooring improved pen hygiene and reduced morbidity due to gastrointestinal diseases. In addition, moving the pigs at weaning to cleaned, slatted floor pens may further reduce disease problems.

Keywords: housing, diarrhea, floors, gastrointestinal diseases, Escherichia coli, hygiene, joint diseases, liveweight gain, morbidity, mortality, slatted floors, weaning.

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Rantzer, D.; Svendsen, J. (2001). **Slatted versus solid floors in the dung area of farrowing pens: effects on hygiene and pig performance, birth to weaning.** *Acta Agriculturae Scandinavica. Section A, Animal Science* 51 (3): 167-174, ISSN: 0906-4702.

NAL Call No.: S3.A27.

Abstract: The effect of slatted versus solid floors in the dung area of farrowing pens on the health and production of pigs from birth to weaning was studied on a research farm which has a small integrated herd with 50-60 sows in production. In half of the farrowing pens, evenly distributed within a unit, the plastic slats were glued together to form a solid surface and only urine drainage was allowed. A total of 201 litters were studied during 1996-99. Pen hygiene in the slatted floor pens in general was significantly better in all trials, and there was a demonstrably higher amount of bacteria in the solid floor pens. Total mortality from birth to weaning was significantly higher for the solid floor treatment group, primarily due to more traumatic injuries and more infection losses. No significant treatment effects on morbidity and daily weight gain were observed. In conclusion, even in a closed herd with batch farrowing, good general hygiene level and good herd immunity, a small change such as solid flooring in the dung area can negatively affect pig health and production before

weaning.
Keywords: farrowing pens, floor type, slatted floors, solid floors, hygiene, mortality, housing, piglets, diseases, trauma.
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Renaudeau, D.; Noblet, J. (2001). **Effects of exposure to high ambient temperature and dietary protein level on sow milk production and performance of piglets.** *Journal of Animal Science* 79 (6): 1540-1548, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: The effects of high ambient temperature and level of dietary heat increment on sow milk production and piglet performance over a 28-d lactation were determined in 59 multiparous crossbred Large White x Landrace pigs kept at a thermoneutral (20 degrees C) or in a hot (29 degrees C) constant ambient temperature. Experimental diets fed during lactation were a control diet (NP; 17.6% CP) and two low-protein diets obtained by reduction of CP level (LP; 14.2% CP) or both reduction of CP and addition of fat (LPF; 15.2% CP); the NE:ME ratio was 74.3, 75.6, and 75.8% for NP, LP, and LPF diets, respectively. All diets provided 0.82 g of digestible lysine/MJ of NE, and ratios between essential AA and lysine were above recommendations. Creep feed was provided after d 21 of lactation. Reduction of CP level did not influence (P > 0.10) milk production, milk composition, or piglet performance. Despite higher nursing frequency (39 vs 34 sucklings per day), milk production decreased (P < 0.01) from 10.43 to 7.35 kg/d when temperature increased from 20 to 29 degrees C. At d 14, DM (18.6 vs 18.1%) and energy (4.96 vs 4.75 MJ/kg) contents in milk tended (P = 0.09) to be higher in sows kept at 29 degrees C. Over the 28-d lactation, piglet BW gain and BW at weaning decreased (P < 0.01) from 272 to 203 g/d and 9.51 to 7.52 kg, respectively, when temperature increased from 20 to 29 degrees C. Daily creep feed intake over the 4th wk of lactation was higher (P < 0.01) at 29 degrees C than at 20 degrees C (388 vs 232 g/litter, respectively), which was reflected in a greater increase in BW gain between wk 1 to 3 and wk 4 at the higher temperature (147 vs 130%); BW gain between weaning and d 14 postweaning was higher (P < 0.05) for piglets originating from sows kept at 29 degrees C (280 vs 218 g/d). In connection with their lower growth rate, DM (31.2 vs 33.0%), protein (15.5 vs 16.0%), lipid (12.3 vs 13.9%), and energy (8.39 vs 9.09 kJ/g) contents in weaned, slaughtered piglets were lower (P < 0.01) at 29 than at 20 degrees C. In conclusion, modification in the CP:NE ratio in order to decrease dietary heat increment did not affect milk production and piglet performance in thermoneutral or hot climatic conditions. Our results confirm the negative effect of high ambient temperatures on milk yield and emphasize the importance of creep feed supply to improve pre- and postweaning growth of piglets in these conditions, especially when weaning occurs after 3 wk of age.
Keywords: piglets, sows, milk yield, lactation, dietary protein, feeds, air temperature, performance, growth, heat stress, creep feeding, milk composition, energy content, liveweight gain, liveweight, weaning weight, pig feeding.

Ruis, M.A.; te Brake, J.H.; Engel, B.; Buist, W.G.; Blokhuis, H.J.; Koolhaas, J.M. (2001). **Adaptation to social isolation. Acute and long-term stress responses of growing gilts with different coping characteristics.** *Physiology and Behavior* 73 (4): 541-51, ISSN: 0031-9384.
NAL Call No.: QP1.P4.
Abstract: The present experiment studied the acute and long term stress responses of reactive and proactive prepubertal gilts to social isolation. Gilts with either reactive or proactive features were identified according to behavioral resistance in a backtest at a young age (2-4 days), respectively being low (LR) and high resistant (HR) in this test. At 7 weeks of age, 12 gilts of each type were socially isolated. Initially, isolation was stressful for both types of gilts, as shown by increased cortisol concentrations and decreased body temperatures. Moreover, both types reacted with increases in exploration and vocalizations. Stress responses to isolation, however, differed in magnitude and/or duration between LR and HR gilts, which was in line with expected reaction patterns on the basis of preferred ways of coping. The cortisol response to isolation was higher in LR gilts, and they generally showed more explorative behavior. HR gilts seemed to be more engaged in walking/running behavior in the first hour after isolation, they generally vocalized more and their noradrenaline excretion in urine was higher at 3 weeks after the start of isolation. Several responses to isolation in the longer term pointed to a prolonged higher general state of stress of HR gilts. Body temperature in HR gilts, for instance, did not recover during 3 weeks of isolation, but values returned to “normal” within 1 day in LR gilts.

At 1 week of isolation, relatively high parasympathetic responsivity to novelty was observed in HR gilts, probably due to stress-related high sympathetic reactivity. A shift in percentages of leucocyte subsets, typically occurring under conditions of stress, only developed in HR gilts during isolation. Finally, gastric ulceration was found in one HR gilt, but did not occur in LR gilts. To conclude, LR and HR gilts differed in their strategies to adapt to social isolation, and especially for HR gilts, this procedure seemed to become a chronic stressor.
Keywords: adaptation, psychological physiology, social isolation, stress, acute disease, body temperature, chronic disease, fear, heart rate, hormones, blood, hydrocortisone, hypothalamo-hypophyseal system, organ weight, pituitary-adrenal system, stomach ulcer, pathology.

Schon, H.; Hornauer, N.; Haidn, B. (2001). **Animal health in outside climate housing with kennels for fattening pigs.** *Agrartechnische Forschung* 7 (1/3): E11-E14, ISSN: 0948-7298.
Keywords: health, climate, finishing, kennels, housing, nasal flora, Actinobacillus pleuropneumoniae, Bordetella bronchiseptica, Pasteurella haemolytica, Pasteurella multocida.

Sharp, J.T. ; Hinrichs, C.C. (2001). **Farmer support for publicly funded sustainable agriculture research: the case of hoop structures for swine.** *American Journal of Alternative Agriculture* 16(2): 81-88, ISSN: 0889-1893.
NAL Call No.: S605.5.A43.
Abstract: Environmental and social concerns about the use of capital-intensive agricultural technologies have fueled questions about the process, impact, and future direction of the system that is largely responsible for developing these technologies, that is, publicly funded agricultural research at U.S. land-grant universities. Although social scientists have analyzed the public agricultural research system and farmers' attitudes towards various capital-intensive agricultural technologies, there has been less research on farmers' attitudes toward publicly funded research that focuses specifically on lower-input agricultural technologies that contribute to sustainability goals. This research examines farmers' attitudes toward publicly funded research on one such low-input technology, deep-bedded hoop structures for swine production. With lower capital costs and purported environmental and management advantages, hoop structures have been promoted to and adopted by growing numbers of Midwest swine producers. The study hypotheses draw on published theories of the treadmill of technology, and of innovation adoption and diffusion. Using a 1997 mail survey of Iowa swine producers (n = 298), we examined factors associated with producers' attitudes toward publicly funded research on hoop structures and found that 40% were supportive of the research, 40% were opposed, and 20% were undecided. Of the variables examined, the producer's assessment of hoop structures' contribution to sustainability, number of external knowledge sources about hoop structures, and formal education were each significantly related to support for publicly funded hoop-structure research. Two farm structure variables, marketings and percentage of income from farming, were not significantly related in this study. Future research on farmers' attitudes toward public sector agricultural research should take account of farmers' views of potential impacts of the specific technologies being researched and developed, and the nature of farmers' ties to the land-grant university system. This study clarifies the importance of farmers' perceptions and concerns about specific agricultural technologies in directing public agricultural research planning and policy toward broader sustainability goals.
Keywords: pigs, agricultural research, sustainability; research support, farmers’ attitudes, pig housing, low input agriculture, innovation adoption, diffusion of information, Iowa.

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NAL Call No.: 290.9 Am32T.
Abstract: The thermal performance of a low-cost, hoop-type swine building (3.55 X 5.7 X 10.3 m) was

evaluated under the winter weather conditions of Central Japan. The hoop building had two curved roofs made from 2.5 cm diameter tubular steel pipes each covered with a reflective film. There was a 20 cm air space between the inner and outer covers, through which the exhaust air flowed. A positive- pressure ventilation fan and an air distribution duct were used to supply the fresh air. The evaluation was conducted for three opening configurations of the air distribution duct (one, two, or four holes on a cross-section of the duct) and presence or absence of an internal curtain. Furthermore, the effect of replacing the reflective film with a PVC film for the east side cover on solar transmission and thus the internal temperature rise was quantified. The building was simulated to house 30 pigs at a body weight of 70 kg. Resistive heating wire was used simulate the sensible heat generation of the pigs at 131.5 W/pig at 10 degrees C temperature. The inside temperature averaged 6.9 degrees C higher than the outside temperature during the minimum ventilation period. As the exhaust air passed through the double-layer air space, 25.4% of exhaust heat transferred back into the building and 74.6% lost to the outside. When replacing the reflective covers with the PVC film covers on the east side, the internal temperature rise increased to an average of 7.6 degrees C with a maximum of 12.7 degrees C. The magnitude of temperature rise was proportional to the transmitted solar radiation, as evidenced by the higher temperature rise during the day and significantly reduced temperature rise at night. To eliminate the effects of cold, nocturnal radiation, the PVC film cover should be covered by the regular reflective cover at night. One-holed air duct had a tendency to produce drafts in the pig occupied zone (POZ 1.2 X 0.7 m), whereas four-holed air duct tended to have less mixing effects on the air. In comparison, the combination two-holed air duct and use of the internal curtain was found to be the best in achieving warmer air temperature and minimizing drafts in POZ.
Keywords: housing, design, thermal properties, heating systems, artificial ventilation, air temperature, air flow, energy requirements, Japan.

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Keywords: farrowing facilities, management, production systems, comparisons, Swedish deep-straw farrowing, Swedish deep-straw and pasture farrowing system, deep-straw hoop structures, combining pasture and hoop structure production, pasture farrowing, confinement farrowing and finishing, confinement farrowing and contract finishing, selecting a system, decision making, Midwest.

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NAL Call No.: SF1.L5.
Keywords: housing, evaluation, certification, quality controls, animal welfare, animal husbandry, animal health, animal behavior, environmental impact, monitoring.

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Keywords: sows, piglets, housing, farrowing pens, floor pens, weaning, aggressive behavior, sow lactation, feeding frequency, suckling, creeps, creep feeding, liveweight gain, animal welfare, feed intake, animal behavior.

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Keywords: air flow, housing, building construction, design, guidelines, housing, standards, ventilation, infiltration, exfiltration, system ventilation capacity, ventilation effectiveness, air distribution, maximum heating, cooling capability.

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Husbandry

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NAL Call No.: QL750.A6.
Abstract: The aim of this experiment was to determine the interactive effects of handling and environmental enrichment on the behaviour, performance and welfare of the growing/finishing pigs. Groups of pigs were exposed to one of eight treatments arranged in a 2 x 4 factorial design with two levels of handling (M: minimal and P: pleasant), and four levels of environmental enrichment (B: barren, C: chain, S: chopped straw, or T: destructible toy). Daily food intake was significantly affected by handling during 1-6 weeks with the P groups eating slightly more food than the M groups (1.88 vs. 1.75 kg/day; S.E.D.=0.077; P<0.05), however, this increased intake was not reflected in daily liveweight gain or food conversion ratio during the same period. The time taken for a group of pigs to exit their pen during a routine handling test was significantly affected by the handling treatments (46.2 vs. 37.8 s for P and M groups, respectively; S.E.D.=3.38; P<0.05). Behavioural time budgets, and postmortem muscle pH and stomach lesion scores were unaffected by treatment. These results suggest that pleasantly handled pigs are more difficult to move during routine husbandry tasks which may be mediated through their reduced fear of humans. 27 ref.
Keywords: behavior, animal welfare, environmental impact, feed conversion efficiency, feed intake, finishing, live weight gain.
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Keywords: husbandry, animal welfare, teeth clipping, teeth grinding, live weight, piglets, techniques, comparison, Hungary, Hungarian language.

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NAL Call No.: 23 Au783.
Keywords: boars, gilts, breed, Large White x Landrace, back fat, plasma, blood, glucose, porcine somatotropin (PST), injection, pre-slaughter treatment, growth stimulant, hormone, urea, nitrogen, average daily gain, commercial group housing, feed conversion ratio, feed intake, gender differences, growth performance.

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Keywords: hormones, animal behavior, animal welfare, physiology, stress effects, weaning times.

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NAL Call No.: HV4701.A557.
Keywords: sows, nose, extensive livestock farming, animal behavior, paddocks, damage, grazing, physical activity, mastication, animal welfare, frustration, stone chewing, bull rings, clip rings.

Hunter, E.J.; Jones, T.A.; Guise, H.J.; Penny, R.H.C.; Hoste, S. (2001). **The relationship between tail biting in**

pigs, docking procedure and other management practices. *The Veterinary Journal* 161 (1): 72-79, ISSN: 1090-0233.
NAL Call No.: SF601.V484
Abstract: The tail length (docked, tipped or undocked) and tail status (bitten or unbitten) of 27,870 pigs from 450 units was recorded at six UK abattoirs. A farm survey of the final finishing stage was used to investigate the relationship between management practice and tail biting. This showed that docking was the most important factor influencing the probability of being not bitten, with 2.4% of docked and 8.5% of long-tailed pigs being tail-bitten. The following factors reduced the probability of long-tailed pigs being tail-bitten; light straw provision, use of natural ventilation or artificially controlled natural ventilation (ACNV), mixed sex grouping, meal or liquid feeding, and use of double or multi-space feeders. Docked and long-tailed pigs provided with light straw and natural ventilation/ACNV had levels of tail biting of 1.2% and 4.3% respectively; 3.9% of docked pigs with artificial ventilation and no straw were tail-bitten. Long-tailed pigs fed via double or multi-space feeders also had 3.9% of tails bitten.
Keywords: behavior, animal, bites and stings, injuries, tail, surgery, husbandry, methods, epidemiology, questionnaires, England.

Kielly, J.; Dewey, C.E.; Cochran, M. (1999). **Castration at 3 days of age temporarily slows growth of pigs.** *Swine Health and Production* 7(4):151-153, ISSN: 1066-4963.
NAL Call No.: SF971 N472.
Keywords: castration, piglets, preweaning period, statistical analysis,weaning, weaning weight, weight gain, surgery, animal welfare.

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NAL Call No.: T223 A21.
Keywords: hogs, sheep, cows, poultry, patent, livestock equipment, sorting livestock, enclosure, guiding livestock, foldable livestock barrier, reduced injury risk, livestock, humans.

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NAL Call No.: 49 J82.
Abstract: A cooperative study involving six experiment stations and 236 crossbred litters was conducted to determine the effect of nominal nipple drinker water flows of 700 mL/min and 70 mL/min (actual = 701 and 76 mL/min, respectively) during winter (November through February; 124 litters) and summer (June through August; 112 litters) seasons on performance of lactating sows and their litters. Within a season, sows were paired according to expected farrowing date and assigned at random to crates. Water flow rate treatments were assigned at random to sows within pairs. Sows were housed in farrowing crates from d 109 of gestation until either d 21 (two stations) or d 28 of lactation (four stations). Within 24 h after farrowing, litters were adjusted to contain 8 to 12 piglets. Sow feed intake (SFI) and litter weight (LW) were recorded weekly. Sow weights were recorded at d 109 of gestation, d 0, and d 21 of lactation. Sows lactating beyond 21 d were also weighed on d 28. Analysis of covariance was applied to sow weight change, average daily SFI, and LW data where litter size after crossfostering was the covariate. Average ambient temperature 30 cm above the floor at 0830 and 1600 was 24.6 +/- 0.15 degrees C and 29.4 +/- 0.14 degrees C, respectively, during summer and 20.7 +/-0.13 degrees C and 21.8 +/- 0.11 degrees C during winter trials. Restricted drinker water flow rate decreased SFI ($P < 0.01$; 4.59 vs. 3.94 kg/d, respectively, for 700 and 70 mL/min) and increased BW loss ($P < 0.01$; 0.56 vs 0.89 kg/d, respectively for 700 and 70 mL/min) but did not affect litter size ($P > 0.87$) or LW ($P > 0.89$) during the first 21 d of lactation. During d 22 to 28, the 70 mL/min flow decreased SFI ($P < 0.01$; 5.02 vs. 4.47 kg/d respectively, for 700 and 70 mL/min). Over the 21-d lactation period, the 70 mL/min treatment depressed ($P < 0.01$) SFI more during the winter (5.12 vs. 4.24 kg/d for 700 and 70 mL/ min, respectively) than during the summer (4.05 vs 3.65 kg/d for 700 and 70 mL/min, respectively). Season affected SFI ($P < 0.01$; 4.68 vs. 3.85 kg/d, respectively, for winter and summer), sow weight loss ($P < 0.001$; 0.46 vs 0.83 kg/d, respectively, for winter and summer), and LW at 21 d ($P < 0.05$; 52.8 vs. 49.6 kg, respectively, for winter and summer) but not (P >

0.96) the number of pigs per litter. Results of this study suggest that ample access to drinking water and controlling ambient temperature during summer months are essential for sow and litter performance.
Keywords: sow, piglets, pregnancy, drinking, energy intake, physiology, pH, physiology, feed, nutrition, body weight, heat, lactation, physiology, litter size, random allocation, seasonal considerations.

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NAL Call No.: SF1.L5.
Keywords: husbandry, housing, bacon, organoleptic traits, food quality, sensory evaluation, feeds, genotypes, ammonia, hygiene, dust, male animals, female animals, taste panels, straw, Scotland.

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Keywords: breed, Large White x Landrace, newborn, piglets, analgesia, animal welfare, sucrose, tail docking, teeth clipping, pain, human infants, distress, management procedures.

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NAL Call No.: T223 A21.
Keywords: patent, aeration apparatus, purification of livestock excretory liquid, low cost, pollution control, outer tank, aeration tube, sludge sedimentation tank, wash water for pig houses, industrial equipment.

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NAL Call No.: SF5 B74 no. 23.
Keywords: finishing, stocking density, animal welfare, livestock, legislation, animal behaviour.

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NAL Call No.: SF396.5 W43 2001.
Keywords: ammonia, husbandry, animal welfare, legislation, 1998 Dutch legislation, housing, piglets, weaning, behavioral need, stress.

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NAL Call No.: QL750.A6.
Keywords: piglets, castration, age, animal behavior, vocalization, pain, suckling, age differences, animal welfare, Netherlands.

Weary, D.M.; Fraser, D. (1999). **Partial tooth-clipping of suckling pigs: effects on neonatal competition and facial injuries.** *Applied Animal Behaviour Science* 65 (1): 21-27, ISSN: 0168-1591.
NAL Call No.: QL750.A6
Keywords: piglets, teeth clipping, liveweight gain, intraspecific competition, teats, litter, sucking, face, trauma, lesions, mortality, phenotypic variation, litter competition.

Wolter, B.F.; Ellis, M.; Curtis, S.E.; Augspurger, N.R.; Hamilton, D.N.; Parr, E.N.; Webel, D.M. (2001). **Effect of group size on pig performance in a wean-to-finish production system.** *Journal of Animal Science* 79 (5): 1067-1073, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: Crossbred pigs (n = 1,400) were used to evaluate the effect of group size (25 vs 50 vs 100 pigs/pen) in a wean-to-finish production system on growth performance and carcass measures. Pigs were weaned at 17 d (range = 15 to 19) of age with a mean initial BW of 5.9 +/- 0.02 kg and taken to a final mean pen weight of 116 +/- 0.9 kg. A 10-phase dietary regimen was used, and pigs had free access to feed and water. Feeder-trough space (4.3 cm/pig) and floor-area allowance (0.68 m2/pig) were the same for all group sizes. Compared to groups of 25, pigs in groups of 50 and 100 animals were lighter (P < 0.001) at the end of wk 8 after weaning and had lower (3%, P < 0.01) ADG and gain:feed (G/F) but similar (P > 0.05) ADFI during the first 8 wk of the study. At the end of the study, pig weight and the coefficient of variation in pig weight within a pen were similar (P > 0.05) across group sizes. During the period from 8 wk after weaning to the end of the study, pigs in groups of 100 compared to 50 animals had greater (3%, P < 0.01) ADG, and pigs in groups of 25 were intermediate for ADG. Average daily feed intake during this period was similar (P > 0.05) for all group sizes; however, G/F was greater (3%, P < 0.01) for groups of 100 compared to 25 or 50 animals. For the overall study period, ADG, ADFI, and G/F from weaning to slaughter weight were similar across group sizes (P > 0.05; 655, 648, and 658 g, 1,759, 1,755, and 1,759 g; and 0.37, 0.37, and 0.37; for ADG, ADFI, and G/F, respectively, for groups of 25, 50, and 100 pigs, respectively). Mortality was similar (P > 0.05) across group sizes; however, morbidity (pigs removed due to poor health or injury) was higher in groups of 25 pigs compared to the other two group sizes (7.0, 3.5, and 3.9% for groups of 25, 50, and 100, respectively; P < 0.05). Group-size treatment did not affect (P > 0.05) carcass dressing percentage, backfat thickness, or loin-eye depth. In summary, growth performance from weaning to market weight was not affected by group size.
Keywords: performance, livestock numbers, group size, husbandry, weaning, finishing, growth, carcass quality, housing, liveweight, liveweight gain, feed conversion, feed conversion efficiency, feed intake, mortality, morbidity, dressing percentage, backfat, fat thickness, muscles.

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NAL Call No.: QL750.A6.
Keywords: animal welfare, behavior, piglets, weaning, age differences, husbandry, animal production, abnormal behaviour, aggressive behavior.

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NAL Call No.: SF55 A78A7.
Keywords: piglets, iron dextran, injection, creep feed, supplemented with iron, immune response, endotoxin lipopolysaccharide (LPS), tumor necrosis factor alpha, average daily gain, iron injection does not contribute to performance, unnecessary practice.

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Legislation

Bach Knudsen, K.E. (2001). **Development of antibiotic resistance and options to replace antimicrobials in animal diets.** *Proceedings of the Nutrition Society* 60 (3): 291-9, ISSN: 0029-6651.
NAL Call No.: 389.9 N953.
Abstract: As there is a risk of developing antibiotic resistance, a number of commonly used antimicrobial growth promoters have been banned in the EU member states. This decision has put new emphasis on using the

diet to control enteric bacterial infections of pigs. Dietary carbohydrates constitute a major proportion of diets for pigs, and the carbohydrate fraction has a diverse composition, with different properties in the gastrointestinal tract, some of which are of importance to gut health. Findings from different studies indicate that dietary carbohydrate composition influences the expression of swine dysentery and infection with nematode worms after experimental challenge with Brachyspira hyodesenteriae and Oesophagostumum dentatum respectively. In both cases the type, amount and physico-chemical properties of the carbohydrates entering the large intestine played an important role in the infection, and emerging data suggest a synergism between different porcine pathogens. There is also increasing evidence that the feed structure, which relates to the type of plant material in the diet and the way it is processed, can be used to reduce Salmonella prevalence at the herd level. However, it should be stressed that using the diet to manage gut health is not straightforward, since the expression of a pathogen in many cases requires the presence of other components of the commensal biota. (75 Refs.)

Keywords: antibiotics, ban, pharmacology, dietary carbohydrates, metabolism, enterobacteriaceae infections, nematode infections, disease, prevention and control, animal feed, dietary carbohydrates, analysis, drug resistance, drug effects, pathogenicity, European Union.

Hayes, D.J.; Jensen, H.H.; Fabiosa, J. (2002). **Technology choice and the economic effects of a ban on the use of antimicrobial feed additives in swine rations.** *Food Control* 13 (2): 97-101. ISSN: 0956-7135.

NAL Call No.: TP372.7 F66.

Keywords: antimicrobial feed additives, bans, regulations, animal rations, analysis, feed, preparation, economics, food safety, pork production, management, technology choices, swine industry, Europe, USA.

Kuzma, C.D. (2001). **Activists begin legal assault against industrial hog farming.** *Journal of the American Veterinary Medical Association* 218 (8): 1246, ISSN: 0003-1488.

NAL Call No.: 41.8 Am3.

Keywords: husbandry, legislation and jurisprudence, animal welfare, environment, waste products, water pollutants.

Lara, A.; Kelly, P.W.; Lynch, B. (2001). **Environmental and animal welfare regulations and the Irish pig industry.** *Rural Economy Situation and Outlook Series No.6, Rural Economy Research Centre: Teagasc Dublin, Irish Republic*, 48 p., ISBN: 1-84170-171-8.

Keywords: production, animal welfare, constraints, environmental impact, legislation, pig farming, production economics, regulations, European Union.

Mellor, D.J.; Stafford, K.J. (2001). **Integrating practical, regulatory and ethical strategies for enhancing farm animal welfare.** *Australian Veterinary Journal* 79 (11): 762-768, ISSN: 0005-0423.

NAL Call No.: 41.8 Au72.

Keywords: assessment of animal welfare, societal expectations, welfare standards, regulation, ethical strategies, welfare management, nutrition, environment, health, behavior, mental needs of animals, science, acceptable standards, economics, New Zealand.

Pellini, T.; Morris, J. (2001). **A framework for assessing the impact of the IPPC directive on the performance of the pig industry.** *Journal of Environmental Management* 63 (3): 325-33, ISSN: 0301-4797.

NAL Call No.: HC75 E5J6.

Abstract: New European Union legislation on Integrated Pollution Prevention and Control (IPPC) is being implemented in the United Kingdom, enacted by the Pollution Prevention and Control Act 1999 and its statutory instruments, the Pollution Prevention and Control (England and Wales) Regulations 2000. This legislation incorporates previously unregulated installations in the food and intensive livestock sectors, such as pig installations above a given threshold size. IPPC requires that installations adopt Best Available Techniques and follow General Binding Rules of good practice in order to manage their environmental effects. IPPC has significant potential impacts for both the environmental and financial performance of the pig industry. In this context, the paper discusses the IPPC implementation process as it applies to the sector and presents a methodological framework for assessing the environmental and cost benefit implications of the new regulations.

Keywords: agriculture, manure, public policy, water pollution, prevention and control, husbandry, conservation of natural resources, cost-benefit analysis, Europe, guideline adherence, water pollution, economics.

Savard, M. (2000). **Modelling risk, trade, agricultural and environmental policies to assess trade-offs between water quality and welfare in the hog industry.** *Ecological Modelling* 125(1):51-66, ISSN: 0304-3800.
NAL Call No.: QH541.15 M3E25.
Keywords: models, risk, international trade, agricultural policy, environmental policy, water quality, animal welfare, pig farming, meat and livestock industry, pollution, optimization, trade liberalization, imports, nitrogen, phosphates.

Spoolder, H.A.M.; Corning, S.; Edwards, S.A. (1999). **The specification of stocking density in relation to the welfare of finishing pigs.** In: *Farm Animal Welfare, Who Writes the Rules? Proceedings of an International Symposium Organized by the British Society of Animal Science, Edinburgh, UK, 1999*, A.J.F. Russel, C.A. Morgan, C.J. Savory, M.C. Appleby, and T.L.J. Lawrence (eds.), British Society of Animal Science (No. 23): UK, pp.150-151.
NAL Call No.: SF5 B74 no. 23.
Keywords: finishing, stocking density, animal welfare, livestock, legislation, animal behaviour.

Swinkels, J.W.G.M.; Spoolder, H.A.M.; Vermeer, H.M. (2001). **Weaning in practi ce.** In: *The Weaner Pig: Nutrition and Management* Varley, M.A.; Wiseman, J. (Eds.), CABI Publishing: Wallingford, UK, pp.317-324, ISBN: 0-85199-532-2.
NAL Call No.: SF396.5 W43 2001
Keywords: ammonia, husbandry, animal welfare, legislation, 1998 Dutch legislation, housing, piglets, weaning, behavioral need, stress.

Walton, J.R. (2001). **Benefits of antibiotics in animal feed.** In: *Recent Developments in Pig Nutrition* No. 3, Garnsworthy, P. C.; Wiseman, J. (Eds.), Nottingham University Press: Nottingham, UK, pp.11-37, ISBN: 1-897676-44-1.
Keywords: production, antiinfective agents, food hygiene, health, penicillin, tetracycline, human health, regulation, legislation.

Webster, A.J.F (2001). **Farm animal welfare: the five freedoms and the free market.** *The Veterinary Journal* 161(3) 229-237, ISSN: 1090-0233.
NAL Call No.: SF601.V484.
Keywords: review, scientific, ethical and economic factors, animal welfare, ethical matrix, wellbeing, autonomy, fitness, suffering, husbandry, legislation, free market, quality assurance schemes, quality control, independent audit.

Wechsler, B.; Frohlich, E.; Oester, H.; Oswald, T.; Troxler, J.; Weber, R.; Schmid, H. (1997). **The contribution of applied ethology in judging animal welfare in farm animal housing systems.** *Applied Animal Behaviour Science* 53 (1/2): 33-43, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: pigs, cattle, poultry, farm animal housing systems, Swiss animal welfare legislation, veterinary, physiological and behavioural tests, animal welfare problems, housing systems, group cages for laying hens, electric cow- trainers, farrowing crates for sows, alternative housing systems, Switzerland.

Wierup, M. (2001). **The Swedish experience of the 1986 year ban of antimicrobial growth promoters, with special reference to animal health, disease prevention, productivity, and usage of antimicrobials.** *Microbial Drug Resistance* 7 (2): 183-190, ISSN: 1076-6294.
Keywords: pigs, beef, poultry, health, disease, ban, antimicrobial growth promoters, zinc oxide, improved management practices, disease prevention, antimicrobial resistance, health, productivity, Sweden.

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Reproduction

Alexopoulos, C. (2001). **Association of Fusarium mycotoxicosis with failure in applying an induction of parturition program with PGF2alpha and oxytocin in sows.** *Theriogenology* 55 (8): 1745-57, ISSN: 0093-691X.
NAL Call No.: QP251 A1T5.
Abstract: This trial was conducted in a farrow-to-finish pig unit from November 1999 to February 2000. Since November 1998 an induction-of-parturition program was applied in gilts and sows with PGF2alpha (2 mL Dinolytic, i.m.) 113 d post service, followed by oxytocin (1 mL Intertocine-S, i.m.) 24 h later. This program resulted in a high proportion of animals farrowing within the working hours of the day. At mid December 1999 splay-legs and edematous swelling and reddening of the vulva started to be observed in newborn piglets. A concurrent decline of parameters related to parturition also was noticed. Mycotoxicological analyses of the feeds revealed a co-occurring contamination with deoxynivalenol and zearalenone. For a 4-week period, sows were divided into two groups: (a) an induction-of-parturition and (b) a non-induction-of-parturition group. Significant differences were found between the two groups relating to prevalence of dystocia (<.05) and pregnancy duration (<.05). Moreover, it was found that prevalence of splay-legs and swelling of the vulva were highly correlated (<.05) with reduction of percentage of sows farrowing within the working day and increase of pre-weaning mortality. It was concluded that such an induction-of-parturition program should be avoided during a Fusarium mycotoxicosis.
Keywords: dinoprost, pharmacology, fusarium, mycotoxicosis, labor, induced parturition, oxytocin, disease, physiopathology, animal feed, analysis, fetal death, epidemiology.

Almeida, F.R.; Mao, J.; Novak, S.; Cosgrove, J.R.; Foxcroft, G.R. (2001). **Effects of different patterns of feed restriction and insulin treatment during the luteal phase on reproductive, metabolic, and endocrine parameters in cyclic gilts.** *Journal of Animal Science* 79 (1): 200-212, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: gilts, litter mates, nutrition, reproduction, oocyte, follicle stimulating hormone, insulin like growth factor I, estradiol, insulin, hormone drug, leptin, luteinizing hormone, progesterone, triiodothyronine [T3], feed restriction, transcutaneous ultrasonography, estrus cycle, fertility, ovulation.

Cheng, H., Althouse, G.C., Hsu, W.H. (2001). **Prostaglandin F2alpha added to extended boar semen at processing elicits in vitro myometrial contractility after 72 hours of storage.** *Theriogenology* 55 (9): 1901-1906, ISSN: 0093 691X.
Keywords: boars, semen, improved fertility, myometrial contractility, semen extender, prostaglandin F 2 alpha, fertility drug, artificial insemination.

Evans, A.C.; O' Doherty, J.V. (2001). **Endocrine changes and management factors affecting puberty in gilts.** *Livestock Production Science* 68 (1): 1-12, ISSN: 0301-6226.
NAL Call No.: SF1.L5.
Keywords: gilts, puberty, age at puberty, estrus, ovarian follicle, gonadotrophin secretion, luteinizing hormone, blood concentration, management influence, air quality, boar effect, body composition, body fat, body weight, breed differences, confinement, feed restriction, hormone profile, nutrition, lean meat, prepubertal period, puberty, induction, reproductive performance, seasonality, selective breeding, weight.

Irie, M. (2001). **Available techniques for early pregnancy diagnosis in swine.** *Journal of Reproduction and Development* 47 (Suppl. 1): S71-S81, ISSN: 0916-8818.
NAL Call No.: SF1 K3.

Keywords: detection method, non return method, rectal palpation, ultrasonography, imaging method, vaginal biopsy, estrus, farrowing, pregnancy stage.

Kashiwazaki, N.; Shino, M. (2001). **Ability of in vitro manipulated porcine embryos to develop to piglets.** *Journal of Reproduction and Development* 47 (Suppl. 1): S35-S39, ISSN: 0916-8818.
NAL Call No.: SF1 K3.
Keywords: transgenics, DNA microinjection method, genetic manipulation, in vitro production system, nuclear transfer, gene targeting technology, gene knockouts.

Klindt, J.; Yen, J.T.; Christenson, R.K. (1999). **Effect of prepubertal feeding regimen on reproductive development of gilts.** *Journal of Animal Science* 77 (8): 1968-1976, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: The effect of prepubertal feed level on growth and reproductive development of gilts was investigated. At 13 wk of age, white crossbred gilts were penned individually and assigned to the following treatments: Ad lib, ad libitum intake from 13 to 25 wk of age (n = 64); Control, ad libitum intake from 13 wk of age until 100 kg BW and then 90% of ad libitum intake until 25 wk of age (n = 65); and Restricted, 74% of ad libitum intake from 13 wk to 25 wk of age (n = 64). Feed was formulated to primarily restrict energy intake. The study was replicated in two seasons. At 25 wk of age, gilts were moved to group pens, approximately 16 gilts/pen, allowed ad libitum access to feed, and estrus detection was initiated. Gilts were mated at first estrus and those recycling were remated. After mating, gilts were moved to gestation stalls and fed 1.5x maintenance. At 30 d of gestation, reproductive tracts were harvested, and numbers of corpora lutea (CL) and live embryos were recorded. From 13 to 25 wk of age, feed consumption was 258 for Ad lib, 251 for Control, and 189 kg/gilt for Restricted, and, from 13 wk of age until 30 d of gestation, total feed consumption was 367 for Ad lib, 356 for Control, and 299 kg/gilt for Restricted gilts. Age at puberty (196 d) and pregnancy (200 d) was not affected (P >.18) by treatment. However, the rate at which gilts attained puberty (e.g., percentage pubertal at 28 d) was greatest in Ad lib (75) and least in Control (61) gilts. Number of CL and live embryos at 30 d of gestation/gilt assigned to the study was unaffected (P >.21) by treatment. Quantity of feed consumed from 13 wk of age to 30 d of gestation per live embryo in gilts assigned to the study was 40.0 for Ad lib, 39.8 for Control, and 30.6 kg/gilt for Restricted gilts. These results indicate that moderate feed restriction of gilts during prepubertal development may increase efficiency of swine production without negative impact on reproductive performance through 30 d of gestation.
Keywords: gilts, pig feeding, puberty, plane of nutrition, energy intake, unrestricted feeding, restricted feeding, age differences, backfat, liveweight gain, estrus, detection, fat thickness, body weight, pregnancy rate, corpus luteum, litter size, feed conversion.

Korthals, R.L. (1999). **The effectiveness of using electronic identification for the identification of estrus in swine.** *ASAE/CSAE-SCGR Annual International Meeting, Toronto, Ontario, Canada, July 18-21, 1999*, ASAE Paper No. 994213, American Society of Agricultural Engineers (ASAE): St Joseph, USA.
Keywords: boars, sows, techniques, estrus detection, economics, detection.

Labrecque, R.; Labrecque, G. (2001). **Method and system for detecting estrus in swine.** *Official Gazette of the United States Patent and Trademark Office Patents* 1244 (2): No Pagination, ISSN: 0098-1133.
NAL Call No.: T223 A21.
Keywords: patent, moveable cart, transport male hog, estrus detection, snout to snout contact, farm equipment.

Martinez, E.A.; Vazquez, J.M.; Roca, J.; Lucas, X.; Gil, M.A.; Parrilla, I.; Vazquez, J.L. (2001). **Deep intrauterine insemination in sows with a low number of spermatozoa: A new and simple procedure.** *Theriogenology* 55 (1): 248, ISSN: 0093-691X.
NAL Call No.: QP251 A1T5.
Keywords: cervix, reproductive system, spermatozoa, reproductive system, deep intrauterine insemination, assisted reproduction method, fertilization method, fiberoptic endoscope technique, insemination method.

Mejia Silva, W.; Cruz Arambulo, R.; Calatayud Marques, D.; Leon, G.; Quintero-Moreno, A. (2001). **Use of**

real-time ultrasound for early pregnancy diagnosis in the sow. [Uso de ultrasonografia modo b en tiempo real para diagnostico precoz de gestacion en la cerda.] *Produccion y Patologia Porcina* 11 (5): 418-422, ISSN: 0798-2259.
Keywords: artificial insemination, diagnostic value, early diagnosis, gilts, pregnancy, pregnancy diagnosis, sows, ultrasonic diagnosis, ultrasonography, Spanish language.

Nagai, T. (2001). **The improvement of in vitro maturation systems for bovine and porcine oocytes.** *Theriogenology* 55 (6): 1291 1301, ISSN: 0093-691X.
NAL Call No.: QP251 A1T5.
Keywords: pigs, cattle, biotechnology, cloning, efficiency, genetically modified, in vitro methods, in vitro embryo production, ovary selection, in vitro oocyte maturation systems, oocyte biotechnology.

Neaupane, T.R.; Pandit, R.K.; Jogi, S. (2001). **Pregnancy diagnosis and induction of farrowing in crossbred sows.** *Indian Journal of Animal Sciences* 71 (2): 142-143, ISSN: 0367-8318.
NAL Call No.: 41.8 IN22.
Keywords: piglet, sow, breed, Large White Yorkshire, reproductive system, vagina, vaginal biopsy, diagnostic method, tiaprost frometamol, adverse effects, dosage, intramuscular administration, oxytocic drug, farrowing induction, piglet mortality, pregnancy diagnosis.

Park, K.W.; Kuhholzer, B.; Lai, L.; Machaty, Z.; Sun Qing, Y.; Day, B.N.; Prather, R.S. (2001). **Development and expression of the green fluorescent protein in porcine embryos derived from nuclear transfer of transgenic granulosa derived cells.** *Animal Reproduction Science* 68 (1-2): 111-120. ISSN: 0378-4320.
NAL Call No.: QP251 A5.
Keywords: nuclear transfer techniques, cloning, somatic cells, granulosa derived cells, in vitro, reproductive system, oocyte, green fluorescent protein, assisted reproduction method, molecular genetic method, cleavage rate, gene expression.

Pena, F.J.; Gil, M.C.; Pena, F. (2001). **Effect of vulvomucosal injection of D cloprostenol at weaning and at insemination on reproductive performance of sows during the low fertility summer season under field conditions.** *Animal Reproduction Science* 68 (1-2): 77-83, ISSN: 0378-4320.
NAL Call No.: QP251 A5.
Keywords: sows, D cloprostenol, fertility drug, hormone, prostaglandin F 2 alpha analogue, vulvomucosal administration, litter size, reproductive performance, seasonality, summer.

Prunier, A.; Guadarrama, C.A.M.; Mourot, J.; Quesnel, H. (2001). **Influence of feed intake during pregnancy and lactation on fat body reserve mobilisation, plasma leptin and reproductive function of primiparous lactating sows.** *Reproduction Nutrition Development* 41 (4): 333-347, ISSN: 0926-5287.
Keywords: sows, breed, Large White x Landrace, lactating, restricted versus ad libitum feeding, backfat thickness, body fat reserves, energy balance, feed intake, lactation, lipogenesis, live weight, milk production, neck fat, pregnancy, reproductive performance, nutrition, gonadotrophin, secretion, leptin, lipids, acetyl coenzyme A carboxylase, glucose 6 phosphate dehydrogenase, luteinizing hormone, malic enzyme.

Ramesh, V.; Saseendran, P.C.; Thomas, C.K. (2001). **Effect of housing systems on the reproductive performance of sows.** *Indian Journal of Animal Sciences* 71 (4): 378-380, ISSN: 0367-8318.
NAL Call No.: 41.8 IN22.
Abstract: An experiment was conducted to find out the effect of 3 types of housing systems namely, conventional house with wallowing tank (Control T1), conventional house with sprinklers (T2) and range system (T3) on the reproductive performance of sows wherein 18 were reared under each system. A significantly lower (P<0.01) air temperature was observed in sprinkler system (33.0 deg C) and range (34.35 deg C). There was no significant difference in relative humidity between the groups. The weight of sows at the time of breeding, one week after farrowing and at weaning were significantly lower (P<0.05) in treatment group T2 (95.55 plus or minus 2.38, 116.58 plus or minus 4.5 and 110.27 plus or minus 4.43 kg, respectively) when compared to T3(111.58 plus or minus 7.48, 138.97 plus or minus 8.32 and 129.54 plus or minus 8.22 kg,

respectively) and T1 (114.44 plus or minus 4.56, 141.14 plus or minus 6.67 and 137.36 plus or minus 6.41 kg, respectively). Significantly higher (P<0.01) percentage of oestrus occurrence, breeding success and intensity of oestrus were observed in T2 and T3 groups than T1 group. The gestation length and postweaning oestrus period were similar. The litter size at birth and weaning in T3(9.38 plus or minus 0.33 and 6.92 plus or minus 0.05) and T2(9.11 plus or minus 0.31 and 6.44 plus or minus 0.34) sows were significantly (P<0.01) higher than T1(7.09 plus or minus 0.68 and 4.63 plus or minus 0.70, respectively). Between T2 and T3 there was no significant difference. The litter weight at birth and weaning (14.35 plus or minus 0.52 kg and 63.84 plus or minus 4.04kg), respectively, in T3 group of sows were found to be significantly (P<0.01) higher than T1. In the present study the reproductive performance of pigs maintained under sprinkler under conventional system. 13 ref.

Keywords: sows, housing, relative humidity, temperature, comparisons, conventional house with wallowing tank, conventional house with sprinklers, range system, reproductive performance, litter size, litter weight, estrus, pregnancy, weaning weight.

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Rehfeldt, C.; Kuhn, G.; Nuernberg, G.; Kanitz, E.; Schneiders, F.; Beyer, M.; Nuernberg, K.; Ender, K. (2001). **Effects of exogenous somatotropin during early gestation on maternal performance, fetal growth, and compositional traits in pigs.** *Journal of Animal Science* 79 (7): 1789-1799, ISSN: 0021-8812.

NAL Call No.: 49 J82.

Keywords: gilts, porcine somatotropin, injected, maternal performance, early gestation, effects on embryonic survival, fetal development, fetal growth, embryonic weight, fetal weight, neonatal weight, reproductive system, endometrium, placenta, glucose, nutrient transfer, proteins, animal compositional traits, analysis.

Romar, R.; Coy, P.; Campos, I.; Gadea, J.; Matas, C.; Ruiz, S. (2001). **Effect of co culture of porcine sperm and oocytes with porcine oviductal epithelial cells on in vitro fertilization.** *Animal Reproduction Science* 68 (1-2): 85-98, ISSN: 0378-4320.

NAL Call No.: QP251 A5.

Keywords: reproductive system, oocyte, semen, monospermy, concentration, frozen thawed, in vitro fertilization, assisted reproduction method, oviductal epithelial cell.

Sato, E.; Kimura, N.; Saeki, K.; Yokoo, M.; Sasada, H. (2001). **Development of a gene modified pig by means of a somatic cell clone technique.** *Journal of Reproduction and Development* 47 (Suppl. 1): S27-S33, ISSN: 0916-8818.

NAL Call No.: SF1 K3.

Keywords: transgenics, oocyte, nuclear transfer, assisted reproduction method, somatic cell clone technique, cytogenetic method.

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NAL Call No.: SF55 A78A7.

Keywords: boar, sows, estrus detection, boar pheromone spray, farrowing interval, weaning to remating interval, farrowing interval, lactation, reproductive efficiency, village conditions, Nepal.

Singleton, W. L. (2001). **State of the art in artificial insemination of pigs in the United States.** *Theriogenology* 56 (8):1305-1310, ISSN: 0093-691X.

NAL Call No.: QP251 A1T5.

Keywords: breeding, sires, genetically superior, husbandry, breeding management. artificial insemination, semen, semen production, collection, evaluation, processing, USA.

Tantasuparuk, W.; Dalin, A.M.; Lundeheim, N.; Kunavongkrit, A.; Einarsson, S. (2001). **Body weight loss during lactation and its influence on weaning to service interval and ovulation rate in Landrace and Yorkshire sows in the tropical environment of Thailand.** *Animal Reproduction Science* 65 (3-4): 273-281,

ISSN: 0378-4320.
NAL Call No.: QP251 A5.
Keywords: sows, breed, Landrace, Yorkshire, tropical climate, ovulation rate, weaning to service interval, body weight loss, lactation length, number of total born piglets, number of live born piglets, litter birth weight, average piglet birth weight, number of pigs weaned, litter weaning weight, average pig weaned weight, ovulation rate, Thailand.

Tummaruk, P.; Lundeheim, N.; Einarsson, S.; Dalin, A.M. (2001). **Effect of birth litter size, birth parity number, growth rate, backfat thickness and age at first mating of gilts on their reproductive performance as sows.** *Animal Reproduction Science* 66 (3-4): 225-237, ISSN: 0378-4320.
NAL Call No.: QP251 A5.
Keywords: gilts, reproductive performance, influence of birth litter size, birth parity number, performance test parameters, age at first mating, backfat thickness, birth litter size, birth parity number, farrowing rate, first mating age, growth rate, remating rate, weaning to first service interval.

Tummaruk, P.; Lundeheim, N.; Einarsson, S.; Dalin, A.M. (2001). **Repeat breeding and subsequent reproductive performance in Swedish Landrace and Swedish Yorkshire sows.** *Animal Reproduction Science* 67 (3 4): 267-280, ISSN: 0378-4320.
NAL Call No.: QP251 A5.
Keywords: gilts, sows, breed, Swedish Landrace, Swedish Yorkshire, repeat breeding, reproductive performance, parity number, boar breed, season, mating type, return to estrus, litter size.

Tummaruk, P.; Lundeheim, N.; Einarsson, S.; Dalin, A.M. (2001). **Reproductive performance of purebred Hampshire sows in Sweden.** *Livestock Production Science* 68 (1): 1-12, ISSN: 0301-6226.
NAL Call No.: SF1.L5
Keywords: sows, breed, Hampshire, reproductive performance, age at first farrowing, parity influence, farrowing rate, seasonal variation, fertility, lactation length, litter size, remating rate, weaning to first service interval.

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Slaughter

Aaslyng, M.D.; Gade, P.B. (2001). **Low stress pre-slaughter handling: effect of lairage time on the meat quality of pork.** *Meat Science* 57 (1): 87-92, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: pens, duration, time, mental stress, prevention, handling, slaughter, pork, meat quality, water holding capacity, pH, exudative meat, temperature, time in holding pens, drip loss.

Alarcon-Rojo, A.D.; Gamboa, J.G.; Grado, A.; Rodriguez-Almeida, F.A. (2001). **Changes in critical variables of the slaughter process and their effect on pork quality.** *Journal of Animal Science* 79 (Supplement 2): 126, ISSN: 0021-8812.
Keywords: meat science, group stunning, meat science, muscle biology, physicochemical, pork characteristics, pork quality, slaughter process, meeting abstract.

Beattie, V.E.; Burrows, M.S.; Moss, B.W.; Weatherup, R.N. (2002). **The effect of food deprivation prior to slaughter on performance, behaviour and meat quality.** *Meat Science* 62(4): 413-418, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: food deprivation, meat quality, feeding behavior, production performance, dietary vitamin-E, feed

withdrawal, pork quality, carcass, weight, genotype, lairage, traits, stress.

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Keywords: androsterone, animal husbandry, animal production, animal welfare, boar taint, carcass grading, carcass quality, castration, consumer surveys, dark cutting meat, male animals, meat production, meat products, meat quality, pig manure, pig meat, processed products, production costs, quantitative analysis, quantitative techniques, reviews, sensory evaluation.

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Keywords: husbandry, animal welfare, loading, reviews, slaughter, stress factors, stunning, transport of animals, unloading.

Costa, L.N.; Fiego, D.P.L.; Dall, O.S.; Davoli, R.; Russo, V. (2002). **Combined effects of pre-slaughter treatments and lairage time on carcass and meat quality in pigs of different halothane genotype.** *Meat Science* 61 (1): 41-47, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: breed, Italian, heavy meat hogs, pre-slaughter treatment, stocking density, skin damage, fighting, carcass quality, evaluation, halothane, genotype, lairage time, meat quality.

Daxenberger, A.; Hageleit, M.; Kraetzl, W.D.; Lange, I.G.; Claus, R.; Le Bizec, B.; Meyer, H.H. (2001). **Suppression of androstenone in entire male pigs by anabolic preparations.** *Livestock Production Science* 69 (2): 139-144, ISSN: 0301-6226.
NAL Call No.: SF1.L5.
Keywords: boars, boar taint, Synovex H Plus, intramuscular implant, anabolic preparations, androstenone suppression, anabolic sex hormones, androstenone, slaughter, implantation site, hormone residues, above threshold values.

Eisemann, J.H.; Morrow, W.E.M.; See, M.T.; Davies, P.R.; Zering, K. (2002). **Effect of feed withdrawal prior to slaughter on prevalence of gastric ulcers in pigs.** *Journal of the American Veterinary Medical Association* 220 (4): 503-506. ISSN: 0003-1488.
NAL Call No.: 41.8 Am3.
Keywords: feed withdrawal, gastric ulcers, incidence, scoring system, slaughter.

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NAL Call No.: HV4701.A557.
Keywords: animal welfare, halothane gene, lairage, preslaughter, mortality rate, transport, quality.

Fabrega, E.; Manteca, X.; Font, J.; Gispert, M.; Carrion, D.; Velarde, A.; Ruiz-de-la-Torre, J.L.; Diestre, A. (2002). **Effects of halothane gene and pre-slaughter treatment on meat quality and welfare from two pig crosses.** *Meat Science* 62(4): 463-472, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: breed, Pietrain, Large White x Pietrain, gilts, halothane genotype, pre-slaughter, meat quality, animal welfare, carcass quality, stress susceptibility, growth performance, feed withdrawal, muscle quality, pork quality, lean growth, genotype, transport, sensitivity.

Faucitano, L. (2001). **Causes of skin damage to pig carcasses.** *Canadian Journal of Animal Science* 81 (1): 39-45, ISSN: 0008-3984.

NAL Call No.: 41.8 C163.
Abstract: Damage to the surface of the carcass after dehairing is a serious commercial problem, since it decreases the grade and subsequently the value of the carcass. In many countries, the incidence of skin damage on the carcass has not been considered to be a problem with high priority, as it seems to be easily solved by just trimming off the skin. However, the presence of an haematoma in the underlying tissue and its negative influence on meat quality must be taken into account. Some European Union (EU) countries are aiming at reducing the incidence of blemished carcasses in order to safeguard the image of the national pork sector for both domestic and exporting markets. Major factors responsible for the incidence of skin damage on the carcass are fighting among mixed groups of pigs and poor handling during the preslaughter stages. Recognition of the economical impact of these two factors on the slaughter pigs may lead to more welfare-friendly handling systems and to reduction in the practice of preslaughter mixing of animals.
Keywords: skin, damage, carcasses, carcass quality, measurement, meat quality, animal welfare, handling, animal husbandry, transport of animals, abattoirs.

Faucitano, L. (2001). **Effects of preslaughter handling on the pig welfare and its influence on meat quality.** In: *Proceedings of the 1st International Virtual Conference on Pork Quality: Welfare, Transport, Slaughter and Consumer, Concordia, Brazil, November 16- December 16, 2000*, EMBRAPA Suinos e Aves Documentos, 69, pp.52-71.
Keywords: animal welfare, carcass quality, loading, meat quality, pig meat, reviews, slaughter, stocking density, stress, transport of animals, unloading.

Geverink, N.A.; de Jong, I.C.; Lambooij, E.; Blokhuis, H.J.; Wiegant, V.M. (1999). **Influence of housing conditions on responses of pigs to preslaughter treatment and consequences for meat quality.** *Canadian Journal of Animal Science* 79(3):285-291, ISSN: 0008-3984.
NAL Call No.: 41.8 C163.
Keywords: pig housing, meat quality, hydrocortisone, farrowing, finishing, handling, pens, stress, straw, litter, transport of animals, animal welfare.

Grandin, T. (2003). **Transferring results of behavioral research to industry to improve animal welfare on the farm, ranch and the slaughter plant.** *Applied Animal Behaviour Science* 81(3): 215-228, ISSN: 0168-1591.
NAL Call No.: QL750.A6.
Keywords: cattle, pigs, slaughter, restraint, handling, welfare, auditing, technology transfer.

Grandin, T. (2001). **Solving return to sensibility problems after electrical stunning in commercial pork slaughter plants.** *Journal of the American Veterinary Medical Association* 219 (5): 608-611, ISSN: 0003-1488.
NAL Call No.: 41.8 Am3.
Keywords:electronarcosis, slaughter, abattoirs, reflexes, eyes, animal welfare.

Hamilton, D.N.; Ellis, M.; Wolter, B.F.; McKeith, F.K.; Wilson, E.R. (2003). **Carcass and meat quality characteristics of the progeny of two swine sire lines reared under differing environmental conditions.** *Meat Science* 63 (2): 257-263, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: barrow, breed, Duroc, Landrace, Large White, Pietrain, gilt, sire lines, longissimus muscle, slaughter, production method, carcass quality, crowded environment, dressing percentage, environmental conditions, genetic differences, pork meat, drip loss, marbling fat content, meat product, pH, paleness, quality, softness, progeny, rearing environment, spacious environment.

Hamman, L.L.; Gentry, J.G.; Ramsey, C.B.; McGlone, J.J.; Miller, M.F. (2001). **The effect of vitamin-mineral nutritional modulation on the pork quality of halothane carriers.** *Journal of Muscle Foods* 12 (1): 37-51, ISSN: 1046-0756.
NAL Call No.: TX556 M4J68.

Keywords: feed supplements, genes, genetics, halothane, preslaughter stress, meat quality, minerals, muscles, nutrition, storage quality, vitamins, water holding capacity, meat color.

Hurd, H.S., McKean, J.D., Wesley, I.V., Karriker, L.A. (2001). **The effect of lairage on Salmonella isolation from market swine.** *Journal of Food Protection* 64 (7): 939-944, ISSN: 0362-028X.
NAL Call No.: 44.8 J824.
Keywords: market pigs, lairage, transport, slaughter, abattoir, holding pens, Salmonella, isolation, fecal samples, distal colon, ileocecal lymph nodes, cecal contents, ventral thoracic lymph nodes, subiliac lymph nodes, carcass swabs, ELISA, detection, labeling techniques, food hygiene, food microbiology, food protection.

Jonsall, A.; Johansson, L.; Lundstrom, K. (2001). **Sensory quality and cooking loss of ham muscle (M. biceps femoris) from pigs reared indoors and outdoors.** *Meat Science* 57 (3): 245-250. ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: ham, meat quality, flavor, tastes, odors, water content, cooking quality, cooking losses, tenderness, farming, housing, pens, free range husbandry, pigs, alleles, genotypes, juiciness, outdoor rearing, acidulous taste, genetics.

Kerth, C.R.; Carr, M.A.; Ramsey, C.B.; Brooks, J.C.; Johnson, R.C.; Cannon, J.E.; Miller, M.F. (2001). **Vitamin mineral supplementation and accelerated chilling effects on quality of pork from pigs that are monomutant or noncarriers of the halothane gene.** *Journal of Animal Science* 79 (9): 2346-2355, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: barrows, gilts, vitamin and mineral supplementation, finishing diet, growth, accelerated chilling of carcasses, carcass and muscle traits, halothane gene carrier versus noncarrier pigs, vitamin E, exudative meat, meat quality, pork quality.

Klont, R.E.; Hulsegge, B.; Hoving-Bolink, A.H.; Gerritzen, M.A.; Kurt, E.; Winkelman-Goedhart, H.A.; de Jong, I.C. (2001). **Relationships between behavioral and meat quality characteristics of pigs raised under barren and enriched housing conditions.** *Journal of Animal Science* 79 (11): 2835-43, ISSN: 0021-8812.
NAL Call No.: 49 J82
Abstract: In this study the effects of barren vs enriched housing conditions of pigs on their behavior during the lairage period (2-h holding period before slaughter), carcass characteristics, postmortem muscle metabolism, and meat quality were studied. The barren housing system was defined by common intensive housing conditions (i.e., with slatted floors and recommended space allowances), whereas the enriched environment incorporated extra space and straw for manipulation. Salivary cortisol concentrations were measured before transport and at the end of the lairage period. During the lairage period the percentage of time spent walking and fighting by the pigs was registered. Carcass characteristics such as weight, meat percentage, and backfat thickness were determined. At 5 min, 45 min, 4 h, and 24 h postmortem, pH, temperature, and lactate concentrations were determined in the longissimus lumborum (LL) and biceps femoris (BF) muscles. Capillarization of the muscle, mean muscle fiber area, and color and drip loss after 2 and 5 d of storage were determined for both muscle types. Pigs from the barren environment had a significantly higher increase in cortisol from farm to slaughter, but no differences in behavior were observed during the lairage period. Carcass characteristics did not differ between pigs from barren and those from enriched housing conditions. Postmortem lactate formation was significantly lower in LL muscles of enriched pigs at 4 and 24 h postmortem. Capillary density and mean muscle fiber area did not differ between the groups of pigs. The percentage of drip loss at 2 and 5 d after storage of LL muscle samples from enriched-housed pigs was significantly lower than that of the barren-housed pigs. Similar tendencies were found for the BF muscle from pigs kept in an enriched environment, but these were not statistically significant. The housing system did not affect meat color. It is concluded that on-farm improvement of animal welfare by environmental enrichment can also lead to beneficial economic effects after slaughter by improving the water-holding capacity of pork.
Keywords: husbandry, handling, housing, meat standards, physiology, abattoirs, animal welfare, behavior, psychology, hydrocortisone, blood, hydrogen-ion concentration, lactic acid, metabolism, skeletal muscle chemistry.

Machado Filho, L.C.P. (2001). **Pig welfare and meat quality. A Brazilian view.** *In: Proceedings of the 1st International Virtual Conference on Pork Quality: Welfare, Transport, Slaughter and Consumer, Concordia, Brazil, November 16- December 16, 2000*, EMBRAPA Suinos e Aves Documentos, 69, pp.32-38.
Keywords: husbandry, animal welfare, cholesterol, consumer preferences, consumer surveys, consumption, flavor, food safety, meat quality, nutritive value, organic foods, public opinion, Brazil, South America.

Maes, D.G.; Deluyker, H.; Verdonck, M.; Castryck, F.; Miry, C.; Vrijens, B.; Ducatelle, R.; De Kruif, A. (2001). **Non-infectious factors associated with macroscopic and microscopic lung lesions in slaughter pigs from farrow-to-finish herds.** *Veterinary Record: Journal of the British Veterinary Association* 148 (2): 41-6, ISSN: 0042-4900.
NAL Call No.: 41.8 V641.
Abstract: A cross-sectional epidemiological study was conducted in 150 randomly selected farrow-to-finish herds to investigate which non-infectious factors might act as risk indicators for the prevalence and severity of macroscopic and microscopic lung lesions in slaughter pigs. Data were collected during herd visits through inspections of the pigs and through interviews with the farmers. Macroscopic lung lesions of pneumonia and pleuritis were recorded at slaughter from 25 pigs per herd, and microscopic lung lesions of lymphohistiocytic infiltration were recorded from 10 pigs per herd. The median herd level prevalences were 24 per cent for pneumonia, 16 per cent for pleuritis and 60 per cent for lymphohistiocytic infiltration. Pneumonia lesions were negatively associated with pleuritis lesions and positively associated with lymphohistiocytic infiltration. Pleuritis lesions were negatively associated with lymphohistiocytic infiltration. The prevalence and the severity of pneumonia lesions were increased by a high frequency of purchasing gilts and by a slaughter date in January to February. The presence of a growing unit also increased the severity of pneumonia. The prevalence and the severity of pleuritis lesions were higher when there were more pig herds in the municipality, and when there were poor biosecurity measures, and their prevalence was increased by a slaughter date in January to February, and their severity by a slaughter date in March to April. An increase in the airspace stocking density in the finishing unit also increased the prevalence of pleuritis. The prevalence and the severity of lymphohistiocytic infiltration in the lung tissue were higher in herds purchasing gilts. Pigs raised in pens with slatted floors were also at higher risk of more severe lesions of lymphohistiocytic infiltration.
Keywords: lung, pathology, pleurisy, pneumonia, disease, epidemiology, cross-sectional studies, epidemiologic studies, prevalence, risk factors, seasons.

Matthews, J.O.; Southern, L.L.; Bidner, T.D.; Persica, M.A. (2001). **Effects of betaine, pen space, and slaughter handling method on growth performance, carcass traits, and pork quality of finishing barrows.** *Journal of Animal Science* 79 (4): 967-974, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Abstract: An experiment was conducted to determine the effects of betaine, pen space, and preslaughter handling method on growth, carcass traits, and pork quality of finishing barrows. For the growth trial, a 2 x 2 factorial arrangement of treatments was used: betaine (0 or 0.250%) and(or) pen space (m2/pig, adequate, 0.035 BW0.67 kg, or inadequate, 0.025 BW0.67 kg). Each treatment was replicated five times with four barrows per replicate. At trial termination, two barrows from each pen were selected to receive either minimal or normal preslaughter handling. Reducing pen space decreased ($P < 0.05$) overall ADFI. Betaine had no affect ($P > 0.10$) on overall ADG, ADFI, or gain:feed. Pigs fed betaine had decreased ($P < 0.10$) carcass length. Other carcass and ham measurements were not affected ($P > 0.10$) by betaine. Pigs with inadequate pen space had increased ($P < 0.10$) ultimate pH, subjective color, cooking loss (fresh and frozen chop), and shear force but decreased rectal temperature, loin muscle CIE L*, biceps femoris CIE b*, and drip loss. Pigs subjected to minimal preslaughter handling had decreased ($P < 0.10$) rectal temperature, plasma cortisol, loin muscle CIE b*, and fresh chop total loss (drip + cooking loss). Pigs fed betaine had increased ($P < 0.01$) initial pH and decreased ($P < 0.10$) drip loss (fresh chop). Cooking loss and total loss (frozen chop) were decreased in pigs fed betaine with adequate pen space but increased in pigs fed betaine with inadequate pen space (betaine x pen space, $P < 0.01$). Pigs fed betaine may have improved pork quality.
Keywords: pigs, betaine, stocking density, floor space, liveweight gain, feed conversion, feed intake, body temperature, animal husbandry, slaughter, dressing percentage, fat thickness, ham, pH, color, losses, blood

plasma, urea, hydrocortisone, animal handling, marbling, drip loss.

Maw, S.J.; Fowler, V.R.; Hamilton, M.; Petchey, A.M. (2001). **Effect of husbandry and housing of pigs on the organoleptic properties of bacon.** *Livestock Production Science* 68 (2/3): 119-130. ISSN: 0301-6226,
NAL Call No.: SF1.L5.
Keywords: husbandry, housing, bacon, organoleptic traits, food quality, sensory evaluation, feeds, genotypes, ammonia, hygiene, dust, male animals, female animals, taste panels, straw, Scotland.

Mitchell, A.D.; Scholz, A.M.; Wang, P.C.; Song, H. (2001). **Body composition analysis of the pig by magnetic resonance imaging.** *Journal of Animal Science* 79 (7): 1800-1813, ISSN: 0021-8812.
NAL Call No.: 49 J82.
Keywords: magnetic resonance imaging, in vivo, organs, tissue analysis, proteins analysis, applications, imaging method.

Morrow, W.E.M.; See, M.T.; Eisemann, J.H.; Davies, P.R.; Zering, K. (2002). **Effect of withdrawing feed from swine on meat quality and prevalence of Salmonella colonization at slaughter.** *Journal of the American Veterinary Medical Association* 220 (4): 497-502. ISSN: 0003-1488.
NAL Call No.: 41.8 Am3.
Keywords: feed withdrawal, pathogen, Salmonella, digestive system disease, redness score, assessment method, meat product, meat quality, slaughter.

Murray, A.; Robertson, W.; Nattress, F.; Fortin, A. (2001). **Effect of pre slaughter overnight feed withdrawal on pig carcass and muscle quality.** *Canadian Journal of Animal Science* 81 (1): 89-97, ISSN: 0008-3984.
NAL Call No.: 41.8 C163.
Keywords: market pigs, overnight fast, abattoir, lairage times, pig carcass, gut contents, longissimus thoracis muscle, carcass contamination, carcass quality, carcass skin damage, feed restriction, liveweight yield, muscle color, muscle quality, meat quality.

Murray, A.C. (2001). **Reducing losses from farm gate to packer. A Canadian's perspective.** In: *Proceedings of the 1st International Virtual Conference on Pork Quality: Welfare, Transport, Slaughter and Consumer, Concordia, Brazil, November 16- December 16, 2000*, EMBRAPA Suinos e Aves Documentos, 69, pp.72-83.
Keywords: husbandry, animal welfare, carcass quality, carcass weight, carcass yield, handling, losses, meat quality, microbial contamination, mortality, reviews, slaughter, stocking density, transport of animals, wastage, North America.

Raj, A.B.M. (1999). **Behaviour of pigs exposed to mixtures of gases and the time required to stun and kill them: welfare implications.** *The Veterinary Record: Journal of the British Veterinary Association* 144(7):165-168, ISSN: 0042-4900.
NAL Call No.: 41.8 V641.
Keywords: pigs, stunning, animal welfare, animal behavior, time consciousness, argon, carbon dioxide, feasibility studies.

Rosenvold, K.; Andersen, H. J. (2003). **The significance of pre-slaughter stress and diet on colour and colour stability of pork.** *Meat Science* 63 (2): 199-209, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Abstract: The influence of pre-slaughter stress and a diet known to affect post mortem muscle metabolism or a standard diet (control pigs) on colour and colour stability of M. longissimus dorsi, M. biceps femoris and M. semimembranosus from 112 female pigs, free of the Halothane gene, was investigated. Pre-slaughter stress increased the early post mortem temperature in the 3 muscles, as well as the pH decline in control pigs, but not in pigs fed the experimental diet. Colour was measured on sliced samples after 0, 2 and 5 days retail display (1, 3 and 6 days post mortem, respectively) from the 3 muscles aged 1 day before cutting as well as on sliced M. longissimus dorsi samples aged 8 days before cutting (8, 10 and 13 days post mortem, respectively). Early post mortem pH was not a main determinant of the colour and colour stability, while the degree of pre-slaughter

stress and especially its influence on temperature early post mortem was crucial in relation to colour development and colour stability. The discoloration rate was enhanced in M. longissimus dorsi aged for 8 days prior to retail display compared with samples aged for 1 day. However, the extent of the discoloration after 5 days of retail display was not inferior in muscle samples aged for 8 days due to a higher degree of blooming. Finally, present data indicate that 3-4 days ageing of pork prior to retail display results in the optimal colour stability.

Keywords: aging, color, diets, discoloration, exercise, muscles, pig meat, postmortem changes, slaughter, stability, storage, stress, temperature.

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Scipioni, R.; Martelli, G. (2001). **Consequences of the use of ensiled sugar beet pulp in the diet of heavy pigs on performances, carcass characteristics and nitrogen balance: A review.** *Animal Feed Science and Technology* 90 (1-2): 81-91, ISSN: 0377-8401.

NAL Call No.: SF95.A55.

Keywords: heavy pigs, nutrition, animal feed, pressed beet pulp silage, nitrogen balance, barley, carcass characteristics, growth, live weight, organic matter digestibility, slaughter.

Shelton, J.L.; Hemann, M.D.; Strode, R.M.; Brashear, G.L.; Ellis, M.; McKeith, F.K.; Bidner, T.D.; Southern, L.L. (2001). **Effect of different protein sources on growth and carcass traits in growing finishing pigs.** *Journal of Animal Science* 79 (9): 2428-2435, ISSN: 0021-8812.

NAL Call No.: 49 J82.

Keywords: animal feed, protein, different protein source effects, soybean meal, carcass trait, growing finishing.

Sinclair, P.A..; Squires, E.J.; Raeside, J.I. (2001). **Early postnatal plasma concentrations of testicular steroid hormones, pubertal development, and carcass leanness as potential indicators of boar taint in market weight intact male pigs.** *Journal of Animal Science* 79 (7): 1877-1882, ISSN: 0021-8812.

NAL Call No.: 49 J82.

Keywords: market pigs, breed, Yorkshire, male, early postnatal biochemical analysis, testicular steroid hormones, market weights, boar taint, potential indicators, carcass leaness, meat quality, pubertal development.

Stoier, S.; Aaslyng, M.D.; Olsen, E.V.; Henckel, P. (2001). **The effect of stress during lairage and stunning on muscle metabolism and drip loss in Danish pork.** *Meat Science* 59 (2): 127-131, ISSN: 0309-1740.

NAL Call No.: TX373.M4.

Abstract: The effect on meat quality of a low stress handling system (LSS) compared with a traditional handling system (TS) was investigated in Duroc x (Landrace x Yorkshire, n = 117) and (Hampshire x Duroc) x (Landrace x Yorkshire) pigs (n = 110) under commercial conditions. In the low-stress handling system the pigs were kept in groups of 15 during lairage and movement up to the stunner. Before the stunner the groups were divided into three groups of five pigs for the C02-stunning in a specially designed set-up. The pH and temperature were determined in m. longissimus dorsi (LD) and m. biceps femoris (BF) at various times post mortem. Immediately after exsanguination a biopsy was taken from the LD and analysed for the concentration of glycogen, lactate and creatine phosphate. The day after slaughter the pH was determined in the LD, BF, m. semimembranosus (SM) and m. semispinalis capitis (SC). The temperature was determined in the LD and BF, the internal reflectance was determined in the LD, SM and BF, the colour was determined in LD, the drip loss was determined in LD and BF, and the amount of blood splashing/bruising was evaluated in LD. There was a tendency for a higher concentration of creatine phosphate in the LSS-group ($P=0.06$). The pH in both the LD and BF on the day of slaughter decreased more slowly from 5 min post mortem to 40 min post mortem in the LSS-group than in the TS-group ($P < 0.001$). From 40 min to 6 h post mortem the rate of the pH decline was similar in the two groups producing the lowest pH-level in the TS group. The day after slaughter the pH was similar in the two groups in the LD and SC, whereas in the BF and SM it was lower in the LSS-group than in the TS-group. The drip loss was lower in the LSS-group in both LD ($P < 0.01$) and BF ($P < 0.05$) whereas the internal reflectance was only different in LD with the lowest value in the LSS-group ($P < 0.001$). The lightness (L^*) was higher in the LSS-group ($P < 0.05$). There was no effect of stunning system on the amount of blood splashing/bruising in the LD. The study showed that by using a low stress stunning system it is possible to decrease drip loss, possibly by increasing the concentration of creatine phosphate and thereby delaying the

acceleration of pH fall in muscles after death.
Keywords: breeds, crossbreds, Duroc, Danish Landrace, Hampshire, pens, abattoirs, stunning, stress, pork, water holding capacity, skeletal muscle, glycogen, lactic acid, phosphocreatine, color, pH, meat quality, postmortem changes, drip loss, low stress stunning, Denmark.

Swanenburg, M.; Urlings, H.A.P.; Keuzenkamp, D.A.; Snijders, J.M.A. (2001). **Salmonella in the lairage of pig slaughterhouses.** *Journal of Food Protection* 64 (1): 12-16, ISSN: 0362-028X.
NAL Call No.: 44.8 J824.
Abstract: The purpose of this study was to determine if lairages of pig slaughterhouses can act as a source of contamination of slaughtered pigs with Salmonella. The prevalence and variety of serotypes of Salmonella in the lairages of two pig slaughterhouses in Netherlands (date not given) were determined, and the efficacy of the usual cleaning and disinfection on the presence of Salmonella was estimated. Lairages of two pig slaughterhouses were sampled three times when pigs were present. Furthermore, these lairages were sampled after the usual cleaning and disinfection, whereas the lairage of one slaughterhouse was sampled an additional time after improved cleaning and disinfection. Samples were collected by swabbing floor and wall surfaces and collecting the residing fluids on the floor throughout the lairage. Salmonella was isolated in 70 to 90% of the samples when pigs were present. The usual cleaning and disinfection reduced the level of contamination with Salmonella to 25% positive samples, whereas improved cleaning and disinfection reduced this level to 10% positive samples. It is concluded that the waiting period in the lairage of at least 2 hours contains a substantial risk for slaughter pigs to become infected with Salmonella, especially for pigs originating from Salmonella-free herds. The usual cleaning and disinfection of the lairage were not sufficient to eliminate this risk, whereas an improved procedure for cleaning and disinfection still was unsatisfactory.
Keywords: abattoirs, cleaning and sterilizing, disinfection, microbial contamination, bacteria, serotypes, stress, salmonella, Netherlands.
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Swanenburg, M.; Urlings, H.A.P.; Snijders, J.M.A.; Keuzenkamp, D.A.; Van Knapen, F. (2001). **Salmonella in slaughter pigs: Prevalence, serotypes and critical control points during slaughter in two slaughter houses.** *International Journal of Food Microbiology* 70 (3): 243-254, ISSN: 0168-1605.
NAL Call No.: QR115 I57.
Keywords: Salmonella contamination, slaughter, bacterial carcass contamination, immune system, lymph nodes, tonsils, liver, rectum, analysis, critical control points, disinfection, environmental samples, microbial analysis, food hygiene, food microbiology, food processing, pork, bacterial prevalence studies, meat product, meat quality, slaughter houses, Netherlands.

Van, O.M.; Warnants, N.; Boucque, C.V.; Delputte, P.; Depuydt, J. (2001). **The preference of the consumer for pork from homozygous or heterozygous halothane negative animals.** *Meat Science* 58 (3): 247-251, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: human, taste preferences, taste tests, swine, heterozygous halothane negative, homozygous halothane negative, meat industry, food quality, consumer preferences, cooking loss, drip loss, meat, quality, shear force.

Velarde, A.; Gispert, M..; Faucitano, L.; Alonso, P.; Manteca, X.; Diestre, A. (2001). **Effects of the stunning procedure and the halothane genotype on meat quality and incidence of haemorrhages in pigs.** *Meat Science* 58 (3): 313-319, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: halothane free, slaughter, abattoirs, stunning systems, head only, head to chest, electrical stunners, carbon dioxide (CO2) stunning system, meat quality, loin muscle, pale, soft and exudative (PSE) meat, hematomas in the shoulders, loins and hams, halothane gene.

Warriss, P.D.; Brown, S.N. (2001). **Pig welfare and meat quality: a United Kingdom view.** In: *Proceedings of the 1st International Virtual Conference on Pork Quality: Welfare, Transport, Slaughter and Consumer, Concordia, Brazil, November 16- December 16, 2000*, EMBRAPA Suinos e Aves Documentos, 69, pp.17-19.

Keywords: animal welfare, consumer preferences, dark cutting meat, exudative meat, handling, meat quality, reviews, slaughter, stress, United Kingdom.

Wolter, B.F.; Ellis, M. (2001). **The effects of weaning weight and rate of growth immediately after weaning on subsequent pig growth performance and carcass characteristics.** *Canadian Journal of Animal Science* 81 (3): 363-369, ISSN: 0008-3984.
NAL Call No.: 41.8 C163.
Keywords: backfat, carcass quality, growth rate, liveweight gain, heavy versus light pigs, weaning weight.

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Stockmanship

Boivin, X., J.A. Lensink, C.A. Tallet, and I.A. Veissier (2003). **Stockmanship and farm animal welfare.** *Animal Welfare* 12(4): 479-492. ISSN: 0962-7286.
NAL Call Number: HV4701.A557
Abstract: Human factors (attitudes, personality traits, self-esteem, job satisfaction) strongly determine our behavior towards animals, animal production and animal welfare. Recent studies have emphasised positive human contacts as indicators of a stockperson's positive attitude towards animals and towards animal welfare in general. Stockmanship can be improved by careful selection of people and/or by training. However, little is known of the biological basis of the effect of stock handling procedures on the welfare of animals. The animal's perception of the stockperson (based both on emotional responses and cognitive aspects such as anticipation, recognition and categorisation), and the existence of sensitive periods in an animal's life, need to be explored in more depth, especially under farm conditions. We need to consider the complexity of human behavior (eg husbandry practices, balance between positive and negative interactions, predictability, controllability) and its effect on animal welfare from the animal's point of view throughout its whole life. This paper identifies the importance of positive human contacts for both animals and stockpeople, and highlights the challenge to maintain such positive contacts despite the trend in modern agriculture to increase the number of animals per stockperson. This requires better knowledge of animal genetics, socialisation to humans during sensitive periods, and management of the social group. We emphasise the ethical importance of the human-animal relationship in the context of farm animal welfare and productivity.
Descriptors: animal husbandry: agriculture, behavior, veterinary medicine: medical sciences, animal production, animal welfare, fear, human animal interaction, human animal relationship, perception, stockmanship.

Carr, J. (2009). **Herramientas basicas para controlar el ambiente en las explotaciones. [Environmental medicine tool box.]**. *SUIS*(57): 24...37. ISSN: 1699-7867.
Abstract: After 25 years of practicing veterinary medicine, the lesson I have learnt is that (excluding PMWS) almost all of the day to day conditions/disorders of the pig can be traced back to problems with stockmanship and man's manipulation of the pig's environment. Even in cases of postweaning multisystemic wasting syndrome (PMWS), a biosecurity breach lies at the bottom of the problem There is no excuse for pre- or postweaning diarrhoea, pneumonia or lameness issues on most farms. The majority of reproductive issues must be resolved by the stockperson. The veterinarian must recognize the impact of the environment in management of stress of pigs under their care and take positive holistic action to resolve the underlying issues, rather than just reaching for a convenient quick fix of medicine.
Descriptors: aetiology, animal health, diarrhoea, disease control, disease prevention, environmental factors, hygiene, lameness, pig housing, pneumonia, reproductive disorders, risk factors, stress, swine diseases, pigs, Porcine circoviruses.
Language of Text: Spanish, LS=English.

Darekar, S.D., C.V. Savalia, and V.K. Sharma (2007). **Antomicrobial residues in food stuffs of animal origin: public health concern**. *Veterinary World* 6(4): 115-118. ISSN: 0972-8988.
NAL Call Number: SF604 .V48
Abstract: Antimicrobial drugs are used to control, prevent and treat infection and to enhance animal growth and feed efficiency. Treatment of animals reared for food, especially pigs and poultry, is generally directed at groups or herds of animals. Currently, approximately 80% of all food-producing animals receive medication for part or most their lives. The main infectious diseases treated are enteric and pulmonary infections, mastitis and skin and organ abscesses. The prevalence of pathogens on farms depends on many factors, not least the type of husbandry, the environmental pressure on a farm and the standard of stockmanship. Factors related to farm management help to minimize the use of antimicrobials. However, even if well managed, the increased density of livestock or poultry in intensive rearing operations requires an aggressive approach to disease control, which can lead to heavy prophylactic and therapeutic antimicrobial use. However, there has been some concern about the use of antimicrobial in food animals resulting in residues in foodstuff of animal origin. Tissue residue means drug, pesticide or toxic breakdown product remaining in edible tissue, milk or egg after natural or technological processes of removal have been occurred. Residues in milk, meat and eggs are antibacterial drugs, hormones, growth promoters, pesticides, heavy metals and industrial chemicals.
Descriptors: aetiology, animal diseases, antibacterial agents, antiinfective agents, disease control, disease prevention, domestic animals, drug residues, drug therapy, drug toxicity, eggs, food contamination, food hygiene, food safety, growth promoters, heavy metals, intensive production, livestock, meat, milk, pesticide residues, poisoning, pollutants, pollution, poultry, public health, synthetic hormones, toxicity .

Dong, G.Z. and J.R. Pluske (2007). **The low feed intake in newly-weaned pigs: problems and possible solutions**. *Asian Australasian Journal of Animal Sciences* 20 (3): 440-452. ISSN: 1011-2367.
NAL Call Number: SF55.A78A7
Abstract: The low feed intake immediately after weaning is responsible for villous atrophy and reduced growth rate in newly-weaned pigs. Overcoming this drawback will produce beneficial results for swine producers, and this warrants an understanding of the factors affecting the feed intake in newly-weaned pigs. In fact, a plethora of factors exert influences on feed intake in newly-weaned pigs, and these factors encompass health status, creep feeding, weaning age, mixing of litters, environment, dietary nutrient level and balance, palatability of ingredients, forms of diet presentation, water supply and quality, and stockmanship. Due to the complexity of the factors that affect the feed intake of weaned pigs, a comprehensive approach should be adopted to overcome the low feed intake problem right after weaning. It warrants mention that it is almost impossible to completely restore the feed intake just after weaning to preweaning level in terms of energy intake through dietary means which are available for being practiced economically and/or technically in current swine production. However, a refined dietary regime will certainly alleviate the low feed intake problem in the immediate postweaning period.
Descriptors: development, nutrition, water quality, growth rate, health status, water supply, feed intake, weaning age, villous atrophy, creep feeding, litter mixing, dietary nutrient level, dietary balance, ingredient palatability, diet presentation form, stockmanship status.

Grandin, T. (2007). **Introduction: effect of customer requirements, international standards and marketing structure on the handling and transport of livestock and poultry**. T. Grandin *Livestock Handling and Transport*, CABI: Wallingford, UK, (Ed.3): 1-18 p. ISBN: 9781845932190; 1845932196.
NAL Call Number: SF88 .L58 2007
Abstract: This chapter discusses the increasing awareness of animal welfare around the world and outlines the effective auditing programmes on animal handling, truck loading and unloading and transport stocking density by large, corporate meat buyers. The importance of stockmanship and economic losses from bruising, weight loss and death losses in cattle and meat quality losses in pigs are also discussed.
Descriptors: animal welfare, death, livestock, livestock transporters, losses, meat quality, stocking density, stocking rate, transport of animals, cattle, pigs.

Heleski, C.R., A.G. Mertig, and A.J. Zanella (2006). **Stakeholder attitudes toward farm animal welfare**. *Anthrozoos* 19(4): 290-307. ISSN: 0892-7936.

Online: http://www.thepress.purdue.edu/
NAL Call Number: SF411.A57
Abstract: We developed a survey to measure attitudes toward farm animal welfare, then targeted two US groups considered highly influential in this area: veterinary college faculty members with large animal/food animal emphasis (VCF) and animal science faculty members (ANS). The survey was conducted via e-mail. E-mail addresses were gathered from 58 animal science departments and 27 veterinary college websites. Our respondents consisted of 446 ANS and 157 VCF In general, VCF had more empathetic attitudes toward farm animal welfare than did ANS. Both groups expressed greater comfort with the current production systems for beef and sheep than for meat birds and layers; dairy and swine were viewed intermediately. When asked about 15 specific husbandry practices/outcomes, more than 80% of our respondents agreed that three of these issues were concerns - flooring effects on lameness in intensively farmed animals, levels of lameness in dairy cattle, and poor/indifferent stockmanship. Four issues had less than 50% agreement - early weaning in pigs, lack of foraging substrate for pigs, beak trimming in poultry and toe trimming in poultry. Several background variables showed significant relationships with our summed attitude scale scores: females were more concerned about farm animal welfare than were males ($p<0.01$); those with liberal political views were more concerned than those with conservative views ($p<0.01$); and those expressing higher religiosity had less concern than those with lower religiosity ($p<0.05$). Age was not significantly related to animal welfare attitudes. When presented with a 7 -point scale where respondents could choose along a continuum between two anchor definitions and one midpoint definition "I believe in using animals for the greater human good, but we have an obligation to provide for the majority of their physiological and behavioral needs," 71% of VCF and 70% of ANS chose the mid-point. There was a significant correlation ($r=0.541$; $p<0.01$) between respondents' self appraisal on this 7-point scale and their summed scores on our scale of concern for animal welfare. When asked to identify obstacles to enhancing farm animal welfare (if they felt enhancements were necessary), over 60% of our respondents chose to provide an open-ended (qualitative) answer. The five most common themes mentioned were economics, lack of consumer willingness to pay, tradition, producer attitudes, and inadequate welfare science research.
Descriptors: animal welfare, attitudes, beef cattle, broilers, consumer attitudes, dairy cattle, floors, lameness, livestock, poultry, religion, sex differences, stocking density, stocking rate, surveys, teachers, traditions , veterinarians, weaning, cattle, fowls, goats, man, pigs, sheep.

Hemsworth, P.H. (2007). **Ethical stockmanship**. *Australian Veterinary Journal* 85(5): 194-200. ISSN: 0005-0423.
NAL Call Number: 41.8 Au72
Abstract: The objective of this review is to consider the ethics of stockmanship, particularly from the perspective of the nature and extent of the duties of stockpeople to their farm animals.It will consider what science tells us about the impact of stockmanship on the animal, particularly the welfare of the farm animal. The effects of human-animal interactions on the stock person will also be considered, since these interactions affect The work performance and job satisfaction of the stockperson and thus indirectly affect animal welfare. Animal ethics is broader than animal welfare and includes economic as well as philosophical, social, cultural and religious aspects. This paper is predicated on the view that farm animals can suffer, and that animal suffering is a key consideration in our moral obligations to animals.Housing and husbandry practices affect farm animal welfare and thus farmers and stockpeople have a responsibility to provide, at minimum, community-acceptable animal housing and husbandry standards for their animals. The farmer's or stockperson's attitudes and behaviour can directly affect the animal's welfare and thus they also have a responsibility to provide specific standards of stockmanship for these animals. However, research suggests that the behaviour of some stockpeople is not as correct as it might be. Such situations exemplify the inevitably unequal human - domestic animal relationship, and this inequality should be considered in analysing the boundary between right and wrong behaviour of humans. Thus ethical discussion, using science and other considerations and involving stockpeople, livestock industries, government and the general public, should be used to establish and assure acceptable stockperson competencies across the livestock industries. Training programs targeting the key attitudes and behaviour of stockpeople presently offer the livestock industries good opportunities to improve human-animal interactions.
Descriptors: animal husbandry: agriculture, philosophy and ethics, animal welfare, ethical issue, human animal interaction, ethical stockmanship, animal housing standards, husbandry standards.

Hemsworth, P.H. and G.J. Coleman (2011). ***Human-Livestock Interactions : the Stockperson and the Productivity and Welfare of Intensively-Farmed Animals***, 2nd. edition, CABI: Cambridge, MA, 216 p. ISBN: 9781845936730.
Descriptors: stockperson skills, knowledge, farm animal welfare, assessment, human-animal interactions, productivity, attitudes of stockpeople, stockperson behavior, animal behavior, models.

Mullan, S., A. Butterworth, H.R. Whay, S. Edwards, and D.C.J. Main (2010). **Consultation of pig farmers on the inclusion of some welfare outcome assessments within UK farm assurance**. *Veterinary Record* 166(22): 678-680. ISSN: 0042-4900.
Online: http://veterinaryrecord.bvapublications.com/archive/
NAL Call Number: 41.8 V641
Abstract: Fifty-six pig farmers who attended a series of health seminars completed a questionnaire to assess their attitude to the inclusion of some welfare outcome assessments within farm assurance. In answer to open questions, farmers were most commonly proud of the productivity (27.5 per cent) and welfare (23.5 per cent) of the pigs on their farm, and the welfare of pigs in the UK industry as a whole (26.1 per cent). The most common thing that farmers wanted to tell consumers about was the welfare of the pigs (55.8 per cent), followed by their stockmanship qualities, the quality of their pig meat and the safety of their pig meat (all 13.5 per cent). In answer to closed questions, 66 per cent of farmers stated they would be either quite willing or very willing to perform welfare self-assessments as part of farm assurance, and 66 per cent would be quite or very willing to be anonymously benchmarked on the welfare of their pigs.
Descriptors: animal production, animal welfare, farmers' attitudes, food quality, food safety, meat hygiene , meat quality, pig farmers, pig farming, pigmeat, questionnaires, pigs.

Munsterhjelm, C., A. Valros, M. Heinonen, O. Halli, and O. Peltoniemi (2006). **Welfare Index and Reproductive Performance in the Sow.** *Reproduction in Domestic Animals* 41(6): 494-500. ISSN: 0936-6768.
Online: http://dx.doi.org/10.1111/j.1439-0531.2006.00700.x
NAL Call Number: SF105.A1Z8
Abstract: To study the relationship between on-farm welfare and reproductive performance in the sow, the TGI 35L Animal Needs Index was modified for use in Finnish pig production. The modified index had a maximal total score of 100. It was comprised of six categories: 'locomotion' (maximal score 21 for dry sows and 11 for lactating sows), 'social interaction' (12/8), 'floor quality' (16/9), 'stable climate' (16/21), 'feeding' (16/23) and 'health and stockmanship' (19/29). Index scorings were performed separately in farrowing, breeding and gestation units on 28 representative Finnish sow farms. One-year production parameters were collected. Multiple linear regression was used for statistical analysis. Total ANI-points varied between 36.5-68.0 for lactating and 39.5-86.0 for dry sows. Litter size increased with increasing scores for 'feeding' in the dry sow unit. Controlling for breed, high scores for 'health and stockmanship' and 'floor quality' shortened the reproductive cycle, probably because of good leg health. The number of weaned piglets per sow per year (PSY) increased with increasing scores for dry sow 'health and stockmanship', 'floor quality' and an interaction of 'feeding' in the farrowing and mating units. PSY increased with decreasing scores for farrowing pen 'climate'. High-quality floors and stockmanship appear to correlate positively with reproductive performance in the sow. Effects of a welfare-promoting feeding strategy on reproduction are contradictory.
Descriptors: sows, food animals, animal welfare, animal reproduction, fecundity, locomotion, swine housing, animal behavior, animal health, swine feeding, air temperature, animal husbandry, farrowing, pregnancy, litter size, parturition interval, piglet, Finland, animal-social-interaction; Internet-resource.
Notes: Includes references.

Reynnells, R.D., Pork Checkoff Program United States, Cooperative State Research, Education and Extension Service, Plant and Animal Systems, Purdue University and Animal Welfare Information Center (U.S.). (2003). ***Proceedings, Symposium on Swine Housing and Well-Being, P.O.R.K. Academy 2002, Kent Feeds.***, Beltsville, Md.: U.S. Dept. of Agriculture, Agricultural Research Service, National Agricultural Library, Animal Welfare Information Center, [2003].: vi, 92 p.: ill.; 28 cm. p.
Online: http://purl.access.gpo.gov/GPO/LPS80574

NAL Call Number: aSF396.3 .S952 2002
Descriptors: sows, gestating, housing, design, group, outdoor, hoop barn, welfare, well-being, stockmanship, training, certification programs, United States Congress; pork industry, trade, moral and ethical aspects, public opinion, internet resource, proceedings.
Notes: "Co-sponsored by Pork Checkoff and the United States Department of Agriculture, Cooperative State Research, Education, and Extension Service, Plant and Animal Systems, Animal Well-Being Project funds administered by Purdue University." "Proceedings .. June 5, 2002, Des Moines, Iowa"--Cover. Shipping list no.: 2003-0264-P. "May 2003." Includes bibliographical references. Also available on the Internet.Contents: session 1. Stockmanship and training: An A and five E's : training stockpeople to be maximizers of pig state-of-being / Stanley E. Curtis ; Ethical considerations of pork production / W. Ray Stricklin ; Availability of resources, models, and training programs / Cynthia P. Smith (see Appendix F) ; Overview of the evaluation of stockmanship / Peter English -- session 2. Practical sow housing system design: Introduction / Larry R. Miller ; The crate / John McGlone ; Group housing of sows in small pens : advantages, disadvantages and recent research / E.A. Pajor ; Sow well -being in extensive gestating sow housing : outdoor and hoop barn systems / M.S. Honeyman ; Large group systems for gestating sows / Rebecca Morrison -- session 3. Consumer perspectives: Introduction / Lew Smith ; USDA Process Certified Program / James L. Riva.

Rushen, J. and A.M. Passille de (2009). **The importance of good stockmanship and its benefits for the animals**. T. Grandin *Improving Animal Welfare: a Practical Approach*, CABI: Wallingford, UK, p. 50-63. ISBN: 9781845935412.
NAL Call Number: HV4708 .I47 2010
Abstract: This chapter discusses the importance of good stockmanship for animal welfare, animal productivity and worker satisfaction. Topics include animal behaviour towards handling, negative effects of fearfulness on productivity, causes of poor stockmanship, attitudes and beliefs of stockpeople, improving stockmanship and assessing stockmanship based on farm audits.
Descriptors: animal behavior, animal production, animal welfare, attitudes, attitudes to work, auditing, beliefs, domestic animals, farm workers, fearfulness, handling, inspection, livestock, relationships, stockmen.

Scipioni, R., G. Martelli, and L.A. Volpelli (2009). **Assessment of welfare in pigs**. *Italian Journal of Animal Science* 8(Supplement 1): 117-137. ISSN: 1594-4077.
Online: http://www.aspajournal.it/index.php/ijas
NAL Call Number: SF1 .I83
Abstract: Animal welfare represents the state of well-being brought about by meeting the physical, environmental, nutritional, behavioural and social needs of the animal or groups of animals under the care, supervision or influence of people. Suitable husbandry techniques and disease control (in which man is directly involved) may satisfy an animal's physical, environmental and nutritive needs. However, it cannot be stated that people's supervision or influence always guarantee the satisfaction of behavioural and social needs. Thus, special attention must be paid to these factors in intensive husbandry. This paper focuses on the main factors characterizing pig welfare based on the productive, physiological, pathological and behavioural indicators; behavioural needs, which are characterized by several traits (it is noteworthy that, since the beginning, all categories of reared pigs are involved in welfare legislation); categories of pigs that often show the effects of negative stimuli on their behaviour (limitations, variations); main critical points on the farm likely to cause welfare impairment or stress including buildings, inner facilities, space allowance, microclimate, lighting systems, environmental stressors, feeding management, mutilations, weaning, social factors, and stockmanship; and environmental stressors including dust, odours (especially ammonia) and noises. This paper takes into account sources, effects and possible solutions for noises; the positive effect of fibrous feeding; environmental enrichment and other possible techniques for improving social status and for preventing or reducing stereotypic behaviour and abnormal reactions. The scientific or objective evaluation of welfare for intensively reared pigs may be carried out by means of direct observation of the animals themselves (animal-based or encompassing performance or output criteria), as well as through examinations of a structural nature (design or resource-based, or derived from engineering or input criteria). Preference should be given to the former since they are can be better adapted to the different pig categories and management systems. Design criteria, on the other hand, are easier to evaluate and they should integrate animal criteria. Thus, the most correct protocols for on-farm

evaluation of pig welfare should involve both animal-based criteria and design criteria. Examples of both criteria are reported herein. In extensive farming which includes (although somewhat improperly) outdoor and organic farming, achieving a good level of welfare is one of the declared objectives. However, there are several causes of welfare impairment that can be successfully overcome only when highly professional workers are employed: unfavourable climate, parasitic diseases, intake of plants containing poisons or antinutritional factors, high piglet mortality.
Descriptors: animal behavior, animal housing, animal husbandry, animal welfare, environmental factors, farm management, nutrition programmes, reviews, space requirements, stress, stress response, pigs.
Language of Text: French.
Notes: Special Issue: Criteria and methods for the assessment of animal welfare.

Szuecs, E., R. Geers, and E.N. Sossidou (2009). **Stewardship, stockmanship and sustainability in animal agriculture**. *Asian Australasian Journal of Animal Sciences* 22(9): 1334-1340. ISSN: 1011-2367.
NAL Call Number: SF55.A78A7
Abstract: Sufficient food supply for all humans was, is, and will remain one of the main priorities for mankind. The choice between food from crops or animals is related to philosophical, religious and ethical, but also cultural and economical, values. However, the concept of sustainable agriculture takes into account the organization of food supply through future generations. Not only quantity, but also quality is important, especially in relation to food safety and the method of production. Specifically, the aspect of animal welfare is becoming increasingly important with the focus on stewardship and stockmanship, i.e. responsibility of humans for their animals. In the future. implications for sustainability in animal production may be of more concern to stewardship paired by stockmanship, responsibility consciousness and morality. The moral as a basic concept of sustainable agriculture is to maintain continuous development in harmony with nature to meet requirements in the world for living creatures including human beings to live in and steward. The objective of this paper is to discuss the above issues from different viewpoints on sustainable food supply, increasing food consumption and environmental protection.
Descriptors: animal care, animal welfare, stockmanship, stewardship, human responsibility.

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Transport

Aaslyng, M.D.; Gade, P.B. (2001). **Low stress pre-slaughter handling: effect of lairage time on the meat quality of pork.** *Meat Science* 57 (1): 87-92, ISSN: 0309-1740.
NAL Call No.: TX373.M4.
Keywords: pens, duration, time, mental stress, prevention, handling, slaughter, pork, meat quality, water holding capacity, pH, exudative meat, temperature, time in holding pens, drip loss.

Agricultural Marketing Service (1999). ***A Guide for Livestock Exporters*** [computer file]. U.S. Dept. of Agriculture, Agricultural Marketing Service, Transportation and Marketing Division: Washington, D.C. Available online at http://www.ams.usda.gov/tmd/livestock/contents.htm
NAL Call No.: aSF89 G84 1999.
Keywords: transportation of livestock, guidelines, exporters, marketing, air transportation, freight forwarders, ocean carriers, inspection facilities.

Apple, J.K.; Kegley, E.B.; Rakes, L.K.; Anschutz, K.S.; Wistuba, T.J.; Maxwell, C.V. (2001). **Effects of supplemental magnesium and short term transportation stress on pork quality.** *Journal of Animal Science* 79 (Supplement 2): 9, ISSN: 0021-8812.
NAL Call No.: 49 J82.

Keywords: transportation stress, short term, longissimus muscle, meat science, pork quality, supplemental magnesium, food supplement, meeting abstract.

Berry, R.J. Lewis, N.J. (2001). **The effect of duration and temperature of simulated transport on the performance of early-weaned piglets.** *Canadian Journal of Animal Science* 81 (2): 199-204. ISSN: 0008-3984.
NAL Call No.: 41.8 C163.
Abstract: The responses and tolerances of early-weaned piglets to transport are not well documented. It is believed that the additive stress incurred by transporting early-weaned pigs predisposes them to increased disease risk and compromised performance. The objective of this work was to investigate the relationship between two primary transportation stressors, duration and temperature, and their effects on piglet performance. Prior to housing on flatdecks at 30 degrees C, transport was simulated by placing 17-d (+/- 1 d) old weaned piglets into wooden boxes of dimensions 1.2 x 1.2 x 1 m (space allowance range 0.18 to 0.36 m2 pig(-1)) with straw bedding. Two trials were conducted. In each trial, 96 piglets were randomly mixed in groups of four and assigned to the following simulated transport durations: no transport (control), 6 h, 12 h (Trial 2 only) and 24 h. Piglets undergoing transport simulation were kept at one of the following temperatures 20, 25 (Trial 1 only), 30 and 35 degrees C. There was a significant interactive effect between transport duration and temperature upon liveweight change in the first 24 h in both trials (P < 0.01). The animals that incurred the greatest liveweight deficit after weaning relative to untransported control groups were predominantly either those that had been transported for 24 h at high transport temperatures (35 and 30 degrees C) or those transported for 6 h at 20 degrees C in Trial 1 and 35 degrees C in Trial 2. The effect of simulated transport was measureable for up to 5 d post-transport. However, by 14 d post-transport there was no detectable influence of transport treatment on feed consumption or weight gain (P > 0.05). The study found piglets are able to recover and perform adequately in the early post-weaning period if extremes of transport duration and temperature are avoided.
Keywords: piglets, transport of animals, duration, environmental temperature, early weaning, simulation, liveweight, liveweight gain, feed intake, physiology.

Bradshaw, R.H.; Randall, J.M.; Forsling, M.L.; Rodway, R.; Goode, J.A.; Brown, S.N.; Broom, D.M.(1999). **Travel sickness and meat quality in pigs.** *Animal Welfare* 8(1):3-14, ISSN:0962-7286.
NAL Call No.: HV4701.A557.
Keywords: pigs, transport of animals, nausea, morbidity, stunning, slaughter, blood plasma, hydrocortisone, endorphins, muscles, longissimus dorsi, pork, meat, meat quality, exudative meat, dark cutting meat, vasopressin, animal welfare.

Christensen, L.; Gade, P.B. (1999). **Temperature profile in double-decker transporters and some consequences for pig welfare during transport.** In: *Farm Animal Welfare, Who Writes the Rules? Proceedings of an International Symposium Organized by the British Society of Animal Science, Edinburgh, UK, 1999*, A.J.F. Russel, C.A. Morgan, C.J. Savory, M.C. Appleby, and T.L.J. Lawrence (eds.), British Society of Animal Science (No. 23): UK, pp.125-128.
NAL Call No.: SF5 B74 no. 23.
Keywords: transporters, animal welfare, livestock, legislation, transport of animals, road transport, livestock transporters, temperature.

Docic, A.; Bilkei, G. (2001). **The effect of short term high feed intake on the onset of puberty in transported gilts.** *Swine Health and Production* 9 (1): 25-27, ISSN: 1066-4963.
NAL Call No.: SF971 N472.
Abstract: A trial, involving 320 incoming gilts (approximately 160 days of age) was conducted to determine whether energy flushing combined with transport, regrouping, and exposure to boars influences the onset of puberty. The gilts were randomly divided into 2 groups. The flushed group (166 gilts) were both transported and energy flushed, and the transported group (154 gilts) were transported only. After transport, gilts were housed in small groups exposed to boars across an aisle. The onset of puberty was determined at slaughter one week after transport. Examination of the reproductive organs revealed that there were more follicles >4 mm and uterine mass was larger (P>.05) in the flushed group than in the transported group. Adrenal gland weight,

ovarian weight, and uterine length did not differ between treatment groups. It is concluded that energy flushing increases follicular growth and uterine weight, which are indicators of puberty in gilts.
Keywords: gilts, feed intake, female animals, flushing, ovarian follicles, puberty, transport of animals.
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Driessen, B.; Geers, R. (2001). **Stress during transport and quality of pork.** In: *Proceedings of the 1st International Virtual Conference on Pork Quality: welfare, transport, slaughter and consumer, Concordia, Brazil, November 16- December 16, 2000*, EMBRAPA Suinos e Aves Documentos, 69, pp. 39-51.
Keywords: carcass quality, loading, meat quality, pig meat, slaughter, stress, temperature, transport of animals, unloading, Europe.

Faucitano, L. (2001). **Effects of preslaughter handling on the pig welfare and its influence on meat quality.** In: *Proceedings of the 1st International Virtual Conference on Pork Quality: Welfare, Transport, Slaughter and Consumer, Concordia, Brazil, November 16- December 16, 2000*, EMBRAPA Suinos e Aves Documentos, 69, pp.52-71.
Keywords: animal welfare, carcass quality, loading, meat quality, pig meat, reviews, slaughter, stocking density, stress, transport of animals, unloading.

Harvey, R.B.; Anderson, R.C., Young, C.R., Swindle, M.M., Genovese, K.J., Hume, M.E., Droleskey, R.E., Farrington, L.A., Ziprin, R.L., Nisbet, D.J. (2001). **Effects of feed withdrawal and transport on cecal environment and Campylobacter concentrations in a swine surgical model.** *Journal of Food Protection* 64 (5): 730-733, ISSN: 0362-028X.
NAL Call No.: 44.8 J824.
Keywords: gilts, breed, Yucatan, surgically implanted, cecal cannulas, infection, Campylobacter jejuni, cecal contents, pH, volatile fatty acids, full fed, food withdrawal, transport stress, livestock trailer, food safety, slaughter.

Hurd, H.S., McKean, J.D., Wesley, I.V., Karriker, L.A. (2001). **The effect of lairage on Salmonella isolation from market swine.** *Journal of Food Protection* 64 (7): 939-944, ISSN: 0362-028X.
NAL Call No.: 44.8 J824.
Keywords: market pigs, lairage, transport, slaughter, abattoir, holding pens, Salmonella, isolation, fecal samples, distal colon, ileocecal lymph nodes, cecal contents, ventral thoracic lymph nodes, subiliac lymph nodes, carcass swabs, ELISA, detection, labeling techniques, food hygiene, food microbiology, food protection.

Kettlewell, P.J.; Hoxey, R.P.; Hampson, C.J.; Green, N.R.; Veale, B.M.; Mitchell, M.A. (2001). **Design and operation of a prototype mechanical ventilation system for livestock transport vehicles.** *Journal of Agricultural Engineering Research* 79 (4): 429-439, ISSN: 0021-8634.
NAL Call No.: 58.8 J82.
Abstract: A prototype, mechanically ventilated, livestock transport vehicle (for pigs, sheep or cattle) is described. The design complies with current legislation and meets the ‘higher standard’ ventilation requirement for vehicles which are to be used to transport animals for over 8 h. Extraction fans are located at regions of low external pressure on the moving vehicle to optimize performance in transit and provide a controlled variable throughput of air. The system provides air movement over all the animals and is independent of vehicle movement. The design of this prototype system has enabled detailed measurements of heat and moisture production of the animals. Preliminary assessment of the system has been effected during two commercial journeys moving pigs from farms to an abattoir. The variability in heat loss from the animals ranged between 1.4 and 1.9 W kg(-1) liveweight but in both cases the split between sensible (45%) and latent (65%) heat loss was comparable. These initial data, when augmented with further studies over a wider range of ambient conditions, can be used as the basis for guidelines for the development of improved forced ventilation systems. Such systems will be an essential component in vehicles which are being designed to improve animal welfare in transit.
Keywords: livestock transporters, farm equipment, design, ventilation, transport, animal welfare.

Marg, H.; Scholz, H.C.; Arnold, T.; Rosler, U.; Hensel, A. (2001). **Influence of long-time transportation stress on re-activation of Salmonella typhimurium DT104 in experimentally infected pigs.** *Berliner und Munchener tierarztliche Wochenschrift*, 114 (9-10): 385-8, ISSN: 0005-9366.
NAL Call No.: 41.8 B45.
Abstract: In this study a Salmonella Typhimurium infection model in swine was used in order to investigate the influence of pre-mortal stress induced by long time period transportation on the re-activation of Salmonella in experimentally infected pigs. Salmonella free pigs were exposed to a highly virulent strain of Salmonella Typhimurium DT104 by direct intragastrical administration. Clinical parameters were monitored and the shedding rate in faeces was qualitatively and quantitatively determined by standard bacteriological procedures for 21 days. The distribution of the challenge organism in 14 different internal organs of transported and nontransported animals was determined. All infected animals developed clinical signs of salmonellosis 12 to 24 hours post infection. About 88 to 100% of the fecal samples were culture-positive up to post exposure day 6, and then varied from 71 to 92% until slaughter, respectively. At necropsy S. Typhimurium was recovered most frequently from caecum and ileocolic lymph nodes (83%), colon (79%), palatine tonsils (71%) and mandibular lymph nodes (62.5%). A negative impact of transportation stress on the shedding rate and the general condition of the animals was observed.
Keywords: etiology, Salmonella typhimurium, growth and development, stress, disease, prevention and control, transportation, feces, microbiology.

Murray, A.C. (2001). **Reducing losses from farm gate to packer. A Canadian's perspective.** In: *Proceedings of the 1st International Virtual Conference on Pork Quality: Welfare, Transport, Slaughter and Consumer, Concordia, Brazil, November 16- December 16, 2000*, EMBRAPA Suinos e Aves Documentos, 69, pp.72-83.
Keywords: husbandry, animal welfare, carcass quality, carcass weight, carcass yield, handling, losses, meat quality, microbial contamination, mortality, reviews, slaughter, stocking density, transport of animals, wastage, North America.

Nabuurs, M.J.; Van Essen, G.J.; Nabuurs, P.; Niewold, T.A.; Van Der Meulen, J. (2001). **Thirty minutes transport causes small intestinal acidosis in pigs.** *Research in Veterinary Science* 70 (2): 123-7, ISSN: 0034-5288.
NAL Call No.: 41.8 R312.
Abstract: Long duration (>10 hours) transport has been described as having either adverse or no effects on porcine health. However, the effect of short duration transport on porcine health is unknown. In the present paper, pigs fed ad libitum (n = 6) were transported for 30 minutes, anaesthetised, instrumented, and cardiovascular and gastrointestinal parameters were measured. Non-transported pigs (n = 6) served as controls. No significant differences between groups were found concerning blood flow in the arteria mesenterica cranialis, heart rate, cardiac output, pulmonal blood pressure, haemoglobin content and haematocrit value. Systolic systemic blood pressure was higher (though not significant), and diastolic systemic blood pressure was significantly higher in the transported pigs than in the controls. Small intestinal pH was significantly lower in transported pigs than in control pigs. We conclude that a 30-minute transport of fed pigs results in small intestinal acidosis. As small intestinal acidosis predisposes to bacterial translocation, even short duration transport should be avoided when possible.
Keywords: acidosis, small intestine, metabolism, physiology, transportation, etiology, animal welfare, blood pressure, heart rate, hematocrit, hemoglobins, analysis, hydrogen-ion concentration, specific pathogen-free organisms, time factors, tonometry.

Perremans, S.; Randall, J.M.; Rombouts, G.; Decuypere, E.; Geers, R. (2001). **Effect of whole-body vibration in the vertical axis on cortisol and adrenocorticotropic hormone levels in piglets.** *Journal of Animal Science* 79 (4): 975-981, ISSN: 0021-8812.
NAL Call No.: 49 J82.Abstract: Vibration, being a consequence of motion during transport, may impair the welfare of pigs. Therefore, the primary objectives of this study were 1) to evaluate during transport simulation the use of ACTH and cortisol plasma levels, which are part of a basic adaptation mechanism of pigs and 2) to define comfort conditions for pigs related to the frequency and acceleration of vibration. Pigs with a body weight between 20 and 25 kg were vibrated in the vertical direction for 2 h at 2, 4, 8, and 18 Hz, in combination

with root mean square acceleration magnitudes of 1 or 3 m/s2. Blood was sampled at regular intervals before, during, and after vibration as the pig's behaviors were recorded. Data on ACTH, cortisol, and behavior could be collected from 104 vibrated pigs and 21 controls. In addition, eight animals (3 controls, 5 vibrated) were treated with 0.1 mg of dexamethasone/kg BW, eight animals (3 controls, 8 vibrated) with 0.1 mg naloxone/kg BW, and six (2 controls, 4 vibrated) with a physiological salt solution. Blood samples were taken and products were administrated via an intravenous catheter. The pigs spent less time lying during both hours of vibration treatment than during control conditions. Compared with 2 and 4 Hz, time spent lying was 10 times shorter at 8 Hz and 18 times shorter at 18 Hz. At 1030, ACTH levels were significantly higher than basal levels in animals vibrated at 2 ($P < 0.0001$), 4 ($P < 0.002$), and 18 Hz ($P < 0.0006$). After 1 h, levels returned to basal values. Cortisol levels increased very rapidly after the beginning of vibration ($P < 0.0001$) and remained higher until 1 h after cessation of vibration ($P < 0.003$). An inferrence of the lines of equal responses for ACTH and cortisol indicated that, in the beginning of vibration exposure, pigs were extremely susceptible to vibrations at lower frequencies (2 and 4 Hz), whereas at the end of vibration exposure the responses were higher at 18 Hz. The application of dexamethasone and naloxone underpinned the emotional component of the response strategy of pigs to vibration. Hence, vibration during transport should be minimized in order to enhance the adaptive capacities of pigs.
Keywords: piglets, transport of animals, whole body vibration, body weight, frequency, acceleration, ride comfort, blood plasma, corticotropin, dexamethasone, naloxone, physical activity, rest, adaptation, animal welfare, refinement.

Schonreiter, S.; Zanella, A.J. (2001). **Assessment of cortisol in swine by saliva: new methodological approaches.** *Archiv fur Tierzucht* 43 (Special):165-170, ISSN: 0003-9438.
NAL Call No.: 49 AR23
Abstract: The common method of saliva sampling with cotton buds was compared with a new Oral Diffusion Sink (ODS) method. ODS method allowed continuous measuring without any manipulation of animals. Steroids from saliva were accumulated for 8 h with a defined flow rate through the ODS. After alcohol extraction all samples were analysed using a radioimmunoassay. Daily profile of cortisol concentration, as well as the effects of 2 stressors, social isolation and a 2-h transportation, were assessed in 10 German Landrace pigs. The concentration of cortisol in cotton buds was significantly higher in the morning than in the evening. During social isolation, significantly higher cortisol concentrations and disintegration of the circadian rhythm were observed in cotton buds, but not in ODS. Highest cortisol concentrations were found during transportation 60 min after loading (18.9 plus or minus 3.9 nmol/litre). It is suggested that the ODS may be suitable for continuous monitoring of acute stress.
Keywords: German Landrace, breed, diagnostic techniques, hydrocortisone, saliva, sampling, stress, transportation, social isolation.
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Seidler, T.; Alter, T.; Kruger, M.; Fehlhaber, K. (2001). **Transport stress, consequences for bacterial translocation, endogenous contamination and bactericidal activity of serum of slaughter pigs.** *Berliner und Munchener tierarztliche Wochenschrift* 114 (9-10): 375-7, ISSN: 0005-9366.
NAL Call No.: 41.8 B45.
Abstract: On transport and at the abattoir animals are confronted with a lot of stressors, such as sound/noise, crowding/mixing, pollutants and infectious agents that act on the organism. After transport stress an endogenous contamination is often seen in slaughter carcasses and presents a hazard for the consumer. These events are often correlated with a rise in endotoxin level (Misawa et al., 1995; Morales et al., 1992) and a modified immune response. Previous own investigations confirm this hypothesis (Zucker and Kruger, 1998, Seidler et al., 2000). The attempt was made to investigate the impact of selected stressors (short term transport (1 h), long term transport (7-8 hrs), high temperature, high humidity and intense handling/moving) on bacterial translocation, endogenous contamination, endotoxin levels and bactericidal activity of body fluids.
Keywords: bacterial infections, bacterial translocation, physiology, endotoxins, blood, stress, disease transmission, abattoirs, husbandry methods, humidity, stress.

Warriss, P.D. (1998). **Choosing appropriate space allowances for slaughter pigs transported by road: a**

review. *The Veterinary Record: Journal of the British Veterinary Association* 142 (17): 449-54, ISSN: 0042-4900.
NAL Call No.: 41.8 V641.
Abstract: In the United Kingdom pigs can spend up to 11 hours in transit to slaughter but on average travel for two to three hours. In the past, international journeys have lasted up to 40 hours and have been over 900 miles long. There is evidence that pigs, like calves and sheep, but unlike adult cattle, prefer to lie down if provided with suitable conditions, particularly bedding, on the vehicle. They will, however, sometimes stand during short journeys, possibly when excessive vibration or uncomfortable flooring, particularly a lack of sufficient bedding, cause discomfort. Current UK legislation and EU Directive 95/29/EC specify that, in general, pigs must have sufficient space to lie down during transit. Measurements of the space needed for sternal recumbency, and direct observations of pigs at different stocking densities, suggest that the minimum space required is equivalent to about 250 kg/m2 for normal slaughter pigs of 90 to 100 kg liveweight. This figure may not be appropriate for very small or very large pigs. In the UK at present, more than half of all slaughter pigs are transported at densities greater than that prescribed (235 kg/m2) in the EU Directive. At stocking densities above about 250 kg/m2 there may not be enough room available for all the pigs to lie down, leading to continual disturbance of recumbent animals by those seeking a place to rest. A stocking density of 322 kg/m2 leads to clear evidence of physical stress. During long journeys (> or = 25 hours) meat quality is reduced by high stocking densities, implying muscle glycogen depletion and possibly fatigue. Higher stocking densities are also associated with higher mortality. There is evidence of wide variations in air temperature inside transporters, particularly for international journeys. Although there are small variations within vehicles, the temperature of the air inside is closely related to the outside temperature. It has been recommended that the temperature within the vehicle should not exceed 30 degrees C in order to remain within the pig's thermoneutral zone. Such temperatures, together with acceptably low concentrations of potentially noxious gases, such as carbon dioxide, can be achieved in moving vehicles by adequate ventilation, provided there is adequate space above the animals' heads. In triple-decked lorries, the height between decks has tended to be reduced and can be as little as 90 cm. Further work is needed to decide whether this is sufficient for modern slaughter pigs.
Keywords: animal welfare, housing, meat, standards, transportation, Great Britain.

Zanella, A.J.; Duran, O. (2001). **Pig welfare during loading and transportation: a North American perspective.** In: *Proceedings of the 1st International Virtual Conference on Pork Quality: Welfare, Transport, Slaughter and Consumer, Concordia, Brazil, November 16- December 16, 2000*, EMBRAPA Suinos e Aves Documentos, 69, pp. 20-31.
Keywords: husbandry, animal welfare, livestock transporters, loading, risk factors, stress, stress response, transport of animals, North America.

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