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Non-pregnant sows' welfare in individual and loose housing system

Anna Augustyńska-Prejsnar

University of Rzeszów, Faculty of Biology and Agriculture,
Department of Animal Production and Poultry Products Evaluation,
ul. Zelwerowicza D9, 36-601 Rzeszów; e-mail: augusta@univ.rzeszow.pl

The aim of this study was to assess the welfare status of sows kept in the individual and loose housing systems. The analyses were conducted on a population of 103 non-pregnant sows kept in 15 pedigree herds in the Podkarpackie province. Welfare status of the sows was evaluated using behaviour, physiological, health state and productivity criteria. The overall welfare status was assessed based on specified critical control points. On the basis of the recorded results a higher level of animal welfare was found in the case of sows kept in the loose housing system.

KEY WORDS: welfare / non-pregnant sows / housing system

Animal welfare is identified primarily with animal housing conditions, basically as a term concerning animals' response to environmental stimuli [6, 10]. It is difficult to evaluate welfare status. In studies conducted to date [4, 14, 18, 19] no single, objective indicator was found, based on which animal housing systems could be assessed in terms of providing appropriate animal welfare levels. In literature on the subject [1, 3, 11, 12, 17] indicators of animal welfare are typically divided into those related to behaviour, physiology, health state and productivity. They may be supplemented with individual appraisal of welfare, used in order to compare welfare of analysed housing systems.

The aim of this study was to evaluate welfare status of non-pregnant sows kept in stall and group housing systems.

Material and Methods

The experimental material comprised a population of 103 non-pregnant sows kept in 15 pedigree herds in the Podkarpackie province. Analyses were carried out in two autumn--winter seasons.

Sows were kept in the shallow bedding system in stall pig houses (in 5 herds) and group housing facilities (in 10 herds). In the individual stall housing system the stall area ranged

from 1.61 m^2 to 2.00 m^2 per 1 sow (mean 1.78 m^2). Group stalls housed on average from three to six sows, with an area of 1.84 m^2 up to 4.00 m^2 per 1 sow (on average 2.69 m^2). The natural lighting index, measured by the ratio of widow area to the floor area, amounted to 1:20 in the individual stall housing and 1:17 for the group housing system. All the animals had free access to feed and water and were subjected to routine veterinary prophylaxis procedures.

Welfare of sows was assessed based on criteria related to behaviour, physiology, health status and productivity. The behavioural criterion was connected with around-the-clock monitoring of behaviour of these sows using a camera and a video recorder with the time-lapse function. The incidence of atypical behaviour was recorded. The physiological criterion included the determination of blood serum haptoglobin concentration using radial immunodiffusion with the application of tests by Tridelta Development Ltd. Readings were provided by spectrophotometry at absorbance of 630 nm. The criterion related to the health status comprised evaluation of the health state in non-pregnant sows, taking into consideration the incidence of disease and trauma as well as limb disorders and injury. The state of health was assessed based on the author's observations, in-depth analysis of herd records and the register of all treatment procedures and measures applied. Performance testing of sows was conducted based on data obtained from herd records. Animal welfare based on the productivity criterion was evaluated using the following parameters: age at first farrowing, farrowing rate, farrowing interval, farrowing frequency, length of breeding performance, lifespan, number of piglets born live in the litter, number of stillborn piglets in the litter, number of reared piglets in the litter and the number of piglets deaths.

The overall welfare level was assessed based on the identified critical control points. The elements of the environment and production technology determining the animal welfare level, for which critical control points were established, included stall area in m^2 per 1 animal; freedom of movement (individual stalls, group stalls, runs); natural lighting in the pig house; access to feed and water; isolation and treatment of sick animals; incidence of disease and injuries in the herd; incidence of behavioural stereotypies; supervision over the animals (daily monitoring of animals, qualifications of the personnel handling the animals, attitude to animals); prophylaxis in the herd (hygienic status of stalls, feeders and troughs; prophylactic measures; quarantine; observance of the all-in/all-out production system; disinfection of pig house facilities; animal handling performed when in protective clothing); prevention measures in the herd (disinfection of halls and transport vehicles; disinfection of the water supply system; presence of the sanitary sluices at the entrance to housing facilities and securing entry routes to the farm; observance of deratisation protocols, adequate fencing of the farm; distance from the pig house to the nearest herd; storage of excrement and slurry). Critical control points are presented in the form of a pattern scale, classifying welfare at five levels: very low, low, medium, high and very high. Based on the arbitrary author's decision each critical control point was assigned a score from 1 to 5 points. The overall score in welfare level assessment is a mean of scores from 10 critical control points.

The significance of differences between two fraction indexes (percentages) for individual atypical behaviours, disorders and injury, limb diseases and injuries under the investigated housing conditions was verified using the significance test for differences between the structure indexes. For the productivity indexes the significance of differences between the tested housing conditions was verified by one-way analysis of variance for a non-orthogonal system. The significance of differences between means was assessed by Tukey's test. Calculations were performed in the STATISTICA 9.1 programme.

Results and Discussion

Animal behaviour, as a long-term, measurable trait, is considered to be a major criterion in the evaluation of welfare [3, 6, 14]. Some authors [2, 9, 19] indicate that behavioural reactions are sometimes the only adaptation reactions to the environment. However, they frequently accompany stress reactions, and they may be manifested in the incidence of ab-

Table 1
Abnormal behaviours in sows in the examined housing systems

Specification	Housing system	
	individual	group
Animals with abnormal behaviours (%)	56.65	32.50
Forms behaviours (%)		
nervousness	33.33	29.58
mutual biting	0.00	7.04
continuous sniffing	3.03	16.90
sitting on hind legs	6.06	0.00
hitting the fixed objects	12.13	4.23
sham chewing	3.03	19.72
bar licking and biting	15.15*	1.41
snout jostling	3.03	8.45*
bar rubbing	15.15	7.04
still standing and listening	9.09	5.63

*P≤0.05

Table 2
Manifestation of external oestrus signs in sows (%) in the examined housing systems

Specification	Housing system	
	individual	group
Clear manifestation of external oestrus signs	65.22	90.00
Weak manifestation of external oestrus signs	21.74	8.75
Absence of external oestrus signs	13.04	1.25

normal behaviours [14]. The highest percentage of animals exhibiting atypical behaviours (56.65%) was recorded for the stall housing system (Table 1). Within the reported types of abnormal behaviours agitation was recorded in both systems. Sitting on hind legs was observed only in the individual stall housing system and was reported in 6.06% sows. In turn, mutual biting was observed in animals kept in group pens (7.04%). Among the recorded behaviours consisting in bar licking and biting as well as snout jostling considerable differences were found between the two investigated housing systems (Table 1). Licking and biting of bars was observed more frequently in individual pens, whereas snout jostling – in the group housing system. The differences were confirmed statistically. In individual pens many cases of such behaviours were recorded, such as rubbing against bars (15.15%) and hitting fixed objects (12.13%). In the group housing system more frequent forms of behaviour included sham chewing (19.72%) and continuous sniffing (16.90%).

A lack of oestrus signs is typically a response to adverse living conditions [2, 14]. The adopted housing system was found to have an effect on the manifestation of external oestrus signs in sows (Table 2). In the group housing system evident manifestation of external oestrus signs was recorded in 90.00% sows, while in individual stalls it was only in 65.22% sows. In individual stalls weak manifestation of oestrus was reported in as many as 21.74% sows, while absence of oestrus signs was found in 13.04% examined animals, respectively.

Animal welfare influences the status of the immune system [26]. Acute phase proteins (APP), particularly haptoglobin (Hp) being one of the most stable proteins, reflect the activation status of the immune system [5, 21]. Determination of Hp contents facilitates monitoring of the health status in a pig herd and evaluation of the animal welfare status [22, 23, 24, 25, 27]. The distribution of results concerning haptoglobin concentration (mg/ml) in blood serum of sows in the investigated housing systems is presented in Table 3. Mean values of haptoglobin concentrations were lower in animals kept in group housing (1.131 mg/ ml). According to Knura et al. [16], blood serum haptoglobin level in pigs is markedly modified by zoohygienic conditions, under which animals are kept. According

Table 3
Haptoglobin concentration (mg/ml) in blood serum of the sows in the examined housing systems

Housing system	Value		
	min.	$\bar{x}$	max.
Individual	1.249	2.758	5.458
Group	0.627	1.131	1.557

Table 4
Diseases and injuries of the sows body in the examined housing systems

Specification	Housing system	
	individual	group
Animals with diseases and injuries of the body (%)	56.52	53.75
Diseases and injuries (%):		
skin abrasions	27.78	48.31
skin injuries	2.78	13.48
tail injuries	2.78	6.74
neck and nape injuries	2.78	6.74
claw abrasions	16.67	10.11
inflammation of skin around the claw, interdigital space and coronet	5.56	1.13
inflammation of fetlock, carpal and tarsal joints	5.56	1.13
lameness	13.88	6.74
leg deformations	13.88*	4.49
leg fractures and contusions	8.33*	1.13

*$P \leq 0.05$

to literature sources [17, 26] it is assumed that the lowest Hp values, irrespective of the animal species, age, sex, body weight or nutrition, are found at an appropriate animal welfare level. Analysis of haptoglobin levels in blood serum of sows kept in the investigated housing systems definitely indicated a higher level of welfare observed in the group housing system (Table 3).

Poor health state always shows inadequate animal welfare, while good health may accompany a deteriorated welfare status [11, 12, 28]. A greater percentage of animals, in which diseases and injuries were recorded in the individual housing system (Table 4). In both housing systems skin abrasions predominated among injury types; however, in group pens their incidence rate was almost two-fold higher. In group pens many skin wounds were also reported, as observed in 13.48% sows. Higher incidence rates were recorded in the individual stalls for claw abrasions (16.67%), lameness and limb deformations (13.88%) as well as limb injury and fractures (8.33%). In the frequencies of limb deformations, limb injuries and fractures a statistically significant difference was observed between sows kept in the individual stalls and in group housing (Table 4). According to D'Silva [7] and Klocek et al. [15], rearing of sows at a limited freedom of movement leads to reduced fitness, particularly the locomotory system, potentially resulting in claw diseases and deformations, manifested in lameness and limb injury as well as disturbed presentation of oestrus signs (as confirmed in the investigations conducted by the author). Limb deformations are a consequence of a complex of clinical symptoms of limb weakness, while one of the etiological factors in that phenomenon is connected with the lack of free movement, particularly in the period of growth [8]. In the individual stall system the percentage of animals suffering from limb diseases and injuries reached 100% (Table 5). Claw abrasions

Table 5
Diseases and injuries of the limbs in sows in the examined housing systems

Specification	Housing system	
	individual	group
Animals with diseases and injuries of the limbs (%)	100.00	53.75
Diseases and injuries (%)	26.09	40.90
claw abrasions		
inflammation of skin around the claw, interdigital space and coronet	8.70*	4.55
inflammation of fetlock, carpal and tarsal joints	8.70*	4.55
lameness	21.74	27.27
leg deformations	21.74	18.18
leg fractures and contusions	13.03*	4.55

*P≤0.05

Table 6
The productive value of sows in the examined housing systems

Specification		Housing system	
		individual	group
Age at the first farrowing (days)	$\bar{x}$	359.59	339.51
	S	31.39	45.82
Mounting efficiency (%)			
natural mounting		94.40	93.12
natural mounting and insemination		82.50	71.14
Farrowing interval (days)	$\bar{x}$	201.80	174.49**
	S	39.11	30.72
Farrowing frequency	$\bar{x}$	1.87	2.15**
	S	0.32	0.32
Breeding performance length (days)	$\bar{x}$	716.61	746.90
	S	413.10	398.45
Lifespan (days)	$\bar{x}$	939.63	974.84
	S	409.20	414.06
Number of piglets born alive (heads)	$\bar{x}$	11.38	11.66
	S	1.33	2.75
Piglets born dead (%)		1.02	0.60
Number of piglets reared in litter (heads)	$\bar{x}$	10.15	10.36
	S	1.43	2.51
Piglets' deaths (%)		15.06	12.69*

**P≤0.01; *P≤0.05

predominated among limb diseases and injuries. The highest frequency of such trauma was found in group pens (40.90%). Considerable differences between the analysed housing systems were recorded in the incidence of limb injury and fractures, inflammation of the skin around the claw, interdigital space and the coronet as well as inflammation of the fetlock, carpal and tarsal joints. These results were confirmed statistically (Table 5). Evaluated health status based on the incidence of diseases and trauma is an important indicator of deteriorated, prolonged animal welfare [17].

High productivity of pigs may sometimes be achieved at a deteriorated animal welfare, typically having a negative effect on the length of their productive lives [1, 12]. Thus when assessing welfare of the sows the length of their productive lives was considered.

Table 7
Welfare level of sows on assigned critical points of control (pts.)

Critical points of control	Housing system	
	individual	group
Area of pen in square meters per one animal	1	4
Freedom of movement	1	4
Natural lightening in hoggery	1	3
Food and water access	4	4
Sick animals' isolation and care	4	5
Stock disorders and injuries occurred	3	3
Stereotypic behaviour occurrence	3	4
Supervision of animals	5	5
Stock prophylaxis	2	4
Stock prevention	2	3
General estimation of welfare standard	2.60	3.90

Scoring scale welfare levels:1,00-1,50 pts. – very low; 1,51-2,50 pts. – low; 2,51-3,50 pts. – medium; 3,51-4,50 pts. – high; 4,51-5,00 pts. – very high

In breeding practice the number of piglets reared to day 21 of life was the main indicator of productivity in sows. Prolificacy of the sows did not differ markedly from the results reported by other authors [13, 20]. These sows farrowed for the first time before the end of the first year of life (Table 6). On average by 20 days earlier, at the age of 339.51 days, sows in the group housing system farrowed for the first time. The adopted housing system had a significant effect on farrowing interval and farrowing frequency in these sows. A longer reproductive performance (746.90 days) and length of life (974.84 days) were found in the sows kept in the group housing system. The numbers of piglets live born and piglets reared from the litter were comparable in both housing systems. Death rates of piglets in the group housing system were lower; the differences proved to be statistically significant.

The level of welfare based on the point score at the specified critical control points is presented in Table 7. In the individual stall system the lowest score was assigned for

stall area per 1 animal, freedom of movement and natural lighting in the pig house, which obviously had an effect on the incidence rate of diseases and trauma in sows. The highest score (5 points) was given for supervision over animals in both housing systems, while for isolation and treatment of sick animals it was in the group housing system. The overall score given in points indicates that welfare of the analysed sows in the group housing system was given high scores, while in the individual stall system it was at the medium level.

Summing up the obtained results a higher level of animal welfare was found in sows kept in the group housing system. A higher percentage of animals exhibiting abnormal behaviours was recorded in the individual housing system. Haptoglobin concentration in the blood serum of non-pregnant sows varied under the tested housing conditions, with a lower Hp level recorded in sows kept in the group housing system. A higher share of animals diagnosed with diseases and injuries was reported in the individual housing system. Under such conditions limb deformations, limb injury and fractures were observed more frequently. A longer reproductive life and a longer length of life were found for sows kept in the group housing system. Analysis of the critical control points showed that the level of welfare for the analysed sows kept in the group housing system was high, while in the individual housing system it was medium.

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