

## **Effect of management with and without litter and of rearing season on the results of conformation evaluation of Polish Large White and Polish Landrace gilts**

**Józef Kulisiewicz, Paweł Szumlewicz,  
Martyna Batorska, Mirosław Poczta**

Warsaw University of Life Sciences (SGGW) in Warsaw,  
Faculty of Animal Sciences, Department of Pig Breeding  
Ciszewskiego 8, 02-786 Warsaw

The studies were carried out with 683 gilts of Polish Large White (PLW) breed and 698 gilts of Polish Landrace (PL) breed. The subject of the studies included linear evaluation of incidence and intensity of conformation defects, being conducted with the application of scale of scores: 0 points – lack of defect; 1 point – small defect; 2 points – distinct defect. The effect of the systems of housing (on litter and without litter) and of the period of rearing (“warm” period – born since March to August and “cold” period – born from September to February) was examined. The housing factor had a strong influence on conformation traits. The sows of PL breed as well as of PLW breed, kept on the litter, received considerably more favourable scores for confirmation as compared to the animals managed without litter. Higher, more unfavorable effect of litter-less management on the traits of hind legs as compared to the fore legs, was recorded. The most unfavorable effect of litter-less management as compared to that one on the litter concerned uneven hooves and X-shaped position of hind legs ( $P < 0.001$ ). The gilts being reared in the “warm” months obtained more favorable total evaluation of confirmation in comparison to the animals managed during “cold” months ( $P < 0.05$ ). Differences in total evaluation of the conformation, caused by the season of rearing, were the result of summing of the small, most frequently statistically insignificant differences in respect of detailed traits.

**KEY WORDS:** pigs / conformation traits / linear evaluation / management and season of rearing

In the contemporary breeding of pigs, the conformation traits do not play a role of markers of performance traits: reproduction, growth rate and meatiness. Their meaning for breeding work in pedigree breeding consists in the fact that culling of the animals due to conformation lowers intensity of selection towards performance traits. In the opinion of certain authors, 15-20% of young breeding pigs are eliminated due to conformation de-

fects, mainly of legs, irrespectively of the results of performance traits' evaluation [18, 22, 26]. The traits of conformation, especially of legs have economic meaning in pig production. Weakness of legs and the limited capacity of moving is the second (after disturbances in reproduction) reason for too early non-intended culling of boars and first of all, of the sows in production herds [1, 4, 14, 21, 25].

The traits of conformation are affected by the genetic factors: breed and gender [9, 16, 17, 18]; nevertheless, their heritability is relatively low. The heritability coefficients are usually found within the limits of value 0.1-0.2 [9, 19, 23], so an important role in shaping of conformation traits is played by environmental factors. On the grounds of the data obtained from breeding associations in the USA, Straw and Taylor [24] report that 44% of the pigs kept on the litter-less slatted floor reveal damages of the legs whereas the discussed damages occur in 28% of the pigs kept on the solid litter floor. The results of the exact sciences concerning the effect of housing system are usually limited to evaluation of the state of hooves [6, 10]. In literature, there is a lack of the information on differences in the results of evaluation different than hooves, important conformation traits of the pigs, depending on the litter and litter-less housing system. Also, the effect of season of rearing on the results of evaluation of conformation traits has been considered only in few publications [2, 12].

The aim of the present paper was to describe the incidence and intensity of conformation defects, with the particular consideration of traits of the legs in the gilts of Polish maternal breeds – PL and PLW, as being managed on the litter and litter-less floor during 2 seasons of rearing.

### **Material and methods**

Material included 698 Polish Large White gilts and 683 Polish Landrace gilts. From among 698 PLW gilts, 394 females came from litter-less housing and 304 animals were kept on litter floor; from the mentioned number, 270 were reared in the “warm” season and 428 were managed during “cold” season. From 683 gilts of PL breed, 186 derived from litter-less management and 497 females were housed on litter floor; 185 animals were reared in the “warm” period and 498 were reared during the “cold” season. The animals came from 18 pedigree herds from the Wielkopolski breeding region. The gilts managed in litter-less system were reared in the group pens with a concrete floor, with concrete slats covering 25% of the pen's area. In the litter management system, the gilts were kept on a shallow straw litter. The females classified into the group reared during the “warm” period were born since March to August and those coming from “cold” season – since September until February.

The confirmation of animals was evaluated at the age of 150-210 days, i.e. during the period of conducting the performance evaluation and qualifying for further breeding. The evaluation was carried out in the period of December 2005 – December 2006. The confirmation was evaluated once by one from two zootechnicians, who had the practice in the field of breeding and evaluation of pedigree pigs. When evaluating the confirmation, the scheme from the paper of Norwegian authors, with a small modification, was utilized [7].

Individual card of conformation assessment was contained in earlier publication of the authors [11]. Evaluation of the detailed traits (19 traits in total) was linearly, three-nominally expressed: correct (lack of defect) – 0 points, small defect – 1 point and distinct defect – 2 points. The employed score evaluation allowed obtaining values of collective traits by summing of the evaluation of detailed traits (scores):

- total evaluation of fore legs;
- total evaluation of hind legs;
- total evaluation of fore and hind legs;
- total evaluation of conformation (total evaluation of fore and hind legs + evaluation of back + evaluation of quality of locomotion + evaluation of the presence of splints). When assessing the moving, its freedom, and lack or incidence of swaying the rump and bending the back, was evaluated.

The analysis of variability was carried out within the breeds, with the application of model (all constant factors), using statistical program SPSS [20]:

$$y_{ijkl} = \mu + \alpha_i + b_j + c_k + ab_{ij} + ac_{ik} + bc_{jk} + e_l$$

where:

$y_{ijkl}$  – value of the trait of  $l$ -th animal from  $i$ -form of housing, from  $j$ -season, evaluated by  $k$ -evaluator;

$\mu$  – mean of the population;

$\alpha_i$  – deviation caused by system of housing ( $i = 1, 2$ ; litter, litter-less);

$b_j$  – deviation caused by system of rearing ( $j = 1, 2$ ; seasons “warm”, “cold”);

$c_k$  – deviation caused by the effect of evaluator ( $k = 1, 2$ ; two evaluators);

$ab_{ij}$ ,  $ac_{ik}$ ,  $bc_{jk}$  – effects of interactions;

$e_l$  – unidentified effect.

## Results and discussion

The results of score evaluation of fore legs of PL and PLW gilts kept in litter-less and litter management systems are given in table 1. The total evaluation of fore legs of the PL gilts housed on litter-less floor was equal to 1.52 and on the litter – 0.97 p. and that one of PLW gilts amounted to 1.29 and 1.02 p., respectively (the scale of evaluation of the detailed traits: 0 points – lack of defect; 1 point – small defect; 2 points – distinct defect). The mentioned differences occurred to be highly statistically significant. In detailed evaluation, significant or highly significant differences were found for few traits. Higher values of score evaluation of detailed traits, indicating the higher intensity of defects in respect of litter-less housing (in accordance with the adopted scale of evaluation) in population of the PL gilts, concerned: incidence of buck kneed, uneven and small, narrow hooves ( $P < 0.05$ ) and in the population of PLW females – upright pastern, small narrow hooves, barrel-like position of legs, evaluated from front side ( $P < 0.01-0.05$ ).

Table 2 contains information on the effect of housing system on the results of linear score evaluation of hind legs. The total assessment of hind legs revealed differences, dependent on the form of management. In litter-less housing, the total evaluation was less favourable than in that one with litter: 2.79 vs. 2.02 p., for PL gilts and 2.40 vs. 1.46 for

**Table 1**

The influence of keeping system on the results of linear scoring of fore legs of PL and PLW gilts

Specification	Breed PL System of keeping				Breed PLW System of keeping			
	without bedding	bedding	SE	P	without bedding	bedding	SE	P
Position – side view:								
buck-kneed	0.16	0.18	0.02	0.016	0.13	0.08	0.02	0.085
sickled	0.13	0.09	0.02	0.886	0.17	0.14	0.02	0.326
Side view of pasterns:								
upright	0.31	0.30	0.03	0.903	0.20	0.11	0.02	0.008
weak	0.29	0.17	0.03	0.207	0.40	0.38	0.04	0.687
Front of view of hooves:								
uneven	0.08	0.03	0.01	0.036	0.04	0.05	0.01	0.534
small, narrow	0.10	0.05	0.02	0.017	0.06	0.02	0.01	0.002
Position – front of view:								
X-shaped	0.27	0.22	0.03	0.415	0.22	0.21	0.03	0.902
O-shaped	0.06	0.04	0.02	0.215	0.07	0.03	0.01	0.022
Total evaluation of fore legs	1.52	0.97	0.07	0.001	1.29	1.02	0.06	0.002

PLW ( $P<0.001$ ). Differences in total evaluation of hind legs, depending on the form of management, were higher in comparison with the total assessment of fore legs. The differences in the total evaluation of hind legs are a result of differences in evaluation of few detailed traits. Higher frequency and intensity of defects in the both populations in litter-less housing system concerned standing-under position (evaluation from side), uneven, small and narrow hooves and X-shaped position – evaluation from rear view) ( $P<0.01-0.05$ ). Higher frequency and intensification in litter housing system in the both discussed population concerned upright position of legs – evaluation from side ( $P<0.02$ ).

Table 3 shows the data on the effect of the system of housing on the results of linear score evaluation of the remaining conformation traits and total evaluation of the conformation. Total evaluation of conformation for litter-less and litter bedding was equal to 6.84 vs. 4.34 p., respectively, for PL gilts and 5.64 vs. 3.31 p., respectively, for PLW gilts. The mentioned differences were a result of differences in total evaluation of fore and hind legs, evaluation of back line and evaluation of motion quality, being in each case less favorable for litter-less housing system. The number of splints on the legs was higher in case of litter-less management as compared to litter bedding but in case of PLW gilts, the differences were statistically insignificant.

The effect of the rearing period on the result of linear score evaluation of fore legs of PL and PLW gilts has been given in table 4. The total evaluation of fore legs was different for the both rearing periods. For PL and PLW gilts reared in the “warm” period, the mean

**Table 2**

The influence of keeping system on the results of linear scoring of rear legs of PL and PLW gilts

Specification	Breed PL System of keeping				Breed PLW System of keeping			
	without bedding	bedding	SE	P	without bedding	bedding	SE	P
Position – side view:								
straight	0.04	0.20	0.03	0.016	0.05	0.22	0.03	0.017
standing under	0.70	0.38	0.04	0.040	0.55	0.19	0.04	0.001
Side view of pasterns:								
upright	0.57	0.49	0.04	0.866	0.44	0.35	0.05	0.074
weak	0.09	0.10	0.02	0.213	0.19	0.13	0.03	0.002
Rear view of hooves:								
uneven	0.26	0.11	0.02	0.000	0.21	0.16	0.03	0.001
small, narrow	0.14	0.06	0.02	0.053	0.16	0.06	0.02	0.016
Position – back of view:								
X-shaped	0.54	0.29	0.04	0.000	0.46	0.26	0.04	0.001
O-shaped	0.44	0.40	0.04	0.076	0.35	0.18	0.04	0.001
Total evaluation of hind legs	2.79	2.02	0.08	0.001	2.40	1.46	0.09	0.001

**Table 3**

The influence of keeping system on results of linear scoring of conformation of PL and PLW gilts

Specification	Breed PL System of keeping				Breed PLW System of keeping			
	without bedding	bedding	SE	P	without bedding	bedding	SE	P
Total evaluation of fore and hind legs	4.31	3.00	0.12	0.001	3.80	2.32	0.13	0.001
Back line:								
sway-back	0.44	0.25	0.04	0.040	0.24	0.11	0.04	0.001
roach-back	0.68	0.35	0.04	0.001	0.63	0.26	0.05	0.001
Locomotion	0.58	0.22	0.02	0.001	0.39	0.16	0.03	0.023
Splints	1.51	0.82	0.05	0.001	0.97	0.78	0.07	0.861
Total conformation assessment	6.84	4.34	0.16	0.001	5.64	3.31	0.19	0.001

value of evaluation was equal to 1.04 and 0.81 p. respectively whereas for those ones, reared during “cold” season, it amounted to 1.27 p. (P<0.05). Highly significant differences

**Table 4**

The influence of rearing season on the results of linear scoring of fore legs of PL and PLW gilts

Specification	PL breed Season				PLW breed Season			
	warm	cold	SE	P	warm	cold	SE	P
Position – side view:								
buck-kneed	0.15	0.21	0.03	0.016	0.13	0.18	0.03	0.643
sickled	0.07	0.13	0.02	0.035	0.06	0.11	0.03	0.472
Side view of pasterns:								
upright	0.31	0.37	0.16	0.812	0.19	0.22	0.04	0.660
weak	0.17	0.25	0.03	0.535	0.23	0.41	0.05	0.101
Front view of hooves:								
uneven	0.05	0.04	0.01	0.992	0.02	0.06	0.01	0.114
small, narrow	0.06	0.07	0.16	0.401	0.03	0.07	0.02	0.159
Position – front of view								
X-shaped	0.20	0.27	0.03	0.006	0.11	0.19	0.03	0.209
O-shaped	0.10	0.15	0.03	0.685	0.05	0.05	0.01	0.683
Total evaluation of front legs	1.04	1.27	0.06	0.035	0.81	1.27	0.08	0.039

were recorded for evaluation of two detailed traits: buck kneed and X-shaped position of legs in PL gilts. The incidence of higher, less favorable scoring for detailed traits during the “cold” versus “warm” season, excluding the uneven hooves in PL and barrel-shaped position in PLW gilts, was recorded.

Table 5 shows the effect of the rearing period on the results of evaluation of hind legs. The total evaluation of hind legs revealed the differences between the both rearing periods but they occurred to be statistically insignificant. The gilts reared during the cold period obtained higher, less favorable scoring. Less favorable evaluation of position (side view) due to frequent occurrence of standing-over defect during the winter period (0.53 vs. 0.45 p.) were statistically confirmed ( $P < 0.05$ ). Worse score evaluation of the animals reared during the “cold” period was recorded in assessment of each detailed trait of PLW gilts. In the population of PL gilts, reared during the “warm” season, certain traits received less favorable evaluation in comparison to the females reared during the “cold” period: upright position of pastern, small, narrow hooves and X-shaped position of legs.

The effect of the rearing period on the results of the evaluation of the remaining conformation traits are given in table 6. The total evaluation of conformation was dependent on the season of rearing. The mean evaluation for PL and PLW gilts, as reared during the “warm” period amounted to 4.89 and 3.41 p., respectively and during the „cold” period – 5.45 and 4.76 p., respectively ( $P < 0.05$ ). Statistically confirmed differences concerned total evaluation of fore and hind legs in the population of PL breed and intensity of “soft” (sway) back incidence. Most of the remaining detailed traits revealed more frequent occurrence of conformation defects during the “cold” period, with summing in the total evaluation of conformation.

**Table 5**

The influence of rearing season on the results of linear scoring of hind legs of PL and PLW gilts

Specification	PL breed Season				PLW breed Season			
	warm	cold	SE	P	warm	cold	SE	P
Position – side view:								
straight	0.12	0.17	0.02	0.541	0.14	0.19	0.03	0.615
standing under	0.45	0.53	0.04	0.012	0.30	0.33	0.05	0.997
Side view of pasterns:								
upright	0.52	0.51	0.04	0.252	0.36	0.40	0.05	0.723
weak	0.07	0.13	0.02	0.082	0.11	0.19	0.03	0.302
Rear view of hooves:								
uneven	0.15	0.17	0.02	0.562	0.10	0.19	0.03	0.074
small, narrow	0.17	0.10	0.02	0.306	0.06	0.12	0.02	0.353
Position – back view:								
X-shaped	0.33	0.41	0.03	0.396	0.32	0.33	0.04	0.745
O-shaped	0.46	0.37	0.04	0.074	0.21	0.27	0.04	0.919
Total evaluation of hind legs	2.17	2.38	0.08	0.220	1.54	2.02	0.10	0.331

**Table 6**

The influence of rearing season on the results of linear scoring of conformation of PL and PLW gilts

Specification	PL breed Season				PLW breed Season			
	warm	cold	SE	P	warm	cold	SE	P
Aggregate evaluation of fore and hind legs	3.21	3.65	0.12	0.041	2.35	3.28	0.14	0.060
Back line:								
sway-back	0.32	0.32	0.04	0.410	0.09	0.22	0.04	0.035
roach-back	0.43	0.49	0.04	0.549	0.32	0.44	0.06	0.971
Locomotion	0.30	0.38	0.02	0.532	0.19	0.29	0.03	0.159
Splints	1.09	1.01	0.05	0.190	0.81	0.87	0.07	0.594
Total conformation test	4.89	5.45	0.15	0.044	3.41	4.76	0.20	0.029

The obtained results allow stating that factor of housing system occurred to have a great influence on conformation traits. Summing score linear evaluation of conformation traits showed that PL and PLW gilts kept of litter bedding obtained better scoring than those ones

kept without litter. Solid floors, covered with litter create better conditions of moving and resting as compared to slatted, litter-less floors. Uncertainty of treading due to a bad quality bedding (excessive hardness, too high width of slats, slippery ground) and damages of feet (hooves) may cause local overweighing of joints and joint cartilages, leading to change in position of legs and, then, to increase the difficulties in moving [15].

Finke et al. [5] kept the pregnant sows in collective litter pens and on litter-less floor, in boxes and in the stands with tying. Due to weak legs, 7.3 and 36.0% of the sows were culled, respectively. Marchant and Broom [13] compared the resistance of bones (sensitivity to breaking) of pregnant sows kept for few reproduction cycles in boxes without litter, or in a big group, in a big compartment with a litter lying part. The resistance of bones in the examined pigs was by 30% higher in case of management in a big group on litter. Dyrzcz [3] studies the effect of litter and litter-less housing on behaviour and production results of fatteners. Any significant differences in total resting time were not found; on the other hand, distinct, statistically confirmed differences in its form were observed. The fatteners, kept on litter floor rested longer in position “on the side”, with the stretched out, non-preserved legs as compared to the animals managed without litter; it amounted to 51% vs. 32% of the 24-hour period, respectively. The percentage of the fatteners, resting in position “on the belly” with the pulled up legs in the both forms of housing system, was equal to 24.9% and 42.0%, respectively. The rest on the side did not cause obstacles in blood supply of the legs.

The cited results of the studies are the confirmation of the effect of housing system on exterior traits, first of all, traits of the legs. Existence of such effect does not mean that the young breeding animals, destined for herd replacement should be kept on the litter. National experience concerning settlement and initial utilization of industrial farms [27] indicate that the young gilts, reared in the conditions different than those ones, created by industrial farms (housing without litter in big groups) were subject, in a great extend, to culling due to adaptation reasons. Litter-less housing is a form of management in big herds, employing labour-saving technologies. Hoeges [8] informs that time consumption for service of one fatteners in litter-less housing system is by 30-50% lower than time consumption in case of management with litter (depending on the level of technique of removing the faeces in litter management system). However, the gilts kept in housing without litter should be subject to especially thorough evaluation of exterior.

The results of the evaluation of conformation traits of breeding gilts, as being given in table 4, 5 and 6, allow stating that the season of rearing is a factor which may have the influence on conformation traits. Summing of the evaluations for detailed traits in a form of total evaluation of conformation occurred to be more favorable in PL and PLW gilts, reared in the “warm” period as compared to the pigs, reared during the “cold” season. Incidence of differences in total evaluation of conformation, being favorable for animals from “warm” period was rather a consequence of summing small differences, being often statistically insignificant, in respect of detailed traits. From among the detailed traits, assessment of the motion quality (locomotion) has the important meaning. The animals from the “warm” period obtained less negative scores, i.e. 0.30 and 0.19, respectively for PL and PLW gilts in comparison with the evaluation from the “cold” period, i.e. 0.38 and 0.29, respectively.



In the respective literature, we may find only innumerable information on the results of evaluation of conformation traits, depending on the season of rearing. Drewry [2] informs about the differences in evaluation of the conformation of the young boars, born during the period of January – February or July – August (assessment in control station) which occurred to be more favorable for the boars, born during the period of January – February, i.e. with a longer period of rearing in the warm season. The discussed young boars had also higher evaluation of skeletal development. Lodde et al. [12] distinguished 6 two-month periods during the year and compared the participation of the boars with the conformation defects, depending on the mentioned periods. The higher participation of the animals with defects of shoulder and frames of the body occurred in the young boras, evaluated during the winter period as compared to the spring season. The mentioned traits were not evaluated in own studies. On the other hand, the defects of legs occurred more frequently in the boars, evaluated in the spring, i.e. born in autumn and reared during the period, classified as “cold”. It referred to pasterns of hind legs, total weakness of fore and hind legs and incidence of splints around the joints. In the own studies, more favorable results of evaluation of pasterns of hind legs were obtained by the PL and PLW gilts, reared during the “cold” period but the differences in score evaluation were statistically insignificant.

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