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EFFECT OF CHANGES IN SOW FATNESS DURING THE REPRODUCTIVE CYCLE ON REARING OF PIGLETS AND QUALITY OF MILK

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Celem badań była analiza wpływu zmian otłuszczenia loch w trakcie różnych faz cyklu reprodukcyjnego na liczbę i masę odchowanych prosiąt oraz na skład chemiczny siary i mleka loch. Badania przeprowadzono na 58 lochach rasy wielkiej białej polskiej i 65 polskiej białej zwisłouchej. W dniu krycia, porodu i odsadzenia prosiąt dla każdej lochy określono grubość słoniny w punkcie P2 za pomocą aparatu ultradźwiękowego Piglog 105. W badaniach uwzględniono liczbę prosiąt w miocie oraz ich masę w 1., 7. i 21. dniu życia. Dokonano także oceny składu chemicznego siary i mleka loch, pobierając próbki siary w dniu porodu oraz mleka w 7. i 21. dniu laktacji. Lochy podzielono na grupy uwzględniając różnicę w grubości słoniny loch w okresach od dnia porodu do odsadzenia prosiąt, od krycia do porodu oraz od krycia do odsadzenia. Wyniki pracy wskazują, że od loch, których grubość słoniny była niższa w dniu odsadzenia niż w dniu porodu, otrzymano liczniejsze mioty o wyższej masie ciała prosiąt w kolejnych dniach odchowu. Również siara i mleko tych loch charakteryzowały się korzystniejszym składem siary z wyjątkiem laktozy. Podobne zależności dotyczące liczby i masy prosiąt zaobserwowano w grupie loch zwiększających grubość słoniny w okresie od krycia do porodu. Biorąc po uwagę cały cykl reprodukcyjny (od krycia do odsadzenia) stwierdzono, że potencjalnie lepsze możliwości odchowu prosiąt mają lochy zmniejszające otłuszczenie w tym okresie. Lochy te, w przeciwieństwie do loch znacznie otłuszczonych, rodziły i odchowały prosięta o wyższej masie ciała oraz produkowały mleko o większej zawartości laktozy.

Słowa kluczowe: grubość słoniny loch, użytkowość rozpłodowa, skład chemiczny siary i mleka

The ability of sows to rear numerous litters as well as properly developed piglets is closely related to their condition and the ability to produce high quality milk. The failures in breeding and production of pigs are often largely related to the inadequate number and inadequate quality of the piglets in the litter. The low degree of heritability of reproductive traits results in the optimization of physiological and environmental factors becoming the main possibility of progress in this area (Marchev & Szostak, 2007; Quesnel et al., 2009). This knowledge is increasingly influencing the assessment of the sows' condition, constituting an important element of breeding in high-production farms.

The necessity of increasing the production of milk needed to rear an increased number of piglets in a litter may cause a reduction in the energy reserves of sows. Excessive loss of fitness is the main reason for the reduced period of sow use and the earlier killing in the herd. Having considered the foregoing, condition of sows during the entire reproductive cycle is of great importance (Gajewczyk et al., 2010). The energy management of sows also affects the quality of milk, which over the course of lactation is directly related to the possibility of proper piglet rearing (Beyer et al., 2007; Rekiel et al., 2011).

The aim of the study was to analyze the impact of changes in sows' fattening during different phases of the reproductive cycle on the number and weight of reared piglets. The influence of these changes on the chemical composition of colostrum and milk of sows investigated was also studied.

Material and methods

The study was carried out on 58 sows of the Polish Large White breed and 65 Polish Landrace sows kept in the farm of the Experimental Station of the National Research Institute of Animal Production in Żerniki Wielkie.

The sows were fed with standard feed mixtures appropriate for particular phases of the reproductive cycle. Beginning from the 7th day of life, piglets were given a compound feed for young piglets, in order to learn to solid feed intake.

On the day of mating, farrowing and weaning of piglets, for each sow the thickness of back fat was determined in point P2 (behind the last rib, 3 cm from the dorsal line) using the Piglog 105 ultrasonic device. The research included all sows that farrowed and reared the first and second litters and 51 sows of the Polish Large White breed and 56 of the Polish Landrace breed, which reared the third litter.

For each litter, the number of piglets and their weight in were determined on the 1st: 7th, and 21st day of life. Chemical composition of sow colostrum and milk was analyzed in the samples of colostrum taken on farrowing day and in milk sampled on days 7 and 21 of lactation. The colostrum and milk were collected from the 1st, 3rd and 6th mammary gland from the left mammary strip. 40 ml samples of colostrum and milk together with the D&F preservative were cooled and stored at 4°C immediately after collection, for up to 10 days before testing in the laboratory. The percentage content of dry matter, protein, fat and lactose was determined in the colostrum and milk samples. The analyzes were carried out with the Milko-Scan 133B apparatus in the Laboratory of Milk Evaluation and Analysis, at the Department of Cattle Breeding and Milk Production of the University of Environmental and Life Sciences in Wrocław.

In order to find out whether the changes in backfat thickness in sows during periods from farrowing to piglet weaning, from mating to farrowing and from mating to weaning affect the examined traits (number of piglets and weight of

piglets and chemical composition of colostrum and sow milk) for 5 experimental groups. The sow breed was not taken into account at the division into groups, treating each subsequent litter as separate data for group analysis.

The division into groups took into account the difference in backfat thickness that sows had:
– on the day of farrowing and on the day of weaning,
– on the day of mating and on the day of farrowing,
– on the day of mating and on the day of weaning.

Table 1 shows the number share of sows in individual experimental groups.

Table 1. Number of sows in groups formed based on the differences in P_2 backfat thickness between farrowing and weaning days, mating and farrowing days, and mating and weaning days

Period	Group				
	1	2	3	4	5
	Difference in backfat thickness				
farrowing – weaning	1 mm and below	0 and 1 mm	2 and 3 mm	4 and 5 mm	6 mm and above
	44	**82**	**100**	**68**	**58**
mating – farrowing	-7 mm and below	-6 and -5 mm	-4 and 3 mm	-2 and -1 mm	0 and above
	60	**71**	**76**	**75**	**70**
mating – weaning	-4 mm and below	-3 and -2 mm	-1 and 0 mm	1 and 2 mm	3 mm and above
	66	**84**	**72**	**78**	**52**

The obrained results were analyzed statistically, using the SAS statistical software package, using a one-way analysis of variance according to the model:

$$Y_{ij} = \mu + a_i + e_{ij}$$

where:
μ – general mean;
a_i – variability between groups;
e_{ij} – error.

Results

The study included 123 sows that farrowed 353 litters. Changes in the fatness of sows in subsequent breeding phases were determined, and it was test if they could affect their reproductive performance, as well as the quality of colostrum

and milk. First of all, the effect of changes in backfat thickness in P2 point between the farrowing and weaning of piglets was analyzed. Accordingly, for each sow the difference in backfat thickness was calculated between the mentioned dates, and it was allocated to one of the five groups listed in Tables 2–4. The smallest difference is represented by the first group, the greatest one – by the fifth. The first group includes sows for which the difference in backfat thickness between the measurement on the day of farrowing and on the day of weaning was -1 mm and lower. Therefore, sows included here had the backfat thickness on the day of farrowing smaller than the thickness of backfat at weaning – meaning those which increased its thickness in this period. The fifth group was represented by sows which lost the most fat cover between the farrowing and the weaning.

As can be seen from the data in Table 2, most piglets farrowed in the litter were sows, for which the difference between the thickness of backfat on the day of farrowing and weaning was 6 mm and more (group 5). The number of piglets farrowed in this group differed statistically significantly from the number of piglets in the first and the second group. Similar differences between the groups were observed in the number of piglets in the litter in subsequent rearing periods. Detailed analysis allows to notice that two sets of subjects (A and B) can be distinguished from the tested sow population. Set A comprises groups 1 to 3, set B – groups 4 and 5. There were no significant differences between the mean values for rearing piglets in the subsequent days of lactation between the groups within set A and B. However, statistically significant and highly significant differences were found between groups from sets A and B, especially in terms of the number of piglets in the subsequent days of lactation, and the piglet weight on the day of birth and on the 21st day of life. The highest value for these traits was demonstrated in groups 4 and 5 (set B), i.e. including sows, which lost 4 mm and more of the backfat thickness from farrowing to piglet weaning.

Table 2. Number and weight of piglets per litter in different groups of sows divided according to the differences in their backfat thickness between farrowing and weaning days

Item	Groups					Significant differences between the groups
	1	2	3	4	5	
	Difference in backfat thickness (mm)					
	-1 and below	from 0 to 1	from 2 to 3	from 4 to 5	6 and more	
Mean difference in group (mm)	-2,28	0,58	2,49	4,40	7,06	
No. of piglets born	11,32	11,53	11,69	11,78	11,92	1-4; **1-5**; 2-5
No. piglets on day 7	10,52	11,10	10,92	11,35	11,56	**1-4**; **1-5**; 2-5; 3-4; **3-5**

No. piglets on day 21	10,13	10,13	10,12	10,69	10,85	1-4; **1-5**; 2-4; **2-5**; 3-4; **3-5**
Weight of piglet at birth (kg)	1,37	1,45	1,43	1,48	1,47	1-2; **1-4**; 1-5
Weight of piglet on day 7 (kg)	2,56	2,62	2,63	2,67	2,68	
Weight of piglet on day 21 (kg)	5,27	5,58	5,39	5,62	5,54	1-4

Values in bold type are significant at P≤0.01, those in normal type at P≤0.05.

No clear trend was observed for the properties characterizing the composition of colostrum and milk presented in Table 3. It was only found that colostrum in the group of sows which reduced the backfat thickness by 4 to 5 mm (group 4), was characterized by a significantly higher dry matter content and lower lactose content compared to the colostrum of group 1 sows (i.e. those that increased their fatness), and a higher fat content compared to sows from group 2. High differences in fat content between groups 2 and 5 as well as significant between groups 2 and 4 were also found. Other significant differences between groups in the content of individual milk components could have been accidental.

Table 3. Chemical composition of sow colostrum and milk in different groups of sows divided according to the differences in backfat thickness between farrowing and weaning days

Item	Groups					Signifi-cance of difference between groups
	1	2	3	4	5	
	Difference in backfat thickness (mm)					
	-1 and below	from 0 to 1	from 2 to 3	from 4 to 5	6 and above	
Mean difference in the group (mm)	-2.28	0.58	2.49	4.40	7.06	
Colostrum:						
- dry matter (%)	21.44	22.07	22.49	22.94	22.84	1.-4
- protein (%)	14.15	14.80	14.85	15.11	14.99	
- fat (%)	4.84	4.51	4.98	5.28	5.63	**2-5,** 2-4
- lactose (%)	2.27	1.99	2.04	1.82	2.11	1.-4
Milk on the 7 day of lactation:						
- dry matter (%)	17.72	18.16	17.70	17.89	18.21	
- protein (%)	4.40	4.65	4.57	4.70	4.51	
- fat (%)	7.42	7.64	7.31	7.73	7.79	
- lactose (%)	5.61	5.63	5.51	5.47	5.67	
Milk on the 21th day of lactation:						
- dry matter (%)	18.16	17.29	18.22	17.53	17.95	1-2; **2-3**
- protein (%)	4.73	4.79	4.95	4.83	4.66	
- fat (%)	7.43	6.41	7.13	6.72	6.84	**1-2**; 2-3
- lactose (%)	5.43	5.65	5.39	5.48	5.63	2-3; 3-5

Values in bold type are significant at P≤0,01, in normal type at P≤0.05.

The second criterion for division into groups was the difference between the thickness of backfat measured on the day of mating and on the day of farrowing. The negative values listed in table 4 mean that sows in the mentioned period increased the thickness of backfat, which allowed preparation of energy reserve for the needs of piglet rearing.

Table 4. Number and weight of piglets per litter in differences groups of sows divided according to the differences in their backfat thickness between mating and farrowing days

Item	Groups					Significance of difference between groups
	1	2	3	4	5	
	-7 and below	from -6 to -5	from -4 to -3	from -2 to -1	0 and above	
Mean difference in group (mm)	-8.87	-5.61	-3.68	-1.51	2.02	
No. of piglets born	11.87	11.72	11.76	11.48	11.48	1-4; 1-5
No. of piglets on day 7	11.48	11.18	11.22	10.89	10.84	1-4; **1-5**
No. of piglets on day 21	10.75	10.35	10.34	10.21	10.18	1-4; 1-5
Weight of piglet at birth (kg)	1.46	1.42	1.46	1.45	1.46	
Weight of piglet on day 7 (kg)	2.63	2.54	2.58	2.70	2.71	2-4; 2-5
Weight of piglet on day 21 (kg)	5.50	5.41	5.41	5.51	5.63	

Values in bold type are significance at P≤0,01, those in normal type at P≤0.05.

As can be seen from the data in the Tab. 4, statistically significant differences in the number of piglets farrowed and reared at particular dates occurred only between group 1 (in which backfat thickness was 7 mm and more) and fourth and fifth (where differences in backfat thickness were minimal or absent) did not occur. Sows that increased their fatness farrowed and reared significantly more piglets.

The difference between the thickness of backfat measured on the day of mating and measured on the day of farrowing did not have statistically significant effect on the weight of piglets. This is confirmed by the lack of significant differences between groups distinguished on the basis of this criterion for almost all characteristics. The difference in weight of piglets on the 7th day between groups 2 and 4 as well as 2 and 5 is the exception.

Taking into account the average groups regarding the chemical composition of colostrum and milk (Table 5), it can be noticed that there are many more differences between them than in case of the previously discussed features. In many cases, sows with a large difference in backfat thickness and therefore

having a larger fat reserve were characterized by more favorable parameters in terms of milk quality. This applies mainly to sows from group 2, which increased their fat cover by an average of 5.61 mm. For the most part, the least favorable indicators (dry matter, protein, fat) characterized groups 4 and 5. At the same time, increased lactose content in milk was observed in group 5. It should be noted that the trends of changes in question have not always found statistical confirmation.

Table 5. Chemical composition of sow colostrum and milk different groups of sows divided according to the differences in backfat thickness of backfat between mating and farrowing days

Item	Groups					Significant differences between the groups
	1	2	3	4	5	
	-7 and below	from -6 to -5	from -4 to -3	from -2 to -1	0 and above	
Mean difference in group (mm)	-8.87	-5.61	-3.68	-1.51	2.02	
Colostrum:	22.30	23.36	22.12	22.58	21.64	
- dry matter (%)						2-3; **2-5**; 3-4
- protein (%)	14.64	15.22	14.90	14.87	14.48	
- fat (%)	5.33	5.40	5.05	5.04	4.22	**1-5**; 2-5; 3-5; 4-5
- lactose (%)	2.04	1.85	2.10	1.93	2.19	2.-5
Milk on day 7 of lactation:	17.96	18.22	17.50	17.80	18.21	
- dry matter (%)						
- protein (%)	4.59	4.71	4.54	4.68	4.49	
- fat (%)	7.52	7.67	7.45	7.30	7.84	
- lactose (%)	5.52	5.51	5.60	5.48	5.70	4.-5
Milk on day 21 of lactation:	17.97	17.97	17.75	17.80	17.66	
- dry matter (%)						
- protein (%)	4.67	5.00	5.05	4.79	4.58	1-3; 2-5; 3-5
- fat (%)	6.85	6.59	6.83	7.07	6.93	
- lactose (%)	5.69	5.35	5.34	5.52	5.69	**1-2**; **1-3**; 2-5; **3-5**

Values in bold type are significance at P≤0,01, those in normal type at P≤0.05.

Results of breeding performance, and composition of colostrum and milk for groups of sows, formed on the basis of differences in the thickness of backfat measured at point P2 on the day of mating and on the day of piglet weaning are presented in Tables 6 and 7. Negative values for the difference in backfat

thickness mean that these sows during this period increased the backfat thickness, while the positive values mean that the backfat thickness of the sows decreased. The first group consisted of sows in case of which the backfat thickness increased in the entire reproductive cycle by 4 mm and more, while the fifth group included those in which the backfat thickness decreased by 3 mm and more.

Data from Table 6 show that there were no statistically significant differences between group means values in terms of the number of piglets farrowed and reared up to 7 days of age. In the number of piglets reared up to day 21, statistically significant differences were found at P≤0.05 level between the first group and the fourth group.

Differences between these groups repeated in case of the piglet weight throughout the rearing period. In addition to them, statistically significant differences were found between the second and fourth groups in the mass of the piglet on the day of birth and in the 7th day of life, as well as between the second and third group in the mass of piglets on the 7th day of rearing.

Table 6. Number of piglets in a litter in particular groups of sows, divided by the differences between the thickness of sows' backfat measured on the day of mating and the thickness of backfat measured on the day of piglet weaning

Item	Groups					Significant differences between the groups
	1	2	3	4	5	
	-4 and below	from -3 to -2	from -1 to 0	from 1 to 2	3 and above	
Mean difference in group (mm)	-5.55	-2.36	-0.53	1.57	4.72	
Number of born piglets	11.58	11.63	11.75	11.63	11.71	
Number of piglets on day 7	10.82	11.17	11.22	11.22	11.02	
Number of piglets on day 21	10.13	10.30	10.40	10.64	10.14	1.-4
Weight of piglets at birth (kg)	1.41	1.42	1.46	1.48	1.46	1-4; 2-4
Weight of piglets on day 7 (kg)	2.57	2.52	2.70	2.73	2.68	1-4; 2-3; **2-4**
Weight of piglets on day 21 (kg)	5.29	5.46	5.41	5.65	5.67	1-4; 1-5

Values in normal type are significant at P≤0.05.

Analyzing the data contained in Table 7, it was found that the highest values for the basic parameters of colostrum were achieved by sows which practically did not change the thickness of the fat cover during the time from mating to

piglet weaning (group 3). The colostrum of these sows was characterized by the highest content of protein and fat, and the lowest content of lactose. It is difficult to determine significant regularities in mean changes for individual characteristics of the analyzed groups on the basis of the difference significances between them. However, one can notice certain tendencies in changes of these means. The colostrum of sows, which increased fatness from mating to piglet weaning (group 1, 2, 3), demonstrated increased fat content in comparison to sows from groups 4 and 5. A tendency to increase the content of dry matter while reducing the content of lactose is noticeable in the milk of these sows (group 1, 2, 3), taken mainly on the 21st day of lactation.

Table 7. Chemical composition of colostrum and dairy sows in individual groups of sows divided by the differences between the thickness of backfat measured on the day of mating and the thickness of backfat measured on the day of piglet weaning

Item	Groups					Significant differences between the groups
	1	2	3	4	5	
	-4 and below	from -3 to -2	from -1 to 0	from 1 to 2	3 and above	
Mean difference in group (mm)	-5.55	-2.36	-0.53	1.57	4.72	
Colostrum:	22.46	22.47	22.82	22.26	22.00	
- dry matter (%)						
- protein (%)	14.94	14.46	15.32	14.63	14.65	2-3; 3-4; 3-5
- fat (%)	5.06	5.29	5.36	4.80	4.34	2-5; 3-5
- lactose (%)	1.98	2.12	1.75	2.10	2.17	2-3; 3-4; 3-5
Milk on the day 7 of lactation:	17.70	18.01	18.24	17.64	18.24	
- dry matter (%)						
- protein (%)	4.41	4.77	4.67	4.54	4.52	1.-2
- fat (%)	7.42	7.51	7.66	7.50	7.78	
- lactose (%)	5.61	5.46	5.50	5.59	5.72	2-5; 3-5
Milk on the day 21 of lactation:	18.22	18.04	17.52	17.51	17.68	
- dry matter (%)						1-3; 1-4
- protein (%)	4.78	5.02	4.96	4.59	4.60	2.-4
- fat (%)	7.26	6.75	6.54	6.77	6.97	1.-3
- lactose (%)	5.50	5.45	5.38	5.55	5.76	2-5; **3-5**

Values in bold type are significance at P≤0,01, those in normal type at P≤0.05.

Discussion

The study included a wide range of changes in the difference of backfat thickness from sows in the next three lactations. The direction of fatness changes related to the reproductive cycle was analyzed. The available literature shows that in case of gilts, their mating is the most advantageous when they are characterized by a daily increase in the range of 600-770 g/day and a backfat thickness of about 15–16 mm. Elements with such parameters are clearly characterized by a greater number of live piglets (Amaral Filha et al., 2010). This opinion is also confirmed by other authors. The described dependence in the sows of Slovenian Large White and Slovenian Landrace was confirmed by Flisar et al. (2012). Similar observations were also noted in Polish breeds (Szulc et al., 2013). Their genetic potential can be used with optimal nutrition and proper health, which should result in the ability to restore energy reserves in the subsequent phases of the production cycle.

Period from mating to weaning

From a breeding point of view, it is necessary to eliminate certain sows from the herd – those which despite optimally balanced and adequately dosed feed are unable to regenerate the body before the next estrous cycle. However, it should be remembered that a significant proportion of sows increase their fatness during the period between mating and piglet weaning. This indicates the potential of these animals to increase the thickness of backfat during subsequent production cycles, which was indirectly proved by the results in these studies. It was found that the higher the value of the difference in backfat thickness in the period between mating and weaning (the more sows increased fatness), the lower the number of piglets reared up to the 21st day of life. In addition, it was proved that the greater the thickness of backfat on the day of weaning (groups 1 and 2), the lower the weight of piglets throughout the rearing period. It seems that this may be the result of a low percentage of lactose in the colostrum and milk of such sows.

Consequently, it may be indirectly indicated that there are potentially better litter rearing possibilities by sows which reduce fat cover during the period from mating to weaning. It seems that such animals may have higher reproductive potential and provide better piglet rearing. Studies by Revell et al. (1998 b) confirm the foregoing thesis. These authors demonstrate that sows with a high backfat thickness were characterized by lower milk yield and greater losses of suckling piglets. It should be noted that all the sows included in the study were fed the same feed, therefore the differences were mainly physiological and not nutritional.

Period from farrowing to weaning

Reducing the backfat thickness during the period from farrowing to piglet weaning in the vast majority of sows is associated with a reduction in the level of energy reserves in adipose tissue, which was spent in the rearing period for

the existence needs, and the production of colostrum and milk during lactation. Analyzing the data obtained in the studies, it was found that the greater the difference in the thickness of backfat sows (the more the fat cover decreased), the more piglets were farrowed alive, as well as alive on the 7th and the 21st day of life. Greater piglet weight was also obtained. This is undoubtedly related to the chemical composition of colostrum and sow's milk. Colostrum of sows reducing backfat thickness in this period has higher content of dry matter and fat, with decreasing lactose content. In their milk, however, there was quite an ambiguous differentiation of dry matter, fat and lactose on the 7th and 21st days of lactation. The reduction of fat deposits by sows during piglet rearing indicates their potentially high reproductive fitness. Rekiel et al. (2011) when determining the relationship between fatness changes and body weight in sows during the so-called "high pregnancy" up to the 21st day of lactation, with the level of selected lipid indices in the blood serum, and basic ingredients and the profile of fatty acids in the colostrum and milk, found that the greater the difference in the thickness of backfat in the period between the so-called "high pregnancy" and piglet weaning, the more fat and energy sow milk contains.

In other study, Rekiel (2002) showed that the weaker condition of sows at weaning is caused by large losses of fat reserves and body weight during offspring rearing, which – with limited feed intake – is a serious production problem. Hansen et al. (2012) who, while conducting studies on Landrace × Yorkshire hybrids, showed that proper feeding of sows during these periods had a positive effect on the number of piglets farrowed alive in the litter, had the same opinion. Similar conclusions, focusing on the proper condition of sows during pregnancy and the related number of piglets in the litter, were presented by Campos et al. (2012). Results of experiments carried out on sows by Kim et al. (2013) showed that proper feeding of sows during pregnancy, in addition to better production results, also limits the occurrence of stress in females, contributing to the improvement om the health of sows and piglets. Rekiel et al. (2007) also proved that at weaning, compared to the "high pregnancy", the thickness of the backfat of the sows at P2 was smaller. Sows lost fat reserves and weight during the piglet feeding period. In addition, they showed that the backfat thickness had no effect on fertility. On the other hand, Revell et al. (1998 a) found that sows – which during the farrowing period were characterized by thick backfat of more than 21 mm – took less feed when rearing offspring.

In authors' own study it was proved that about 50% of sows (groups 2 and 3) showed the ability to maintain energy reserves (backfat) at a constant level despite the high demand associated with very good litter rearing during lactation. This is important from a practical point of view. It proves not only the good nutritional conditions, but also the high efficiency of the organism ready to quickly enter the next production cycle – even in restrictive farming conditions. Both excessive fatness of sows (group 1) and significant deficiencies or exhaustion of the body during the rearing period result in subsequent difficulties in mating performance or poorer results of rearing the next litter with more

piglets farrowed dead and smaller weight of piglets up to and including the day of weaning, which was confirmed in studies by Rekiel (2002), Beyga & Rekiel (2009), Wientjes et al. (2013) and Roongsitthichai et al. (2013).

Period from mating to farrowing

In the vast majority of sows, the content of adipose tissue increases in the period from mating to farrowing. Tummaruk et al. (2001) in the Landrace and Yorkshire sow studies found that gilts with a higher daily feed intake have thicker backfat during farrowing and take more feed during lactation. On the other hand, Gaughan et al. (1995) proved that the thickness of backfat in the mating period is positively correlated with the length of the production period of sows, and therefore their longevity. In the literature there are few examples of research discussing a significant increase in the thickness of backfat sows during the gestation period. Individual traits (genotype) certainly determine this (Szyndler-Nędza et al., 2016, 2017), and the issue concerns a very small group of sows which is difficult to select. However, the results of direct measurements obtained in this respect clearly document the occurrence of such sows which may be the baseline for further studies in this area. Even more because the large differences in backfat thickness can result in increased milk production with better quality. This may affect not only the better results of piglet rearing – also in the next lactation, but also the regeneration after significant losses of body fat.

Based on authors' own study, it was found that the higher the difference in backfat thickness in the period between mating and farrowing, the higher the number of live-farrowed piglets as well as on the days 7 and 21. At the same time, higher fat content and variable lactose and dry matter contents in colostrum were observed. The possibility of increasing the thickness of backfat in sows in the gestation period is of great importance, as confirmed in studies by Sell-Kubiak et al. (2013). Once again, the obtained results can be related to the biological potential of the sows, but a more important conclusion is to draw attention to the importance of the gestation period which has not been appreciated so far. The dietary needs of sows are then associated with the development of fetuses, uterus, placenta, and preparation of udder for lactation. Optimal feeding of sows during gestation can significantly affect the improvement of their condition, as well as the number and weight of farrowed piglets.

In conclusion, the sows whose backfat thickness was lower on weaning day than on farrowing day, produced larger litters with heavier piglets on successive days of growth. Also the colostrum and milk of these sows was characterized by more beneficial composition of colostrum except for lactose.

Similar relationships for the number and weight of piglets were observed in the group of sows which increased their backfat thickness between mating and farrowing. In this case, no definite dependencies related to the chemical composition of colostrum and milk were found.

Considering the entire reproductive cycle (from mating to weaning), the sows that decreased their fatness in this period were found to have higher potential to rear piglets (group 4 and 5). These sows, unlike sows increasing their fat cover by 4 mm and more (group 1) farrowed and weaned heavier piglets and produced milk with higher lactose content.

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Effect of changes in sow fatness during the reproductive cycle on rearing of piglets and quality of milk

SUMMARY

The objective of the study was to analyze the effect of changes in sow fatness during different stages of the reproductive cycle on the number and weight of weaned piglets, and on the chemical composition of sow colostrum and milk. Fifty-eight Polish Large White and 65 Polish Landrace sows were studied. On the day of mating, farrowing and weaning, P2 backfat thickness was measured for each sow using a Piglog 105 ultrasound device. The study accounted for the number of piglets per litter and their weight at 1, 7 and 21 days of age. Chemical composition of sow colostrum and milk was analyzed in the samples of colostrum taken on farrowing day and in milk sampled on days 7 and 21 of lactation. Sows were divided into groups according to the difference in backfat thickness from farrowing to weaning, from mating to farrowing, and from mating to weaning. The results show that the sows whose backfat thickness was lower on weaning day than on farrowing day, produced larger litters with heavier piglets on successive days of growth. Also the colostrum and milk of these sows was characterized by more beneficial composition of colostrum except for lactose. Similar relationships for the number and weight of piglets were observed in the group of sows which increased their backfat thickness between mating and farrowing. Considering the entire reproductive cycle (from mating to weaning), the sows that decreased their fatness in this period were found to have higher potential to rear piglets. Unlike fatter sows, these sows gave birth to and weaned heavier piglets and produced milk with higher lactose content.

Key words: backfat thickness of sows, reproductive performance, chemical composition of colostrum and milk