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Analysis of relationship between sows colostrum and milk somatic cell count and reproductive performance traits

Analiza zależności między składem chemicznym oraz liczbą komórek somatycznych siary i mleka loch a cechami rozrodu

Summary. The relationship between the major chemical constituents and somatic cell count (SCC) in sows colostrum and milk and the rearing results of piglets was analyzed. The studies involved 20 crossbred Polish Large White (PLW) × Polish Landrace (PL) sows in the second and third reproduction cycles. The chosen reproductive performance traits were plotted against the level of each chemical composition component and the SCC of colostrum (1 lactation day) and milk (7 lactation day). The chemical composition of sows colostrum and milk as well as the SCC estimates proved to be significantly modified by the lactation stage and season. It was also found that a higher share of the major components of sows colostrum and milk with the lower SCC favored the higher litter size and piglet usability for rearing expressed as body weight and daily weight gains.

Key words: sows, chemical composition, somatic cell, piglet rearing

INTRODUCTION

Litter size and its biological value are considered to be determinants of the farm economic performance. They are dependent on various genetic and environmental conditions, among which the chemical composition of gilt colostrum and milk has a profound effect [McNamara and Pettigrew 2002]. Variability in milk composition is affected by a number of factors regarding breed, individual traits, physiology and environment [Walkiewicz *et al.* 2006]. Besides, suboptimal lactation function of the mammary gland due to disorders also has influence on piglet rearing efficiency [Klobasa *et al.* 1987]. Therefore, it would be economically advisable to determine some indices useful as diag-

nostic tools for mastitis and concurrent conditions. Establishment of somatic cell numbers in gilt colostrum and milk offers the opportunity for appropriate diagnostic evaluation. However, only few papers addressing this issue do not give a precise order of magnitude estimates [Rekiel and Więcek 2002].

The objective of the present analyses was to evaluate the variability of milk chemical composition and the SCC level during the 21-day lactation period as well as comparative analysis of major components throughout the spring-summer and autumn-winter season aimed to indicate the optimum chemical composition of milk and colostrum and the SCC to obtain high production efficiency of gilts.

MATERIAL AND METHODS

The experiment was performed at two replications at the pig farm of a closed production cycle. The studies involved 20 crossbred Polish Large White × Polish Landrace sows. The housing facility for gestating sows, lactating ones and boars was divided into 4 sections. The farrowing section included two chambers (respectively, 16 and 10 animals each) of the same accommodation – litterless pens of 3.75 m^2 area with anti-slide slanted, plastic floor grate and the computer-controlled mechanical ventilation. Sows are introduced to the farrowing unit 14 days before the expected farrowing date to get acclimated to the new surrounding as well as for monitoring the farrowing progress. A feed ration in the standard feeding regime during the lactation season comprised 17.1% crude protein and 12.65 MJ/KG metabolic energy, 0.81% lysine, 0.29 methionine, 0.85% calcium, 0.60% phosphorus, 0.22% sodium. Colostrum and milk were collected on 1, 7, 14 and 21 lactation days of the second and third reproduction cycle after the intravenous administration of 15 IU of synthetic oxytocin. Milk was always taken from the same teat pairs, i.e. 2, 4, 6 pair. Colostrum and milk were collected during two seasons, that is the spring-summer (from 1 March to 31 August) and autumn – winter (from 1 September to 28 February), taking samples at least twice a month).

The chemical composition of colostrum and milk was determined with INFRARED MILK ANALYZER Bentley 50 evaluating a content of dry matter, fat, protein and lactose, whereas the somatic cell counts (thousand/ml) by SOMACOUNT 150. The established SCC numbers were converted to natural logarithm (LOG).

Data characterizing utility value of gilts at the second and third reproduction cycle included the number of piglets born alive per litter (unit), number of piglets per litter on 4, 14, 21 days of age (u), piglet mortality rate at week-periods from 1 to 21 days of life (%), average piglet body weight in litter on 1 day of life (g) and at successive week-intervals to 21 days of age, daily body weight gains at week-intervals from birth to 21 days of life, sows milk performance to 21 lactation day (kg) calculated with the following formula: sows milk efficiency to 21 lactation days = (litter weight on 21 days of age – litter weight at birth) × 4,0 [Grudniewska 1998].

The reproduction performance traits of gilts were plotted against a level of each constituent of the chemical composition and the SCC of colostrum (1 lactation day) and milk (7 lactation day) of the gilts according to the pattern in Table 1.

Table 1. Boundary values of chemical components and SCC
Tabela 1. Wartości graniczne składników chemicznych i LKS

Trait Cechy	Colostrum – Siara		Milk – Mleko	
	Group I ≤ … Grupa I ≤ …	Group II ≤ … Grupa II ≥ …	Group I ≤ … Grupa I ≤ …	Group II ≤ … Grupa II ≥ …
SCC LKS	1100×10^3	1101×10^3	1200×10^3	1201×10^3
Fat (%) Tłuszcz (%)	6.0	6.1	6.9	7.0
Protein (%) Białko (%)	11.0	11.1	5.8	5.9
Lactose (%) Laktoza (%)	2.9	3.0	5.0	5.1
Dry matter (%) Sucha masa (%)	20.5	20.6	18.5	18.6

The determined values were derived from the means for the experimental group on a given lactation day.

The obtained numerical data were analyzed statistically (STATISTICA 6.0) calculating the arithmetic means and standard deviations. Differences related to a particular trait between the groups were verified with the Duncan`s test at the $p \leq 0.05$ and $P \leq 0.01$ significance level.

RESULTS

The mean chemical composition and the counts of somatic cells at the 21-day lactation period was presented graphically in Figure 1. Fat concentration ranged between 6.02% and 6,99% and it did not show any significant dependence on a sampling day.

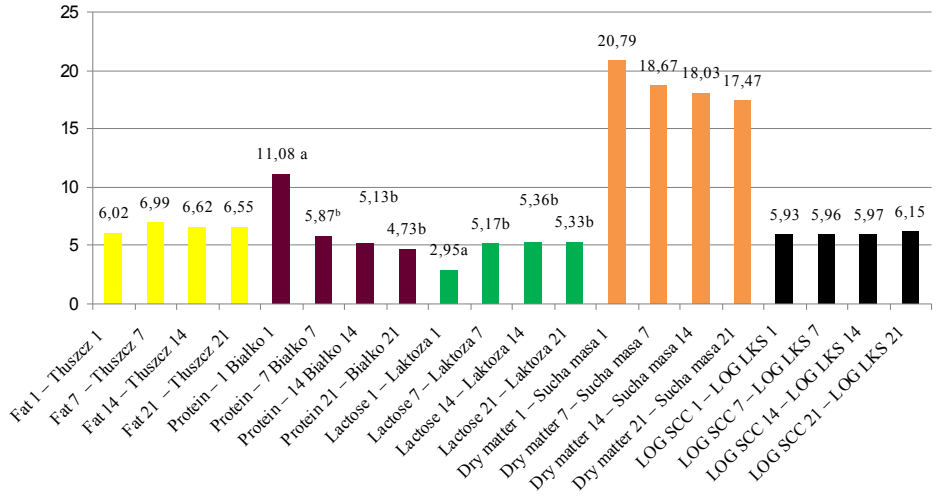

Fig. 1 Chemical composition and SCC estimated in sows colostrum and milk at 21-days lactation
Ryc. 1. Skład chemiczny oraz LKS siary i mleka loch w 21-dniowej laktacji

However, the contribution of lipid fraction in colostrum and milk has proven to be significantly modified by a season. A higher fat level was noted in the samples collected during spring-summer farrowings (Tab. 2). A protein level in the experimental gilts` colostrum was significantly higher as compared to the samples taken on 7.14 and 21 lactation days ($p \leq 0.05$), but generally, a sampling season did not have significant influence on this constituent concentration. The mean values oscillated from 11.08 on 1 lactation day up to 4.73 on 21 lactation days (Fig. 1, Tab. 2).

Table 2. Percent chemical composition and SCC estimates in sows colostrum and milk at given seasons

Tabela 2. Procentowy skład chemiczny oraz liczba komórek somatycznych w siarze i mleku loch w określonych sezonach roku

Specification Wyszczególnienie	Autumn-winter season Okres jesienno-zimowy		Spring-summer season Okres wiosenno-letni	
	x	SD	x	SD
Fat 1 – Tłuszcz 1	5.48^{a}	2.12	6.52^{b}	1.58
Protein 1 – Białko 1	11.07	2.79	11.09	2.60
Lactose 1 – Laktoza 1	2.93	1.04	2.96	0.94
Dry matter 1 – Sucha masa 1	20.61	3.38	20.96	1.99
SCC 1 ($\times 10^3$) – LKS 1 ($\times 10^3$)	1606.0^{A}	392.5	722.2^{B}	194.5
LOG SCC 1 – LOG LKS 1	6.11^{A}	0.36	5.77^{B}	0.31
Fat 7 – Tłuszcz 7	6.39^{a}	2.08	7.53^{b}	0.55
Protein 7 – Białko 7	6.10	0.72	5.67	2.62
Lactose 7– Laktoza 7	5.05	0.75	5.27	1.03
Dry matter 7 – Sucha masa 7	18.82	1.08	18.54	2.12
SCC 7 ($\times 10^3$) – LKS 7 ($\times 10^3$)	1647.6^{a}	462.3	962.5^{b}	274.1
LOG SCC 7 – LOG LKS 7	6.10	0.35	5.85	0.37
Fat 14 – Tłuszcz 14	6.51	0.83	6.72	1.51
Protein 14 – Białko 14	5.13	0.52	5.13	1.28
Lactose 14 – Laktoza 14	5.33	0.66	5.40	1.17
Dry matter 14 – Sucha masa 14	18.13	1.47	17.94	0.76
SCC 14 ($\times 10^3$) – LKS 14 ($\times 10^3$)	1570.6^{a}	352.8	969.1^{b}	105.2
LOG SCC 14 – LOG LKS 14	6.14^{a}	0.24	5.81^{b}	0.44
Fat 21 – Tłuszcz21	6.44	0.90	6.65	0.97
Protein 21 – Białko 21	5.07^{A}	0.46	4.43^{B}	0.49
Lactose 21– Laktoza 21	5.53	0.83	5.15	0.75
Dry matter 21 – Sucha masa 21	17.92	1.13	17.07	1.50
SCC 21 ($\times 10^3$) – LKS 21 ($\times 10^3$)	1866.8^{a}	234.0	1321.8^{b}	135.5
LOG SCC 21 – LOG LKS 21	6.22	0.24	6.09	0.17

$^{a,A,\ldots}$ – in rows the means denoted by different letters are significantly different; a, b – $p \leq 0.05$; A,B – $p \leq 0.01$

As for lactose, elevated concentration of this component was established from 7 to 21 lactation day. It ranged between 5.17 and 5.36% and was significantly higher by 2.22% –2.41% ($p \leq 0.05$) compared to colostrum (Fig. 1). When in fact, a lactose content did not undergo any lactation season-induced modification (Tab. 2).

A notable factor providing an insight into the mammary gland health state and consequently, the potential milk yield in gilts is somatic cell counts. This component level in the gilt group under investigation was found within the range of 5.93% in colostrum obtained on 1 lactation day up to 6.15% in the milk samples collected on 21 day postpartum (Fig. 1). Taking into account litter size from 1 to 21 days of piglet age, there was not recorded significant impact of the SCC estimates established in colostrum on 1 lactation day on this indicator value. However, the raised values were determined in the gilts with the SCC1 lower or equal 1100×10^3. It was noted that higher body weight and daily gains had the piglets from the dams of lower SCC in colostrum (Tab. 3). As for daily weight gains, they were shown to be higher in the piglet group with SCC1 below 1100 within the period of 1 to 21 lactation days and the established differences referred to group II turned out to be statistically confirmed ($p \leq 0.05$ and $P \leq 0.01$). Alike, fat concentration (above 6,1%) in colostrum had beneficial effect on the litter size on 1, 7, 14 and 21 days of life. Some significant differences were reported referring to 14 and 21 day of life (Tab. 4).

The elevated protein content in the colostrum on 1 lactation day significantly affected piglet body weight as determined on 14 day of life ($P \leq 0.01$). As regards daily weight, colostrum protein was also shown to induce a positive growth rate response in piglets. Protein concentration in colostrum at the 11% level or higher led to the increased by 151.07 g daily gains as compared to the piglet group fed colostrum of a lower protein content from 14 to 21 lactation days (Tab. 5). Alike, in the case of lactose there were also noted definite production implications (Tab. 6). A lactose level exceeding 3% contributed positively to the number of reared piglets on 7.14 and 21 days of life, reduced piglet death loss, increased average body weight on 21 day of age and daily gains from 7 to 21 days of age.

According to the data summarized in Table 4, milk fat content on 7 lactation day had significant impact on piglet body weight. The piglets receiving milk of ≤ 6.9% fat concentration weighed significantly more on 7 and 21 day of age as compared to the individuals suckling milk of ≥ 7.0% fat level. However, proteins are imperative to build up new cells which is supported by the obtained numerical data and presented in Table 5. Protein content surpassing 5.1% proved to be a factor significantly affecting piglet body weight on 7 lactation day, it reached 3160 g and was higher by 626.76 g as against the piglets fed milk of fat content under 5%. Concurrently,there was observed significant importance of milk protein quantity for daily weight gains in piglets. Their growth rate from 14 to 21 day of life appeared to be higher in the gilt group of increased protein concentration, i.e. above 5.1%. It was likely to result from the introduction of a solid diet, whose protein might be antagonistic to the maternal protein during the I supply period. It is evidenced by the daily gains recorded in the third week of piglet life. In this age group, higher growth rate was observed in the piglets receiving milk of protein content ≤ 5.0%. A lactose content in milk on 7 lactation day, alike in colostrum, on the farrowing day affected the litter size from birth till 21 day of life. The data presented in Table 6. imply that the higher number of piglets per litter was characteristic of a gilt group of a milk lactose level ≤ 5.0%. There was also found beneficial effect of a dry

Table 3. Comparison of SCC in milk and colostrum with sows reproduction indices
Tabela 3. Porównanie liczby komórek somatycznych (LKS) zawartych w siarze i mleku do wskaźników rozrodu loch

Specification Wyszczególnienie	Group I SCC1 ≤ 1100 × 10^3 Grupa I LKS1 ≤ 1100 × 10^3		Group II SCC1 ≥ 1101 ×10^3 Grupa II LKS1 ≥ 1101 × 10^3		Gorup I SCC7 ≤ 1200 × 10^3 Grupa I LKS7 ≤ 1200 × 10^3		Group II SCC7 ≥ 1201 × 10^3 Grupa II LKS7 ≥ 1201 × 10^3	
	x	SD	x	SD	x	SD	x	SD
Number of pigs born alive per litter (unit) Liczba prosiąt żywo urodzonych w miocie (szt.)	11.92	1.37	11.89	1.17	-	-	-	-
Number of pigs in litter on 2 day of life (u.) Liczba prosiąt w miocie w 7 dniu życia (szt.)	11.00	1.35	10.34	1.23	10.82	1.25	10.63	0.89
on 14 day of life (u.) w 14 dniu życia (szt.)	10.25	1.08	9.67	1.01	10.11	1.15	9.94	0.78
on 21 day of life (u.) w 21 dniu życia (szt.)	10.24	1.05	9.65	1.00	10.09	1.12	9.90	0.70
Piglet death loss from 1 to 7 day of life (%) Upadki prosiąt w okresie od 1 do 7 dnia życia (%)	4.02	1.07	6.51	1.56	-	-	-	-
from 7 to 14 day of life (%) od 7 do 14 dnia życia (%)	3.67	0.99	3.68	1.07	3.81	0.98	3.54	1.01
from 14 to 21 day of life (%) od 14 do 21 dnia życia (%)	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01
from 1 to 21 day of life (%) od 1 do 21 dnia życia (%)	7.66	1.62	10.27	1.89	-	-	-	-
Piglet body weight on 1 day of life (g) Masa ciała prosięcia w 1 dniu życia (g)	1436.7	181.0	1310.8	298.9	-	-	-	-
on 7 day of life (g) w 7 dniu życia (g)	3100.0^a	490.6	2588.3^b	536.7	3041.44	605.55	2682.13	522.67
on 14 day of life (g) w 14 dniu życia (g)	5801.6^a	880.1	4484.4^b	726.1	4977.84	859.21	4521.42	816.80
on 21 day of life (g) w 21 dniu życia (g)	6606.6	639.9	6497.7	798.5	6767.74	669.39	6456.45	708.62
Piglet daily gains from 1 to 7 day of life (g) Przyrosty dobowe prosiąt od 1 do 7 dnia życia (g)	277.2^a	71.4	211.3^b	69.5	-	-	-	-
from 7 to 14 day of life (g) od 7 do 14 dnia życia (g)	412.2^A	85.21	230.7^B	67.2	-	-	-	-
from 14 to 21 day of life (g) od 14 do 21 dnia życia (g)	335.6	98.8	254.1	90.6	382.64^a	75.24	246.77^b	90.92
from 1 to 21 day of life (g) od 1 do 21 dnia życia (g)	264.8	34.9	253.1	29.2	374.34^a	59.91	246.41^b	53.15
Gilt milk yield to 21 day of life (kg) Wydajność mleczna loch do 21 dnia życia (kg)	209.1	50.7	187.4	44.1	-	-	-	-

$^{a,A...}$ In rows the means denoted by different letters are significantly different: a, b – $p \leq 0.05$; A, B – $p \leq 0.01$

Table 4. Comparison of fat content in colostrum and milk with gilt reproduction indices
Tabela 4. Porównanie udziału tłuszczu w siarze i mleku do wskaźników rozrodu loch

Specification Wyszczególnienie	Group I FAT1 ≤ 6,0 Grupa I TŁU1 ≤ 6.0		Group II FAT1 ≥ 6,1 Grupa II TŁU1 ≥ 6.1		Group I FAT7 ≤ 6,9 Grupa I TŁU7 ≤ 6.9		Group II FAT7 ≥ 7 Grupa II TŁU7 ≥ 7	
	x	SD	x	SD	x	SD	x	SD
Number of pigs born alive per litter (unit) Liczba prosiąt żywo urodzonych w miocie (szt.)	11.61	1.22	12.34	1.21	-	-	-	-
Number of pigs in litter on 2 day of life (u) Liczba prosiąt w miocie w 7 dniu życia (szt.)	10.45	1.2	11.2	1.3	11.00	0.92	10.62	1.12
on 14 day of life (u.) w 14 dniu życia (szt.)	9.6^{a}	1.1	10.5^{b}	1.1	10.37	0.91	9.76	1.08
on 21 day of life (u.) w 21 dniu życia (szt.)	9.6^{a}	1.0	10.5^{b}	1.2	10.35	0.89	9.74	1.02
Piglet death loss from 1 to 7 day of life (%) Upadki prosiąt w okresie od 1 do 7 dnia życia (%)	5.3	0.9	4.8	1.1	-	-	-	-
from 7 to 14 day of life (%) od 7 do 14 dnia życia (%)	4.2	1.1	3.0	1.0	2.94	0.44	4.19	1.09
from 14 to 21 day of life (%) od 14 do 21 dnia życia (%)	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
from 1 to 21 day of life (%) od 1 do 21 dnia życia (%)	9.5	1.8	7.8	1.6	-	-	-	-
Piglet body weight on 1 day of life (g) Masa ciała prosięcia w 1 dniu życia (g)	1344.2	270.2	1392.2	206.7	-	-	-	-
on 7 day of life (g) w 7 dniu życia (g)	2974.2	573.7	2572.2	487.4	3291.2^{A}	340.8	2500.7^{B}	451.3
on 14 day of life (g) w 14 dniu życia (g)	4797.5	819.3	4863.3	946.4	4916.2	711.5	4770.0	953.9
on 21 day of life (g) w 21 dniu życia (g)	6703.3	801.9	6368.9	502.1	7028.0^{A}	804.2	6289.2^{B}	468.2
Piglet daily gains from 1 to 7 day of life (g) Przyrosty dobowe prosiąt od 1 do 7 dnia życia (g)	271.7^{A}	77.9	196.7^{B}	54.7	-	-	-	-
from 7 to 14 day of life (g) od 7 do 14 dnia życia (g)	303.9	96.6	381.8	89.6	270.8	39.6	378.2	68.6
from 14 to 21 day of life (g) od 14 do 21 dnia życia (g)	317.6	87.6	258.9	96.6	347.2	55.9	253.2	63.4
from 1 to 21 day of life (g) od 1 do 21 dnia życia (g)	267.9	34.1	248.8	28.1	-	-	-	-
Gilt milk yield to 21 day of life (kg) Wydajność mleczna loch do 21 dnia życia (kg)	196.9	53.2	201.2	44.3	-	-	-	-

[a,A,...] In rows the means denoted by different letters are significantly different: a, b – $p \leq 0.05$; A, B – $p \leq 0.01$

Table 5. Comparison of protein content in colostrum and milk with gilt reproduction indices
Tabela 5. Porównanie udziału białka w siarze i mleku do wskaźników rozrodu loch

Specification Wyszczególnienie	Group I PROT1 ≤ 11,0 Grupa I BIA1 ≤ 11.0		Group II PROT1 ≥ 11,1 Grupa II BIA1 ≥ 11.1		Group I PROT7 ≤ 5,0 Grupa I BIA7 ≤ 5.0		Group II PROT7 ≥ 5,1 Grupa II BIA7 ≥ 5.1	
	x	SD	x	SD	x	SD	x	SD
Number of pigs born alive per litter (unit) Liczba prosiąt żywo urodzonych w miocie (szt.)	12.00	1.29	11.85	1.09	-	-	-	-
Number of pigs in litter on 2 day of life (u.) Liczba prosiąt w miocie w 7 dniu życia (szt.)	10.57	1.05	10.86	1.23	11.00	1.12	10.44	1.24
on 14 day of life (u.) w 14 dniu życia (szt.)	10.01	1.01	10.00	1.46	10.08	1.06	9.88	1.13
on 21 day of life (u.) w 21 dniu życia (szt.)	10.00	1.01	10.00	1.46	10.01	1.12	9.80	1.09
Piglet death loss from 1 to 7 day of life (%) Upadki prosiąt w okresie od 1 do 7 dnia życia (%)	6.44	1.08	4.41	1.01	-	-	-	-
from 7 to 14 day of life (%) od 7 do 14 dnia życia (%)	2.54	0.54	4.30	0.68	4.41	0.83	2.77	0.66
from 14 to 21 day of life (%) od 14 do 21 dnia życia (%)	0.00	0.00	0.00	0.00	0.02	0.01	0.03	0.01
from 1 to 21 day of life (%) od 1 do 21 dnia życia (%)	8.98	1.70	8.70	1.66	-	-	-	-
Piglet body weight on 1 day of life (g) Masa ciała prosięcia w 1 dniu życia (g)	1452.8	284.9	1320.7	213.6	-	-	-	-
on 7 day of life (g) w 7 dniu życia (g)	2627.1	634.4	2889.2	527.33	2533.3^{A}	501.7	$3160.\ 0^{B}$	442.1
on 14 day of life (g) w 14 dniu życia (g)	4358.5^{A}	546.9	5059.2^{B}	662.4	4630.0	887.9	4972.5	834.4
on 21 day of life (g) w 21 dniu życia (g)	6697.1	939.0	6491.4	566.8	6435.0	707.4	6726.8	682.2
Piglet daily gains from 1 to 7 day of life (g) Przyrosty dobowe prosiąt od 1 do 7 dnia życia (g)	195.7	73.1	261.9	72.9	-	-	-	-
from 7 to 14 day of life (g) od 7 do 14 dnia życia (g)	288.5	65.9	361.6	62.9	244.9^{A}	44.0	406.5^{B}	58.6
from 14 to 21 day of life (g) od 14 do 21 dnia życia (g)	238.6^{A}	94.4	389.6^{B}	88.3	243.5^{a}	85.8	348.4^{b}	90.8
from 1 to 21 day of life (g) od 1 do 21 dnia życia (g)	262.1	43.5	258.3	27.1	-	-	-	-
Gilt milk yield to 21 day of life (kg) Wydajność mleczna loch do 21 dnia życia (kg)	199.7	54.1	198.2	47.4	-	-	-	-

$^{A...}$ in rows the means denoted by different letters are significantly different: A, B – $p \leq 0.01$

Table 6. Comparison of lactose content in colostrum and milk with gilts reproduction indices
Tabela 6. Porównanie udziału laktozy w siarze i mleku do wskaźników rozrodu loch

Specification Wyszczególnienie	Group I LACT1 ≤ 2.9 Grupa I LAK1 ≤ 2.9		Group II LACT1 ≥ 3.0 Grupa II LAK1 ≥ 3.0		Group I LACT7 ≤ 5.0 Grupa I LAKT7 ≤ 5.0		Group II LACT7 ≥ 5.1 Grupa II LAKT7 ≥ 5.1	
	x	SD	x	SD	x	SD	x	SD
Number of pigs born alive per litter (unit) Liczba prosiąt żywo urodzonych w miocie (szt.)	12.07	1.38	11.57	0.97	-	-	-	-
Number of pigs in litter on 2 day of life (u.) Liczba prosiąt w miocie w 7 dniu życia (szt.)	10.71	1.03	10.86	1.06	10.44	1.33	11.00	1.27
on 14 day of life (u.) w 14 dniu życia (szt.)	9.93	1.14	10.14	1.09	9.67	1.01	10.25	1.12
on 21 day of life (u.) w 21 dniu życia (szt.)	9.92	1.24	10.14	1.09	9.65	1.00	10.22	1.10
Piglet death loss from 1 to 7 day of life (%) Upadki prosiąt w okresie od 1 do 7 dnia życia (%)	6.01	1.11	3.23	0.78	-	-	-	-
from 7 to 14 day of life (%) od 7 do 14 dnia życia (%)	3.93	0.87	3.29	0.97	3.78	0.88	3.66	1.02
from 14 to 21 day of life (%) od 14 do 21 dnia życia (%)	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
from 1 to 21 day of life (%) od 1 do 21 dnia życia (%)	9.91	1.54	6.51	1.02	-	-	-	-
Piglet body weight on 1 day of life (g) Masa ciała prosięcia w 1 dniu życia (g)	1337.8	198.8	1418.5	319.5	-	-	-	-
on 7 day of life (g) w 7 dniu życia (g)	2876.4	545.3	2652.8	612.7	2944.4	554.3	2695.0	570.0
on 14 day of life (g) w 14 dniu życia (g)	4890.7	822.5	4695.7	966.0	4567.7	771.1	5019.1	892.6
on 21 day of life (g) w 21 dniu życia (g)	6451.4	595.8	6777.1	871.3	6588.8	910.9	6538.3	523.4
Piglet daily gains from 1 to 7 day of life (g) Przyrosty dobowe prosiąt od 1 do 7 dnia życia (g)	256.4	79.1	205.7	99.6	-	-	-	-
from 7 to 14 day of life (g) od 7 do 14 dnia życia (g)	335.7	61.8	340.4	80.0	270.5	48.7	387.3	73.7
from 14 to 21 day of life (g) od 14 do 21 dnia życia (g)	260.1[a]	97.3	346.9[b]	91.0	336.8	64.8	253.1	59.0
from 1 to 21 day of life (g) od 1 do 21 dnia życia (g)	255.6	20.8	267.9	40.2	-	-	-	-
Gilt milk yield to 21 day of life (kg) Wydajność mleczna loch do 21 dnia życia (kg)	193.28	52.58	209.68	40.21	-	-	-	-

[a,...] in rows the means denoted by different letters are significantly different: a,b – $p \leq 0.05$

Table 7. Comparison of dry matter content in colostrum and milk with gilt reproduction indices
Tabela 7. Porównanie udziału suchej masy w siarze do wskaźników rozrodu loch

Specification Wyszczególnienie	Group I DM1 ≤ 20.5 Grupa I SM1 ≤ 20.5		Group II DM1 ≥ 20.6 Grupa II SM1 ≥ 20.6		Group I DM7 ≤ 18.5 Grupa I SM7 ≤ 18.5		Group II DM7 ≥ 18.6 Grupa II SM7 ≥ 18.6	
	x	SD	x	SD	x	SD	x	SD
Number of pigs born alive per litter (unit) Liczba prosiąt żywo urodzonych w miocie (szt.)	11.75	1.28	12.01	1.29	-	-	-	-
Number of pigs in litter on 2 day of life (u) Liczba prosiąt w miocie w 7 dniu życia (szt.)	10.37	1.41	11.01	1.22	10.86	1.02	10.57	1.01
on 14 day of life (u.) w 14 dniu życia (szt.)	9.87	1.24	10.08	1.02	9.85	0.94	10.28	1.08
on 21 day of life (u.) w 21 dniu życia (szt.)	9.87	1.24	10.08	1.02	9.82	0.90	10.23	1.01
Piglet death loss from 1 to 7 day of life (%) Upadki prosiąt w okresie od 1 do 7 dnia życia (%)	6.29	1.06	4.34	0.95	-	-	-	-
from 7 to 14 day of life (%) od 7 do 14 dnia życia (%)	2.41	0.62	4.51	1.08	4.84^{A}	1.09	1.46^{B}	0.23
from 14 to 21day of life (%) od 14 do 21 dnia życia (%)	0.00	0.00	0.00	0.00	0.02	0.01	0.03	0.01
from 1 to 21 day of life (%) od 1 do 21 dnia życia (%)	8.71	1.25	8.82	1.74	-	-	-	-
Piglet body weight on 1 day of life (g) Masa ciała prosięcia w 1 dniu życia (g)	1426.2	300.5	1326.9	199.3	-	-	-	-
on 7 day of life (g) w 7 dniu życia (g)	2880.0	653.6	2753.8	523.0	2777.1	435.6	2871.4	418.1
on 14 day of life (g) w 14 dniu życia (g)	4462.5	602.7	5049.2	621.0	4962.8	729.3	4551.4	669.7
on 21 day of life (g) w 21 dniu życia (g)	6778.7	854.5	6419.2	568.4	6633.5	750.2	6412.8	590.2
Piglet daily gains from 1 to 7 day of life (g) Przyrosty dobowe prosiąt od 1 do 7 dnia życia (g)	242.2	89.1	237.8	90.1	-	-	-	-
from 7 to 14 day of life (g) od 7 do 14 dnia życia (g)	263.7	49.1	382.5	60.6	365.9	53.0	279.9	80.8
from 14 to 21 day of life (g) od 14 do 21 dnia życia (g)	387.7^{A}	87.2	228.3^{B}	66.6	278.5	66.2	310.2	68.5
from 1 to 21 day of life (g) od 1 do 21 dnia życia (g)	268.1	34.3	254.6	31.3	-	-	-	-
Gilt milk yield to 21 day of life (kg) Wydajność mleczna loch do 21 dnia życia (kg)	203.27	52.95	195.97	47.45	-	-	-	-

$^{A...}$ in rows the means denoted by different letters are significantly different: A,B – $p \leq 0.01$

matter content on the piglet survival rate. Higher contribution of this component to milk induced significant reduction of piglet mortality rate in the second week of life (Tab. 7).

DISCUSSION

Improvement of reproductive performance through selective breeding proves to be challenging and arduous, therefore the research studies addressing this problem highlight the potential factors defining a level of swine reproductive performance parameters [Babicz *et al.* 2004, Babicz *et al.* 2005, Szostak and Sarzyńska 2006, Bloemhof *et al.* 2008]. A major factor affecting litter size and biological value is chemical and cytological composition of milk and colostrum. It is noteworthy that there is a significant interrelationship between levels of each milk components. As lactation progresses, the proportions between them undergo marked alternations that allow for appropriate development of neonatal pigs and the course of metabolic processes in suckling piglets [Auldist *et al.*2000].

As it was shown in the present researches, a fat content in milk and colostrum did not show a significant dependence on a lactation day. While, a lipid fraction content in milk and colostrum appeared to be significantly modified by a season. Elevated fat concentration was established in the samples collected during the spring-summer farrowing period. The obtained values were lower than those presented in the studies of Boruta *et al.* [2009] where analyzing the milk samples from the PLW and PL gilts, a fat percentage reached 9.11 and 9.22 during the 24-day lactation period. Whereas Rząsa *et al.* [2004] determined a fat level in crossbred PLW/PL gilts at the 17% level.

A sampling season did not affect significantly a content of protein and lactose. The studies of Migdał and Klocek [1996] displayed that a substantial aspect of milk quality is teat location on the udder. The lowest protein level is determined in milk obtained from the first teat pair, while the highest from the fourth and seventh pair of teats. This element can be correlated to somatic cell counts, but a considerable element that differentiates this parameter value is season. The raised SCC estimates in the lactation period course determined in the present studies was reported at the autumn-winter season. The established differences plotted against the spring-summer months proved statistically significant. The noted tendency could arise from the time changes of microclimate conditions associated with the ambient temperature fall with a concurrent rise of a moisture content inside the building [Renaudeau *et al.* 2010]. Boruta *et al.* [2009] defined the SCC in the milk from the PLW and PL gilts at the level of 2086 and 2883, respectively, the values markedly higher compared to those in the present researches. It is assumed that the numbers of somatic cells make a critical index of the udder health status and consequently, the milk secretion process [Rekiel *et al.* 2008]. The results of this study have supported this assumption. The gilts whose colostral milk showed lower SCC values were characterized by higher milk yield. It is vital from the economic standpoint as piglet body weight and growth rate at their early life are major determinants of swine usability for the subsequent fattening system [Johansen *et al.* 2003].

Changes in a content and ratio of the main chemical components of milk in the progressing lactation are widely known and well-grounded. In this aspect, proper piglet raising relies on the optimum level of protein, fat and lactose provided during the suc-

cessive feeding stages of a litter. As the current studies demonstrated, the gilts producing milk of a high fat content were characterized by better results of litter performance. It was observable in higher litter size and the reason for that could be enhanced viability of piglets induced by the quantity of lipids received at the early stage of life [Canario *et al.* 2010]. Analogical dependences were reported for a protein and lactose content, whose higher concentration in colostrum and milk implicated increased piglet body weight and daily gains from birth to 21 days of life. Hence, these are crucial factors for appropriate development of neonatal pigs. Protein is an essential element for building muscle tissues, while lactose – one of the most important dietary components for neonatal pigs that provides energy and prevents from hypoglycemia.

CONCLUSION

A lactation stage and season proved to be the elements modifying the chemical composition of gilt colostrum and milk as well as the somatic cell count. It was also found that a content of protein, fat, lactose and the SCC estimates in colostrum and milk constitute factors affecting the litter rearing performance indicators. Higher concentration of the major components of gilt milk and colostrum with the low SCC tend to favor the improvement of the production efficiency parameters.

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Streszczenie. Wykonano analizę zależności pomiędzy udziałem głównych składników chemicznych i liczby komórek somatycznych siary i mleka a wynikami odchowu prosiąt. W badaniach uwzględniono 20 loch mieszańców ras wielkiej białej polskiej i polskiej białej zwisłouchej w drugim i trzecim cyklu reprodukcyjnym. Wybrane cechy użytkowości rozpłodowej loch odniesiono do poziomu poszczególnych elementów składu chemicznego oraz liczby komórek somatycznych siary (1 dzień laktacji) i mleka (7 dzień laktacji). Skład chemiczny siary i mleka loch oraz LKS okazały się istotnie modyfikowane przez fazę oraz sezon laktacji. Wykazano również, że większy udział głównych składników w siarze i mleku loch oraz niski wskaźnik LKS był korzystniejszy dla uzyskania większej liczby prosiąt w miocie oraz ich przydatności do odchowu wyrażonej masą ciała oraz przyrostami dobowymi.

Słowa kluczowe: lochy, skład chemiczny, LKS, odchów prosiąt