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MORPHOMETRIC CHARACTERISTICS OF THE OVARIES OF GILTS DEPENDING ON THEIR GROWTH RATE AND BODY WEIGHT AT SLAUGHTER

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Abstract

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The aim of the study was to determine the effect of lifetime daily weight gain and body weight at slaughter on the size of ovaries in gilts. The study was carried out on 105 gilts that were crossbred from Polish White Landrace sows and Polish Large White boars and raised on breeding farms. The gilts were divided into three groups according to their growth rate: I – gilts with lifetime daily weight gain of 400-500 g; II – 501-600 g; and III – 601-700 g. To determine the effect of body weight at slaughter on the condition of the ovaries and on the number of corpora lutea on the ovaries, the gilts were divided into four groups: I – 80-90 kg; II – 91-100 kg; III – 101-110 kg; and IV – 111-120 kg. The growth rate of the gilts, measured as lifetime daily weight gain, was found to significantly affect the development of the ovaries (dimensions and weight). The largest parameters were noted for the ovaries of gilts with daily weight gain in the 400-500 g range. The weight of the gilt at slaughter significantly influenced the weight of the ovaries. The greatest ovary weight was observed in the gilts from the 111-120 kg weight group.

Introduction

The development of the reproductive organ in gilts begins during foetal life. If the foetus is malnourished during this period, the development of the ovaries and uterus is impaired, which has a negative impact on the later fertility of the sows (Migdał et al., 2004). In subsequent stages of life the reproductive system of the gilt undergoes intensive changes, from the moment of birth until full physical maturity. These changes affect both morphometric and histological characteristics (Maciołek, 1999; Mroczek, 2002; Walkiewicz and Wielbo, 1984). The dynamics of changes in the development of the reproductive organs in gilts are influenced by endogenous and exogenous factors (Akińcza, 2008; Bidanel et al., 1996; Gajewczyk, 2001). Intensive selection aimed at improving fattening and slaughter traits can lead to underdevelopment of internal organs. Studies by many researchers indicate that the reproductive organs of gilts reared in different environmental conditions exhibit substantial variation in weight, size and histological structure (Branny and Kaczmarczyk, 1980; Czarnecki and Owsianny, 1994; Klocek et al., 1998; Walkiewicz and Wielbo, 1984). Szostak and Sarzyńska (2006) observed that the weight of the ovaries and of the corpora lutea and corpora lutea spuria on both ovaries was greater in gilts reared in small-scale farming conditions. The authors also noted a considerably higher percentage of developmental defects of the ovaries in industrially farmed gilts. Kotowski (2011) reports that genital tract development in gilts reared in large-scale farming conditions (housing with no paddock, limited light, complete feed rations) is slower than in those reared on small-scale pig farms.

Developmental anomalies in the reproductive system of sows are difficult to identify and are rarely diagnosed based on clinical examination. Causes of infertility in sows are most often diagnosed based on external symptoms, which often results in an incorrect diagnosis (Kauffold et al., 2005). Post-slaughter evaluation of the female reproductive organs is one means of monitoring problems associated with reproduction (Karvaliene et al., 2007). Post-slaughter examination of ovaries of gilts of various ages, raised in particular farm conditions, may be highly useful in breeding practice.

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The aim of the study was to determine the effect of lifetime daily weight gain and body weight at slaughter on ovary size in gilts.

Material and Methods

The study was conducted on 105 gilts crossbred from Polish White Landrace sows and Polish Large White boars and raised on breeding farms. They were kept in conditions typical of small-scale farms. Feeding in each age category was in accordance with norms (Grela et al., 2009). In order to determine the effect of growth rate on the condition of the ovaries (dimensions and weight), the gilts were divided into three groups. Group I consisted of gilts with daily weight gain of 400-500 g, group II – 501-600 g and group III – 601-700 g. To determine the effect of body weight at slaughter on the condition of the ovaries and on the number of corpora lutea on the ovaries, the gilts were divided into four groups: I – 80-90 kg, II – 91-100 kg, III – 101-110 kg and IV – 111-120 kg.

The age of the gilts, which was necessary to determine daily weight gain, was established based on the breeding documentation conducted by the farm (registry of births). The average birth weight was subtracted from the weight of the gilt at slaughter, and the difference was divided by the number of days from birth to slaughter. All animals were slaughtered at the same slaughterhouse, according to the same procedures.

Immediately after slaughter the ovaries of the gilts were collected for morphometric analysis. The following measurements were made:

- weight of left and right ovary (g);
- length of left and right ovary (cm);
- width of left and right ovary (cm);
- number of corpora lutea on left and right ovary.

The data were analysed statistically by one-way analysis of variance using the Statistica software package.

Results and Discussion

Table 1 presents the dimensions of the ovaries of gilts with different growth rates. The longest ovaries both left and right, were noted in the gilts with the lowest daily weight gain, between 400 and 500 g. The mean ovary length in this group differed significantly ($p \leq 0.05$) from the mean ovary length in gilts from the group with the highest daily weight gain (gr. III). No significant differences in ovary width were found between groups, but a decrease in ovary width can be observed as growth rate increases. The coefficient of variation for ovary length ranged from 20.5% to 23.1%, with the highest value attained in the group of gilts with low daily weight gain. The coefficient of variation for ovary width was similar, and had the highest value in the fastest-growing gilts (gr. III). Our earlier study (Szostak and Sarzyńska, 2006) of ovaries of gilts raised in different farming systems found that this factor did not significantly influence the weight and linear dimensions of the ovaries. The only tendency observed was better gonad development in gilts raised on small-scale farms. The mean weight of the left ovary in these gilts was 4.82 g, which was 0.87 g higher than that of the left ovary in gilts from industrial farms. Moreover, more corpora lutea were found on the ovaries of gilts from small-scale farms. The higher averages for the weight of the left ovaries translated into better functionality and in consequence more oocytes.

The weight of the ovaries in the groups of gilts analysed varied depending on the growth rate of the gilts (Table 2). The data indicate that the weight of the ovaries is associated with their dimensions. The greatest ovary weight (left and right) was noted in gilts from group I (with the lowest growth rate). The average weight of the left ovary was 4.53 g, and that of the right ovary was 4.21 g. The coefficient of variation for this trait was highest (15.1%) for the left ovary in the gilts with the lowest daily weight gain (gr. I). The weight of the ovaries of the gilts in group II was similar to that noted in group I. The weight of the ovaries in the group III gilts, whose daily weight gain was 601-700 g, differed significantly from that observed in groups I and II. The differences between the groups were at a level of $p \leq 0.05$. Ovary weight is very important in reproduction because it determines the number of ovulated oocytes (Grermanova et al., 1993; Szostak, 2005).

Table 3 illustrates the effect of the body weight of gilts at slaughter on the weight of their ovaries. The ovary measure-

Table 1
Size of ovaries of the gilts at different growth rate

Group	Growth rates, g	Length of left ovary, cm		Breadth of left ovary, cm		Length of right ovary, cm		Breadth of right ovary, cm	
		$\bar{x}$	V%	$\bar{x}$	V%	$\bar{x}$	V%	$\bar{x}$	V%
I	400-500	3.91[a]	21.5	2.13	20.5	3.71[a]	23.1	2.33	19.4
II	501-600	3.48	22.1	2.08	21.3	3.22	21.2	2.11	20.5
III	601-700	2.21[a]	21.8	1.65	22.4	2.10[a]	20.5	1.51	22.3

Values in columns marked with the same letters differ significantly at $p \leq 0.05$

ments showed that greater body weight in the gilts resulted in increased ovary weight. The greatest ovary weight was observed in the gilts whose body weight was 111-120 kg, and differed significantly from that of the gilts in groups I (80-90 kg) and II (91-100 kg). Fairly large variation in ovary weight can be observed in all of the groups, indicated by coefficients of variation ranging from 21.6% to 25.6%. In all of the body weight groups the mean weight of the left ovary was higher than that of the right ovary. This was also true of gilts with different growth rates (Table 2). Other authors have obtained similar results (Walkiewicz and Kondracki, 1988).

No significant differences were noted in the number of corpora lutea in gilts with different body weights (Table 4). However, slightly more corpora lutea were noted on left ovaries than on right ovaries. An identical number of corpora lutea on both ovaries (15.1) was observed in the gilts in the 80-90 kg and 111-120 kg weight groups. The variation for this trait in the gilts from the weight groups analysed ranged from 20.03% to 23.45%. The lowest variation in the number of corpora lutea on the left ovaries was noted in the group of gilts whose body weight ranged from 101 to 110 kg, while in the case of the right ovaries the greatest variation was in the group with a body weight of 111-120 kg. In gilts produced by crossing modern breeds it is difficult to establish the relationship between body size and the age at which they reach sexual maturity, and thus the state and functioning of the ovaries (Koczanowski et al., 2004). Taking into account that in as many as 60% of cases of culling of primiparous sows the cause is unsuccessful reproduction (Dourmand et al., 1994), and that underdevelopment of reproductive organs is difficult to diagnose based on clinical examinations, it would be advisable in breeding practice to more frequently draw information on reproductive problems from post-slaughter testing.

Conclusions

Modern farming methods based on the use of fast-growing breeds create new determinants that may affect young, growing organisms. These effects may include changes in the development of the ovaries. The growth rate of gilts, measured as lifetime daily weight gain, significantly affects the development of the ovaries (dimensions and weight). The largest parameters were noted in the ovaries of gilts whose daily weight gain ranged from 400 to 500 g.

The weight of the gilt at slaughter significantly affected the weight of the ovaries. The greatest ovary weight was observed in the gilts from the 111-120 kg weight group.

References

Akińcza, J., 2008. Wpływ pory roku i systemu utrzymania na rozwój układu rozrodczego loszek czysto rasowych i mieszańcowych. The effect of season and rearing system on development of reproductive organs of purebred and crossbred gilts. *Roczniki Naukowe Polskiego Towarzystwa Zootechnicznego,* **4** (3): 193-199.

Bidanel, J. P., J. Gruand and C. Legault, 1996. Genetic variability of age and weight at puberty, ovulation rate and ambryo

Table 2
Weight of ovaries of the gilts at different growth

Group	Growth rates, g	The left ovary weight, g		The right ovary weight, g	
		$\bar{x}$	V%	$\bar{x}$	V%
I	400-500	4.53[a]	15.1	4.21[a]	12.8
II	501-600	4.41[b]	13.2	4.13[b]	11.9
III	601-700	3.32[ab]	12.9	3.41[ab]	12.5

Values in columns marked with the same letters differ significantly at $p \leq 0.05$

Table 3
Weight of ovaries of gilts of different slaughter weight

Weight of gilt, kg	The left ovary weight, g		The right ovary weight, g	
	$\bar{x}$	V%	$\bar{x}$	V%
80 - 90	3.55[a]	25.6	3.11[a]	23.1
91 - 100	3.62[b]	23.1	3.51[b]	22.8
101-110	3.97	22.7	3.84	21.6
111-120	4.21[ab]	24.5	4.17[ab]	23.7

Values in columns marked with the same letters differ significantly at $p \leq 0.05$

Table 4
Number of corpora lutea in ovaries of gilts of different slaughter weight

Weight of gilt, kg	Number of corpora lutea (units)			
	left ovaries		right ovaries	
	$\bar{x}$	V%	$\bar{x}$	V%
80 - 90	8	23.1	6.7	21.8
91 - 100	7.9	22.9	7.2	21.9
101 - 110	7.6	20.3	7.1	22.2
111 - 120	7.8	22.9	7.3	23.4

survival in gilts and relation with production traits. *Genet. Sel. Evol*., **28:** 103-115.

Branny, A. and J. Kaczmarczyk, 1980. Badania porównawcze narządów rozrodczych loszek z tuczu przemysłowego i tradycyjnego. *Roczniki Naukowe Zootechniki,* **7** (1): 131-139. (Pl).

Czarnecki, R. and J. Owsianny, 1994. Płodność potencjalna loch pierwiastek oraz stopień jej wykorzystania. *Przegląd Hodowlany,* **7:** 21-23. (Pl).

Dourmand, J. V., M. Etienne, A. Prunier and J. Noblet, 1994. The effect of energy and protein intake of sows on their longevity, a review. *Livest. Prod. Sci.,* **40:,** 87-97.

Gajewczyk, P., 2001. Wpływ różnych sposobów odchowu loszek w fermie przemysłowej na rozwój ich układu rozrodczego, użytkowość rozplodową oraz niektóre parametry krwi i kości. *Zeszyty Naukowe AR Wrocław.* **CLXXXI**, 411 pp. (Pl).

Germanowa, L., B. Benkov and B. Szostak, 1993. Effect of breed and season the development of the sexsystem, the rate of ovulation and the number of foetuses in young hybrid swine. *Genetics and Breeding,* **26** (2): 129-136 (Bg).

Grela, E. R., J. Pastuszak and U. Bloch, 2009. Poradnik nowoczesnego żywienia świń. *Uniwersytet Przyrodniczy, Lublin*. 50 pp. (Pl).

Karvaliene, B., H. Zilinskas and V. Riskevicience, 2007. Post mor-tem examination of sows genital organs culled for reproductive disturbances and immunohistochemical studies on Era and PR-A receptors in the anoestral sows uterus. *Reprod. Dom Anim*., **42:** 275-281.

Kauffold, J., T. Rautenberg, G. Hoffmann, N. Beynon, I. Schelenberg and A. Sobiraj, 2005. A field study into the appropriate-ness of transcutaneous ultrasonography in the diagnoses of uterine disorders in reproductively failed pigs. *Theriogenology,* **64:** 1546-1558.

Klocek, C., J. Koczanowski, W. Migdał and J. Kaczmarczyk, 1998. Przydatność rozpłodowa loszek czysto rasowych i mieszańców odchowanych grupowo i indywidualnie. Reproductive usefulness of gilts depending on genotype and housing system. *Zeszyty Naukowe Akademii Rolniczej im H. Kołłątaja, Kraków.* **345** (33): 19-26.

Koczanowski, J., W. Migdał and C. Klocek, 2004. Wpływ stopnia otłuszczenia loszek czystorasowych pbz i wbp oraz mieszańców (pbz x wbp) na wiek osiągania dojrzałości płciowej, wielkości owulacji i stan narządów rozrodczych. The effect of fatness rate of purebred (Polish Landrace and Polish Large White) and crossbred (Polish Landrace x Polish Large White) gilts on the age of sexual maturity, the ovulation rate and condition of reproductive organs. *Zeszyty Naukowe Przeglądu Hodowlanego.* **72** (2): 11-17.

Kotowski, K., 2011. Poprawiamy efekty produkcyjne loch. *Trzoda Chlewna,* **7:** 34-37 (Pl).

Maciołek, H., 1999. Wpływ systemu chowu na cechy morfometryczne i histologiczne narządów wewnętrznych loszek. *Przegląd Hodowlany.* **1:,** 12-15 (Pl).

Migdał, W., D. Wojtysiak, P. Paściak, T. Barowicz and M. Pieszka, 2004. Effect of the eddition of com oil and a-tocopherol acetate in feed on the histochemical profile of *m. longissimus lumborum* of the fatteners. *Pol. J. Food Nutr. Sci*. **13/54 (2):** 175-178.

Mroczek, J., 2002. Przebieg procesu wzrostu i rozwoju świń. *Trzoda chlewna,* **3:** 54-57 (Pl).

Szostak, B. and J. Sarzyńska, 2006. Badania porównawcze narządów rozrodczych loszek z różnych systemów chowu. Comparative Studies of Reproductive Organs of Gilts from Different Methods of Breeding. *Annales UMCS EE,* **XXIV** (14): 95-100.

Szostak, B., 2005. Charakterystyka narządów rozrodczych i płodności potencjalnej loszek w różnym wieku. Charcteristics of reproductive organs and potential fertility of gilts at dirfferent age. *Roczniki Naukowe Polskiego Towarzystwa Zootechnicznego*, **1** (2): 343-349.

Walkiewicz, A. and E. Wielebo, 1984. Próba oceny potencjału rozrodczego loszek odchowanych w gospodarstwach indywidualnych. Evaluation of reproductive potential in gilts reared on private farms. *Zeszyty Problemowe Postępów Nauk Rolniczych,* **335:** 121-125.

Walkiewicz, A. and S. Kondracki, 1988. Potencjalna i rzeczywista płodność loszek odchowywanych w warunkach fermowych. Potential and real Fertility of Sows Reared in Farm conditions. *Zeszyty Problemowe Postępów Nauk Rolniczych,* **335:** 115-119.

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