Journal of Elementology ISSN 1644-2296

Karpiesiuk K., Jarocka B., Kozera W., Antoszkiewicz Z., Okorski A., Woźniakowska A. 2022.
Effect of successive lactations and nutrition on selected chemical components of sow milk.
J. Elem., 27(4): 1007-1020. DOI: 10.5601/jelem.2022.27.1.2264

RECEIVED: 4 March 2022
ACCEPTED: 4 September 2022

ORIGINAL PAPER

EFFECT OF SUCCESSIVE LACTATIONS AND NUTRITION ON SELECTED CHEMICAL COMPONENTS OF SOW MILK*

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Abstract

The aim of this study was to determine the effect of nutrition and successive lactations on the content of selected chemical components and the fatty acid profile of sow milk. The chemical composition of milk samples collected from 108 PIC sows was evaluated. During the study, sows were allocated to two independent experiments. In Experiment I, sows were divided into three parity groups. In Experiment II, sows were divided into two groups based on the type of concentrate included in the diet. In both experiments, the content of selected chemical components was determined in sow milk in view of the effect exerted by successive lactations (Experiment I, 54 animals) and nutrition (Experiment II, 54 animals). Milk samples were obtained by hand milking on lactation days 1 and 10, respectively. The samples were subjected to chemical analyses to determine their content of dry matter, total protein (Kjeldahl method), crude fat (Soxhlet extraction) and crude ash, and the fatty acid profile. Fat was extracted by the Soxhlet method. Fatty acids were separated and determined by gas chromatography in a gas chromatograph (CP-3800, Varian, Walnut Creek, California, USA). Fatty acid methyl esters (FAMEs) were prepared according to the modified Peisker method (methanol:chloroform:concentrated sulfuric acid, 100:100:1, v/v). Milk collected from sows fed diet 2 was characterized by higher concentrations of monounsaturated fatty acids (MUFAs), polyunsaturated fatty acids (PUFAs), unsaturated fatty acids (UFAs), hypocholesterolemic fatty acids (DFAs), *n*-3 and *n*-6 fatty acids, compared with milk collected from sows fed diet 1 that contained not only soybean oil but also hardened fish oil. Milk collected during the first and second lactation had higher fat content than milk collected during the third, fourth and subsequent lactations.

Keywords: sows, chemical composition, fatty acids, milk, nutrition

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* The project financially supported by the Minister of Science and Higher Education from the program titled "Regional Initiative of Excellence" for the years 2019-2022, Project No. 010/RID/2018/19, amount of funding PLN 12.000.000.

INTRODUCTION

Colostrum, the first form of milk, and then mature milk are fed to piglets for the first 3 – 4 weeks of their life. Although piglets receive supplemented, complete diets in the early stage of growth, colostrum and milk are most willingly consumed (Rząsa, 2007). They provide all essential nutrients required for the normal growth and development of young animals (Edwards, 2002, Rząsa et al. 2004, Le Dividich 2006, Rząsa 2007, Quesnel et al. 2012, Eckert, Szyndler-Nędza 2018). Raising large litters of healthy and strong piglets is determined by both genetic and environmental factors. The quantity and quality of milk produced by a sow is affected by the interaction of those factors.

The productivity of pigs is characterized by reproductive, growth, feed efficiency, carcass and meat quality traits. These reproductive performances are analyzed most frequently: total number of piglets born (including stillborn), number and litter weight of piglets at 21 days old, number and weight of piglets at weaning, and survival rate of pre-weaning piglets (Klimas et al. 2020). The high milk yield of sows contributes to piglet vitality, health and high body weight gains (Toner et al. 1995, King et al. 1997). The volume of colostrum produced by sows may vary, depending on their body condition, parity and prolactin levels. Unlike the amount of milk, the amount of colostrum produced by sows is not determined by litter size. A sow produces approximately 3.6 kg of colostrum on the first day postpartum, and its intake by the newborns varies, depending on their number in the litter. The volume of colostrum available per piglet during the first 24 h after birth decreases by around 30 g for each additional piglet born (Le Dividich, 2006). Revell et al. (1998), Migdał et al. (2003), Koska, Eckert (2016), and Declerck (2017) demonstrated that not only the quantity but also the quality of colostrum and milk play a very important role in animal production, because their poor quality may reduce the growth rate of piglets. According to many authors (Fahmy 1972, Inoue et al. 1980, Surdacki et al. 1984, Walkiewicz et al. 1985, Göransson 1990, Auldist et al. 1998, Barowicz, Kwolek 2001, Boruta et al. 2009), the chemical composition of both colostrum and milk can change in response to numerous factors, such as the sow's age, breed and diet. However, analyses of the chemical composition of sow milk, conducted to date, have revealed considerable differences in the content of individual chemical components, which are often caused by unidentified factors and therefore are difficult to interpret (Rząsa 2007).

The aim of this study was to determine the effect of nutrition and successive lactations on the content of selected chemical components and the fatty acid profile of milk in PIC sows.

In order to achieve the research objective, colostrum and milk samples collected from sows in their first-second, third-fourth, fifth and subsequent lactations were analyzed for the content of dry matter, crude ash, total protein, casein proteins, whey protein, crude fat, and the fatty acid profile of fat.

MATERIALS AND METHODS

The chemical composition of milk samples collected from 108 PIC sows was evaluated. During the study, sows were allocated to two independent experiments. In Experiment I, sows were divided into three parity groups. In Experiment II, sows were divided into two groups based on the type of concentrate included in the diet. In both experiments, the content of selected chemical components was determined in sow milk in view of the effect exerted by successive lactations (Experiment I, 54 animals) and nutrition (Experiment II, 54 animals).

Experiment I

group I – 18 sows in their first or second lactation,

group II – 18 sows in their third or fourth lactation,

group III – 18 sows in their fifth and subsequent lactations;

Experiment II

group I – 27 sows – concentrate I,

group II – 27 sows – concentrate II.

During the experiments, sows were kept in pens with free access to water. The animals were fed complete diets that were formulated in accordance with the Pig Nutrient Requirements and the Nutritional Value of Pig Diets (2015). Ground grain was the main component of the diets, which contained concentrate I or concentrate II. Soybean meal was the main protein source in both concentrates (42% in concentrate I, 70% in concentrate II), and concentrate I also contained rapeseed meal (25%) and sunflower meal (7.5%) as protein sources; soybean oil was the energy source in both concentrates (0.5% in concentrate I, 1.5% in concentrate II), and concentrate I contained also fish oil (2.5%). Molasses-sugar beet pulp (1%) was the source of structural and easily digestible carbohydrates in concentrate II. Both concentrates also contained amino acids, vitamins, benzoic acid and mycotoxin sorbents (Table 1).

Concentrate I had a higher content of crude fiber and crude fat than concentrate II (by 44% and 33.6%, respectively). Both concentrates had identical sodium content (0.87%). Concentrate II had a higher content of crude protein, methionine, lysine and calcium than concentrate I (by 7.6%, 7.0%, 3.4% and 11.9%, respectively) – Table 1.

Depending on the stage of the production cycle, sows were fed two types of diets: a diet for pregnant sows (PS – diet 1) and a diet for lactating sows (LS – diet 2). In both diets, the major ingredients were wheat, triticale (higher inclusion level in diet LS) and barley (higher inclusion level in diet PS) – Table 2. Diet PS contained also faba bean (6%) and wheat bran (10%), and diet LS contained soybean oil (1%). Both diets contained the evaluated concentrates (concentrate I or concentrate II), which composed 12.5% in diet PS and 20% in diet LS. Depending on the feeding group, sows received diets

Table 1

Chemical composition (%) of concentrates used to formulate complete diets for sows

Component	Concentrate I	Concentrate II
Crude protein	34.28	37.08
Crude fiber	5.62	3.15
Lysine	2.80	2.98
Calcium	4.76	5.40
Sodium	0.87	0.87
Crude fats and oils	4.32	2.87
Crude ash	21.83	23.60
Methionine	0.53	0.57
Phosphorus	1.15	1.19

Table 2

Ingredient composition (%) of diets for pregnant and lactating sows

Ingredient	Pregnant sows	Lactating sows
Wheat	15	34
Triticale	10	15
Barley	46.5	30
Faba bean	6	-
Wheat bran (up to 9% fiber on a dry matter basis)	10	-
Soybean oil	-	1
Concentrate I/II	12.5	20
Total	100	100

PS and LS containing concentrate I or concentrate II (Table 2). The proximate chemical composition of diets was consistent with the Pig Nutrient Requirements and the Nutritional Value of Pig Diets (2015) for pregnant and lactating sows.

Sows were fed diet PS from insemination until 1.5 weeks before farrowing, and then diet LS was administered. The animals received 2 kg of feed twice daily for one week, and three days before the due date the amount of feed was gradually decreased to 2 kg per day (2 x 1 kg). On the expected day of farrowing, sows did not receive any feed. In the first week after farrowing, the amount of feed was gradually increased so as to reach the maximal feed level required for sow maintenance and milk production (*ad libitum* feeding) until the end of the second week after farrowing. Piglets were weaned at 28 days of age; sows were fasted for one day after weaning. From post-weaning until insemination, feed was increased to an adequate amount (flushing).

Milk samples were obtained by hand milking on lactation days 1 and 10, respectively. Milk samples were collected after (approx. 15 min) an intramuscular injection of 2 ml synthetic oxytocin. The experiment was approved by the Local Ethics Committee for Animal Experimentation in Olsztyn.

Chemical analyses of milk were performed in the laboratory of the Department of Animal Nutrition and Feed Science at the University of Warmia and Mazury in Olsztyn. Total protein content was determined by the Kjeldahl method. Casein proteins were isolated by curd precipitation with a solution of acetic acid and sodium acetate. The precipitated casein curd was filtered through hardened nitrogen-free filter paper. The filtrate was analyzed to determine the content of whey proteins. Whey proteins were precipitated in an alkaline environment at boiling temperature, and were isolated on filter paper. The nitrogen content of whey proteins was determined by the Kjeldahl method. The concentration of total nitrogen in each protein fraction was converted into the content of total protein and whey proteins in milk samples.

Milk fat was extracted by the Roese–Gottlieb method. Ammonium hydroxide was used to weaken lipid-protein bonds and release fat. Then, ethyl alcohol was added, and fat was extracted with mixed ethers (diethyl ether and petroleum ether). Total fat content was determined gravimetrically after solvent evaporation.

The dry matter content of milk samples was determined by the gravimetric method according to AOAC (2011). Then, the samples were mineralized, and crude ash content was determined gravimetrically.

The content of fatty acids in milk fat was determined by gas chromatography, using fat extracted from milk samples by the Roese-Gottlieb method. Fatty acid methyl esters (FAMEs) were prepared according to the modified Peisker method (Żegarska et al. 1991). Individual fatty acids were separated and determined on the Varian CP-3800 gas chromatograph (carrier gas – helium) equipped with a flame-ionization detector (FID, detector temperature - 250°C), a capillary column (200°C) and an injector (split 50:1; 225°C). Sample size was 1 μl. Fatty acids were identified by comparing the retention times at the maximum peak heights of the analyzed FAMEs with the retention times at the maximum peak heights of FAME reference standards (Sigma-Aldrich). The relative abundance of each fatty acid was expressed as a percentage of total fatty acids in each sample (Żegarska et al. 1991, AOAC. 2011).

The results were analyzed statistically. The significance of differences between the mean values of the analyzed parameters in groups was determined by one-way analysis of variance (ANOVA) with the use of Duncan's test (Statisica 13.3).

RESULTS AND DISCUSSION

The effect of two diets containing different concentrates on the chemical composition of sow milk

The effect on nutrition on the chemical composition and fatty acid profile of sow milk was evaluated in the study. Diets PS and LS (for pregnant and lactating sows, respectively) contained concentrate I or concentrate II. The content of the analyzed chemical components was higher in milk samples collected from sows fed diet 1 containing concentrate I than in milk samples collected from sows fed diet 2 containing concentrate II, but the noted differences were not significant (Table 3).

It should be stressed that the content of whey proteins was higher ($P \leq 0.05$) in milk from sows fed diet 1, compared with diet 2 (5.19% vs. 3.02%,). An analysis of the chemical composition of sow milk during successive lactations revealed significant differences only in crude fat content ($P \leq 0.01$). Milk from sows in their first-second lactation had higher crude fat content (6.17%) than milk from sows in their third-fourth, and fifth and subsequent lactations (4.19% vs. 4.30%) – Table 4. Mazur, Stasiak (2006), and Fuchs et al. (2007) noted differences in the protein content of milk when the

Table 3

Content (%) of selected chemical components in milk samples collected from sows fed two different diets

Specification	Diet 1	Diet 2
Dry matter	21.40	20.13
Crude ash	0.834	0.747
Total protein	8.817	8.203
Whey proteins	5.19^{a}	3.02^{b}
Crude fat	5.023	4.744

Key: *a*, *b* ($p \leq 0.05$) – different letters denote statistically significant differences;
Diet 1 containing concentrate I, Diet 2 containing concentrate II.

Table 4

Content (%) of selected chemical components in milk samples collected from sows during successive lactations

Specification	Lactations		
	1^{st} – 2^{nd}	3^{rd} – 4^{th}	$>4^{th}$
Dry matter	20.999	20.708	20.597
Crude ash	0.727	0.818	0.827
Total protein	8.659	8.035	8.837
Whey proteins	4.182	3.715	4.498
Crude fat	6.172^{A}	4.185^{B}	4.295^{B}

Key: *A*, *B* ($p \leq 0.01$) – different letters denote statistically significant differences.

composition of sow diets was modified. In a study by Fuchs et al. (2007), protein content was 10% higher in colostrum ($P \leq 0.05$) but 1.39% lower in milk samples collected from pregnant and lactating sows fed diets supplemented with brewer's yeast, compared with sows fed control diets. Mazur, Stasiak (2006) found that on lactation day 7, the protein content of milk was higher ($P \leq 0.05$, $P \leq 0.01$) in sows fed a diet containing around 30 g fat kg^{-1} feed than in sows fed diets containing around 20 g and 40 g fat kg^{-1} feed; on lactation day 21, milk from sows receiving 40 g fat kg^{-1} feed had the highest protein content. Liu et al. (2014) demonstrated that milk from sows fed diets supplemented with 15 g of dietary citric acid (CA) contained more protein (by approx. 13.5%) than milk from sows fed diets supplemented with 0 (control), 5 and 10 g kg^{-1} CA, whereas the content of crude fat and dry matter in milk remained unchanged. Jackson et al. (1995) added corn oil, and Coffey et al. (1994) and Migdał (1996) added dietary fats, including vegetable oils, to sow diets and found that milk fat content increased by approximately 1% to 2%. Boyd et al. (1982) demonstrated that sows fed a tallow-supplemented diet produced milk with a higher concentration of fat (by 14.9%) compared with control group sows. This was also the only of the cited studies where dry matter concentration was higher (by 3.6%) in milk from sows receiving tallow. Barowicz et al. (2002) observed no significant differences in the composition of milk from sows fed diets supplemented with utilized fat or linseed oil.

The fatty acid composition of sow milk was affected by the two concentrates contained in experimental diets (Table 5).

Table 5

Fatty acid composition (% of total fatty acids) of milk fat in sows fed two different diets

Specification	Diets	
	diet 1 (concentrate I)	diet 2 (concentrate II)
$C_{4:0}$	0.016	0.021
$C_{6:0}$	0.027	0.020
$C_{8:0}$	0.026	0.024
$C_{10:0}$	0.192	0.147
$C_{12:0}$	0.084^{A}	0.161^{B}
$C_{14\ iso}$	0.001	0.001
$C_{14:0}$	3.17	2.965
$C_{15:0}$	0.128	0.147
$C_{16\ iso}$	0.022^{B}	0.001^{A}
$C_{16:0}$	30.982	31.225
$C_{17:0}$	0.268	0.289
$C_{18:0}$	4.829	4.932
$C_{20:0}$	0.160^{B}	0.129^{A}
$C_{22:0}$	0.104^{A}	0.185^{B}
ΣSFAs	**39.958**	**40.249**

cont. Table 5

Specification	Diets	
	diet 1 (concentrate I)	diet 2 (concentrate II)
$C_{10:1}$	0.026	0.020
$C_{12:1}$	0.000	0.000
$C_{14:1}$	0.239^{B}	0.161^{A}
$C_{16:1}$	9.570	8.592
$C_{17:1}$	0.345	0.338
$_{C18:1\ c}9$	33.262	31.525
$_{C20:1}$	0.505^{B}	0.309^{A}
ΣMUFAs	**43.946**	**40.945**
$_{C18:}2$	13.582^{A}	16.108^{B}
CLA	0.069^{B}	0.053^{A}
$C_{18:3}$	1.281	1.368
$C_{20:2}$	0.000	0.005
$C_{20:4}$	0.668	0.787
$_{C20:5}$	0.50^{b}	0.105^{a}
$C_{22:5}$	0.341	0.385
$C_{22:6}$	0.000	0.000
ΣPUFAs	**16.096^{A}**	**18.806^{B}**
ΣUFAs	**60.042**	**59.751**
ΣOFAs	**35.128**	**35.316**
ΣDFAs	**64.872**	**64.684**
Σn-3	**1.772**	**1.858**
Σn-6	**14.255^{A}**	**16.895^{B}**

Legend: *a*, *b* ($p \leq 0.05$) – different letters denote statistically significant differences, *A*, *B* ($p \leq 0.01$) – different letters denote statistically significant differences.

Milk from sows fed diet 2 containing concentrate with lower fat content (1.5% soybean oil) had higher (by 14.41%) concentrations of polyunsaturated fatty acids (PUFAs) – $P \leq 0.01$, whereas milk from sows fed diet 1 containing concentrate with higher fat content (0.5% soybean oil, 2.5% hardened fish oil) had higher (by 6.83%) concentrations of monounsaturated fatty acids (MUFAs), non-significant difference.

$C_{18:1\ c9}$ predominated in the group of MUFAs, accounting for 75.69% and 77.00% of total MUFAs, respectively, in milk from sows fed diets 1 and 2. A significant difference was noted only in the content of $C_{20:1}$, which was higher (by 31.81%) in milk from sows receiving diet 1 ($P \leq 0.01$).

In the group of PUFAs, the content of conjugated linoleic acid (CLA) and $C_{20:5}$ was 23.19% ($P \leq 0.01$) and 21.0% ($P \leq 0.05$) higher in milk from sows fed a diet with concentrate I, which contained not only soybean oil but also hardened fish oil, compared with milk from sows fed a diet with concentrate II; in the latter samples, the content of $C_{18:2}$ was 15.68% higher ($P \leq 0.01$). The content of *n*-3 and *n*-6 PUFAs in sow milk was also determined. The concentrations of *n*-3 fatty acids in milk remained similar regardless of the diet, whereas the content of *n*-6 fatty acids was 15.63% higher in milk from sows fed diet 2 ($P \leq 0.01$).

No significant differences were found in the total content of saturated fatty acids (SFAs) in the milk of sows receiving different diets. However, the concentrations of $C_{12:0}$ and $C_{22:0}$ were significantly higher in milk from sows fed diet 2, whereas the concentrations of $C_{16\ iso}$ and $C_{20:0}$ were higher in milk from sows fed diet 1 ($P \leq 0.01$) – Table 6.

Table 6

Fatty acid composition (% of total fatty acids) of milk fat in sows during successive lactations

Specification	Lactations		
	1^{st} – 2^{nd}	3^{rd} – 4^{th}	$>4^{th}$
$C_{4:0}$	0.015	0.020	0.22
$C_{6:0}$	0.0195	0.022	0.016
$C_{8:0}$	0.022	0.033	0.024
$C_{10:0}$	0.157	0.187	0.144
$C_{12:0}$	0.215	0.228	0.211
$C_{14\ iso}$	0.001	0.000	0.002
C14:0	3.236^{A}	2.166^{B}	3.300^{A}
C15:0	0.125^{A}	0.112^{A}	0.186^{B}
$C_{16\ iso}$	0.035	0.000	0.002
$C_{16:0}$	32.398	31.557	30.977
$C_{17:0}$	0.263	0.226	0.295
C18:0	5.196^{a}	5.170^{a}	4.453^{b}
C20:0	0.150^{Bb}	0.126^{A}	0.136^{a}
$C_{22:0}$	0.129	0.216	0.199
ΣSFAs	**41.961**	**40.061**	**39.969**
$C_{10:1}$	0.022	0.029^{b}	0.016^{a}
$C_{12:1}$	0.000	0.000	0.000
$C_{14:1}$	0.185	0.212	0.197
$C_{16:1}$	7.400	10.280	8.307
$C_{17:1}$	0.329	0.320	0.360
$C_{18:1\ c9}$	33.665^{B}	32.827^{a}	29.464^{Ab}
C20:1	0.454^{Bb}	0.310^{a}	0.297^{A}
ΣMUFAs	**42.055^{a}**	**43.977^{B}**	**38.641^{Ab}**

cont. Table 6

Specification	Lactations		
	1^{st} – 2^{nd}	3^{rd} – 4^{th}	>4^{th}
$C_{18:2}$	13.592^{A}	13.561^{A}	18.375^{B}
CLA	0.073^{b}	0.055^{a}	0.055^{a}
$C_{18:3}$	1.197^{a}	1.185^{a}	1.492^{b}
$C_{20:2}$	0.000	0.000	0.007
$C_{20:4}$	0.691^{a}	0.747	0.862^{b}
$C_{20:5}$	0.117^{a}	0.100^{A}	0.161^{Bb}
$C_{22:5}$	0.315^{a}	0.313^{a}	0.438^{b}
$C_{22:6}$	0.000	0.000	0.000
ΣPUFAs	**15.985^{A}**	**15.962^{A}**	**21.390^{B}**
ΣUFAs	**58.039**	**59.939**	**60.031**
ΣOFAs	**36.765**	**34.891**	**35.515**
ΣDFAs	**63.235**	**65.109**	**64.485**
Σn-3	**1.629^{A}**	**1.599^{A}**	**2.091^{B}**
Σn-6	**14.282^{A}**	**14.308^{A}**	**19.243^{B}**

Key: *a*, *b* ($p \leq 0.05$) – different letters denote statistically significant differences, *A*, *B* ($p \leq 0.01$) – different letters denote statistically significant differences.

In a study by Barowicz et al. (2002), the content of MUFAs and SFAs in colostrum was lower, and the content of PUFAs, in particular *n*-3 PUFAs, in colostrum and milk was higher in sows fed diets supplemented with linseed oil than in sows fed diets supplemented with utilized fat. Higher concentrations of PUFAs were also noted by Wielbo (1995) in the milk of sows fed diets supplemented with rapeseed oil. In a study by Migdał et al. (2003), the content of SFAs was higher in the colostrum of sows fed a diet containing 2% CLA than in the colostrum of sows fed diets containing 4% CLA or sunflower oil ($P \leq 0.05$). Skrzypczak et al. (2015) observed a strong positive correlation between the content of linoleic acid (*n*-6) in milk and the body weight of piglets (r=0.456), and a negative correlation with piglet mortality (r=-0.312). The above authors also found that the UFA content of colostrum and milk was correlated with the body weights and growth rate of piglets, and their lower mortality.

The effect of successive lactations on the chemical composition of sow milk

The effect of successive lactations on the chemical composition and fatty acid profile of sow milk was also analyzed in this study. Milk samples were collected from three groups of sows, in their first-second, third-fourth, fifth and subsequent lactations.

It should be noted that crude ash content tended to increase, and dry matter concentration tended to decrease in milk samples collected during successive lactations (non-significant differences, Table 4). Similar results were reported by Koska, Eckert (2016) who found that milk fat content was higher in younger animals (1st lactation) than in older animals (2nd and 3rd lactation). The cited authors emphasized that the above values were noted only on the first day of lactation (colostrum), and were not confirmed on lactation days 7 and 21 (milk). Koska, Eckert (2016) also observed higher concentrations of dry matter (by 4.0%) and protein (15.7%) in milk collected on days 7 and 21 of the first and second lactations, compared with the third lactation.

Table 6 presents the fatty acid composition of milk from sows in their first-second, third-fourth, and fifth and subsequent lactations.

The proportion of MUFAs in total fatty acids was comparable in milk from sows in their first-second and third-fourth lactation, but lower than in milk from the oldest sows, by 8.8% and 13.8%, (respectively $P \leq 0.05$ and $P \leq 0.01$). In the group of MUFAs, the highest proportions of $C_{18:1\ c9}$ and $C_{20:1}$ were noted in sows in their first-second lactation, at 33.65% and 0.45%, respectively ($P \leq 0.01$), and their content decreased in successive lactations to 32.83% and 0.31% in the third-fourth lactation, and to 29.46% and 0.3% in the fifth and subsequent lactations. The differences in the content of $C_{18:1}$ and $C_{20:1}$ in milk were highly significant ($P \leq 0.01$) between the first-second and the fifth and subsequent lactations, and significant ($P \leq 0.05$) between the first-second and third-fourth lactations for $C_{20:1}$, and between the third-fourth and the fifth and subsequent lactations for $C_{18:1}$.

Milk from the oldest sows, compared with milk from sows in their first-second and third-fourth lactation, had a higher content of PUFAs (by 25.27% and 25.38%, respectively), *n*-3 fatty acids (by 22.09% and 23.5%, respectively), and *n*-6 fatty acids (by 25.8 and 23.6%, respectively) ($P \leq 0.01$). In the group of PUFAs, milk from the oldest sows (5th and subsequent lactations) had a highly significantly higher ($P \leq 0.01$) content of $C_{18:2}$ – compared with milk from sows in their first-second and third-fourth lactation, and $C_{20:5}$ – compared with sows in their third-fourth lactation; significant differences ($P \leq 0.05$) in the content of $C_{20:5}$ in milk were noted between sows in their first-second vs. fifth and subsequent lactations. Milk from the oldest sows also had a significantly higher ($P \leq 0.05$) content of $C_{18:3}$ and $C_{22:5}$, compared with milk from sows in their first-second and third-fourth lactation, and $C_{20:4}$, compared with milk from sows in their first-second lactation. Milk from the youngest sows (1st – 2nd lactation) had higher CLA content than milk from sows in their third-fourth and fifth and subsequent lactations.

Differences in the proportions of SFAs and UFAs in total fatty acids were not significant. However, the proportion of SFAs tended to decrease, and the proportion of UFAs tended to increase steadily during successive lactations.

In the group of SFAs, the highest concentrations of $C_{15:0}$ and $C_{18:0}$ were noted in milk from sows in the fifth and subsequent lactations (*P*≤0.01 and *P*≤0.05, respectively), compared with milk from sows in their first-second and third-fourth lactation. The content of $C_{14:0}$ in milk was highest during the third-fourth lactation (*P*≤0.01). The content of $C_{20:0}$ in milk was highest in the first-second lactation, and it was highly significantly higher (*P*≤0.01) than in the third-fourth lactation, and significantly higher (*P*≤0.05) than in the fifth and subsequent lactations.

CONCLUSIONS

The content of whey proteins was significantly higher in the milk of sows fed diet 1. Milk collected from sows fed diet 2 was characterized by higher concentrations of MUFAs, PUFAs, UFAs, DFAs, n-3 and n-6 fatty acids, compared with milk collected from sows fed diet 1, which contained not only soybean oil but also hardened fish oil (non-significant differences). Milk collected during the first and second lactation had higher fat content than milk collected during the third, fourth and subsequent lactations. The content of the remaining chemical components in milk did not vary across lactations. The content of hypocholesterolemic fatty acids (DFAs) decreased, and the content of hypercholesterolemic fatty acids (OFAs) increased in successive lactations (non-significant differences).

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