Quendler, Elisabeth; Helfensdörfer, Veronika; Baumgartner, Johannes and Boxberger, Josef

Work quality assessment of different farrowing systems

Work-related musculoskeletal disorders are a common problem in farming. The Austrian market offers different keeping systems to piglet farmers. Farmers should be able to easily and comfortably operate these systems. Therefore this study was carried out to determine discomfort and workload of existing keeping systems for farmers, and to identify possibilities of design improvements. The working postures of farmers were recorded with a digital video technique over 56 days. The video films were analysed as regards certain task elements by observers, and 448 postures were encoded, using the OWAKO Working Posture Analysing System (OWAS). The physically strenuous work processes occurred during feeding, mucking, and some special tasks. Discomfort and workload differences existed between the pens and crates, and further minor differences within these two groups. Overall, improvements can be achieved by using auxiliary handling devices, design changes of system components or other tools and the environment.

Keywords
Piglets, ergonomics, workloads, work-related postures, farrowing systems

Abstract
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A major contributing factor to actual health risks of physical labour is the body posture adapted and moved mass during farm work. Different farrowing systems (pens and crates) were analysed in terms of human welfare, based on ergonomic criteria, and the results of this analysis should be used for improvements in farrowing system designs.

The observational and widely used method OWAS is used for early identification and quantification of postures associated with musculoskeletal disorder in piglet farming [1]. It is a compromise between the high cost of direct methods and the low validity and the subjectivity of self-report techniques.

Material and methods

The study of body postures related to eight different farrowing systems, produced by Austrian companies, was conducted on a large commercial farm in Austria. The work was carried out by up to four workers, managing 600 sows separated in five groups. One group of sows was installed in 109 farrowing places of four units under the same management conditions. The other groups were housed in groups on litter and in single feeder boxes. Each unit had eight to twelve crates or pens of each type. The working activities around each crate or pen type in the different farrowing systems were indirectly logged.

Digital video technology with analogue cameras was used for indirectly compiling data of the work processes.

For the identification and evaluation of harmful working postures related to task elements, identified on the video, the OWAS (Ovako working posture analysis system) was used.

OWAS codes cover 84 different posture combinations, four back postures, three arm postures, and seven leg postures, each expressed by a digit [2]. The use of strength or weight of loads is classified by a three-class scale and the forth digit, which covers the three weight classes up to 10 kg, between 10 and 20 kg, and more than 20 kg of load.

The OWAS classes and determined codes were used for calculating the dimensionless index of workload "L" that can be generated for task elements and work processes. For taking into account lower moved weights, the mass-related load index "L_M" was calculated for each task element and work process [3].

Results

All pen-specific work in and around each type of pen was observed over two cycles, each one lasting 28 days. The cameras were adjusted to record all task elements immediately around and within the investigated crates and pens. The cameras were positioned 2.9 m above the working area. The working conditions were considered normal; the workers remarked only minimal interference.

Influencing variables like masses moved, distances travelled, moving speed, and preparatory and post working processes outside the farrowing system area were manually determined by direct paper and pencil observation of the workers and their postures in the working area, as well as by measuring.

A total of 448 body postures related to task elements were analysed using the described OWAS-based method with preparatory and post operations outside the system areas. The coding related to task elements ensured a precise determination [4]. For hazardous and uncomfortable postures, the video recordings enabled the observer to identify possible reasons [5].

Discomfort and strain varied, depending on the keeping system used. The physically strenuous work processes in all farrowing systems during suckling and pregnancy were feeding and mucking, which needed to be done daily. The highest portion of Class 1 and therefore the lowest workload and mass flow by hand existed during group housing. The task element that caused discomfort and strain related to Class 2 was climbing on the feeding corridor because of the high level differences. The tasks preparation of artificial insemination, closing and opening of a heavy dropping cover during mucking by hands, and the change of boots were considerably uncomfortable (Class 3). Less than 1 % of the working time caused discomfort from posture and mass, expressed by a very low factor L_M (0.001), but nearly 11 % of the working time caused discomfort from posture.

Differences existed both within the farrowing systems and within the two groups of pens and crates. Within the pens, FS3 achieved the highest proportion of Class 1 and 4, and the lowest in Classes 2 and 3.

Class and factor L differences between FS2 and FS3 were mainly due to different time requirements of the task elements. The remarkable higher portion of Class 2 and Class 3 of FS1 resulted from the different design of the pens. Although FS1 had the highest factor L, which means the highest portion of harmful postures among all pen types, it caused the lowest time requirements through discomfort with workloads over two kilograms, as expressed by the lowest factor L_M.

In comparison with pens, the crates caused a higher portion of Class 2 and 3, and lower portion of Class 1 and 4 tasks. Their factor L was higher than the lowest value within the pen group. The main reasons for these findings were the existence of one cage per system for the fixation of the sow with its opening and closing devices and other door latching mechanisms which necessitated additional postures of Class 2, and lower walls around the crate area which supported easier entry by climbing in.

The differences between the crate systems within the posture classes were due to different time requirements of working elements. Variations in the posture dimension of the same task elements resulted from construction differences. Inconvenience was very often related to higher time requirements.

The strenuous tasks of Class 2, 3, and 4 can be improved by using auxiliary handling devices (tables, lifting strap, chairs or stools, wheels, storage containers with outlet port above the floor, construction changes, etc.), design changes of system components (opening and closing devices, material changes, etc.) or other work tools and the work environment. Similar aspects were discussed for certain work processes in construction work [6], for dairy farming [7], and for a perchery system [1].

Table 1

Results of postures in piglet farming related to different farrowing systems in percent

System	Klasse 1 *Class1* %	Klasse 2 *Class 2* %	Klasse 3 *Class 3* %	Klasse 4 *Class 4* %	L[1)]	L_M[2)]	T_{Lb}[3)] %	T_{Lbm}[4)] %
FS1	80,4	18,6	0,73	0,18	120,7	2,00	19,6	2,76
FS2	85,8	13,2	0,63	0,41	115,7	2,24	14,2	3,52
FS3	86,1	12,9	0,57	0,48	115,4	3,86	21,9	3,43
KS1	78,1	21,3	0,67	0,01	122,6	2,51	21,9	3,87
KS2	82,5	16,9	0,64	0,01	118,2	2,69	17,5	3,14
KS3	79,4	20,0	0,59	0,00	121,2	2,40	19,2	3,56
KS4	81,6	17,7	0,67	0,01	119,1	3,00	18,4	3,08
KS5	77,3	22,1	0,63	0,00	123,3	2,90	22,7	3,57
WS[5)]	89,3	4,51	6,14	0,00	116,8	0,001	10,7	0,38

[1)] L: Belastungsindex nach Lundquist/*index of workload*.
[2)] L_M: massenbezogener Belastungsindex/*mass-related load index N*.
[3)] T_{Lb}: physisch belastende Arbeitszeiten ohne von Hand bewegten Massen in Prozent der Gesamtarbeitszeit (ohne Management)/*physically strenuous working time requirements without mass movement in percentage of total working time (without management).*
[4)] T_{Lbm}: Physisch belastende Arbeitszeiten mit von Hand bewegten Massen in Prozent der Gesamtarbeitszeit (ohne Management)/*physically strenuous working time requirements with mass movement in percentage of total working time (without management)*.
[5)] WS: Wartestall/*group housing unit*.

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Autors

PD Dipl.-Ing. Dr. MSc Elisabeth Quendler is an assistant at the Division of Agricultural Engineering, Department of Sustainable Agricultural Systems, University of Natural Resources and Applied Sciences, Vienna, Peter Jordan Straße 82, A-1190 Vienna, e-mail: elisabeth.quendler@boku.ac.at

Dipl.-Ing. Veronika Helfensdörfer is a research assistant at the Division of Agricultural Engineering, Department of Sustainable Agricultural Systems, University of Natural Resources and Applied Sciences, Vienna, e-mail: veronika.helfensdoerfer@boku.ac.at

Dr. med. vet. Ass. Prof. Johannes Baumgartner is an assistant at the Institute of Animal Husbandry and Animal Welfare, University of Veterinary Medicine, Vienna, e-mail: johannes.baumgartner@vu-wien.ac.at

O. Univ. Prof. Dr. Dr. Josef Boxberger is working group leader at the Division of Agricultural Engineering, Department of Sustainable Agricultural Systems, University of Natural Resources and Applied Sciences, Vienna, e-mail: josef.boxberger@boku.ac.at

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