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ASSESSMENT OF THE QUALITY OF RAW MILK PURCHASED DEPENDING ON THE PRODUCTION SCALE

OCENA JAKOŚCI SKUPOWANEGO MLEKA SUROWEGO W ZALEŻNOŚCI OD WIELKOŚCI PRODUKCJI

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Streszczenie. Celem prowadzonych badań była ocena jakości mleka surowego skupowanego przez zakład mleczarski, z uwzględnieniem wielkości skupu, jakości mleka surowego oraz sezonowości jego skupu. Gospodarstwa podzielono na grupy ze względu na ilość produkowanego mleka: 1 grupa – do 5000 kg mleka miesięcznie, 2 grupa – 5001–10 000 kg, 3 grupa – 10 001–15 000 kg, 4 grupa – ponad 15 000 kg. Stwierdzono nieco większą procentową zawartość tłuszczu w mleku z grupy 4. Czystość mikrobiologiczna mleka była zbliżona we wszystkich grupach, przy czym podkreślić należy małą LKS i OLB. Stwierdzono nadal istniejącą sezonowość produkcji. Wielkość produkcji w okresie żywienia letniego była większa o około 18%. Celowa wydaje się dalsza specjalizacja gospodarstw i przejście w większych gospodarstwach na całoroczny system żywienia paszami konserwowanymi (TMR).

Key words: raw milk production, composition and quality, seasonality of production.

Słowa kluczowe: wielkość produkcji mleka surowego, skład i jakość, sezonowość produkcji.

INTRODUCTION

The suitability of milk for consumption and processing is primarily determined by its hygienic quality, which is an indication of the conditions prevailing in the producer's farm. Main importance is attributed to the hygienic conditions in which animals stay, the conditions for obtaining and storing milk and the health of cows. This problem was dealt with by many authors including Simianer et al. (1991), Smith (2003), Stanek et al. (2004), Skrzypek et al. (2006), Sharma et al. (2011), Bortacki et al. (2016). In Poland, over the last several years, milk yield and quality systematically increased. This was due to the introduction of new technologies of feeding, maintenance, raw material harvesting and distribution (Pieróg et al. 2001; Jurczak et al. 2003; Przysucha et al. 2003). The major problem was the seasonality of production and purchase of milk, which often exceeded 2: 1 quantities of milk produced during the summer months compared to winter (Wójcik et al. 1997; Wójcik et al. 1998; Bałowska and Litwińczuk 2003).

The purpose of the study was to analyze the quality of raw milk purchased by the dairy plant, taking into account the volume of purchase from individual suppliers.

MATERIAL AND METHODS

The research was carried out on the basis of data on the purchase volume and the milk assessment obtained from the documentation of the laboratory of the Dairy Plant (distribution center) in Pырzyce belonging to the MLEKOVITA Capital Group. Data on monthly delivery, percentage of fat and protein, total number of bacteria and number of somatic cells were collected for the period 1.01.2013 to 31.12. Suppliers are divided into four groups according to the quantity of milk supplied: 1 group to 5000 kg of milk per month; 2 groups 5001–10 000 kg of milk; 3 groups of 10 001 to 15 000 milk per month; 4 group over 15 000 kg of milk per month.

The significance of the differences in the parameters compared between the producer groups was determined by means of one-way analysis of variance in the non-ortogeneic system, while the significance of differences in the mean number of somatic and bacterial cells was determined using the Kruskal-Wallis test using the Statistica program.

RESULTS AND DISCUSSION

In the individual groups of producers, the following average deliveries were achieved: in 1 – 3966 kg (v 43.86%), in 2 – 5868 kg (v 32.68%), in 3 – 12 122 kg (v 25.49%) and in 4 – 19 392 (v 65.54%). The assessed producer groups were dominated by smaller producers with relatively large variations in supply within the groups, while the greatest variability was found in the largest production group of which we can say that they were specialized farms.

In Table 1 and on Fig. 1 and Fig. 2 one presented the average percentage of fat and protein in milk from different groups of suppliers, and the content of these components in particular months of the year. The mean percentage of fat in milk was quite large in all groups, but significantly ($p \leq 0.05$) higher in the group of the largest producers. This could have been due to a greater number of manufacturers feeding the herds with modern systems (TMRs). According to Gawlik (2010), cow's consumption of a larger structural bulk feed with higher energy concentration results in an increase in the fat content in milk. In individual months, the percentage of fat was also predominantly higher in group 4. It was also found that the fat content decreased in the summer months, which was probably caused by pasture feeding, especially in smaller production groups. The average percentage of protein increased with production. One found significantly ($p \leq 0.05$) higher protein content in milk from group 4 producers compared to other groups and significantly higher ($p \leq 0.05$) in group 3 compared to groups 2 and 4. According to Lipiński (2008) and Radkowska (2013), the protein content of milk is primarily determined by the energy content of the feed, which can be increased by increasing the proportion of solid feed, the use of very high quality basic feed and various feed additives. The percentage of protein decreased slightly in the first months of the pasture season (May, June) and then gradually increased in all groups.

Table 1. Percentage of fat and protein in milk
Tabela 1. Procentowa zawartość tłuszczu i białka w mleku

Group Grupa	Number of milk suppliers Liczba dostawców (n)	Fat – Tłuszcz [%]			Protein – Białko [%]		
		\bar{x}	s	v	\bar{x}	s	v
1	60	3.90 ^a	0.17	4.36	3.24	0.12	3.70
2	60	3.90 ^a	0.18	4.61	3.26	0.08	2.45
3	60	3.88 ^a	0.17	4.38	3.30	0.07	2.12
4	36	3.98 ^b	0.18	4.52	3.35	0.06	1.79
Total ogółem	216	3.91	0.18	4.60	3.28	0.09	2.90

a, b – statistically significant differences at $p \leq 0.05$ – różnice istotne na poziomie $p \leq 0,05$.

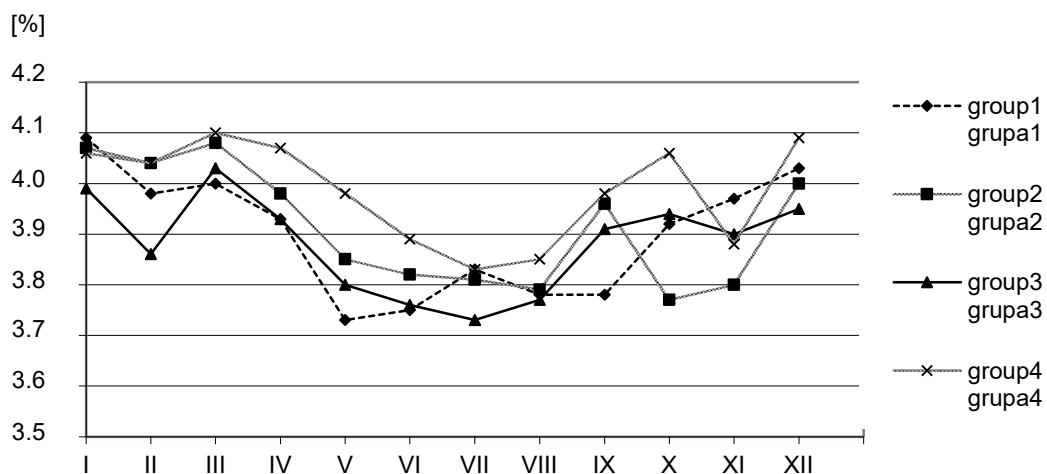


Fig.1. Average percentage of fat in milk in particular months of the year
Rys.1. Średnia procentowa zawartość tłuszczu w mleku w poszczególnych miesiącach roku

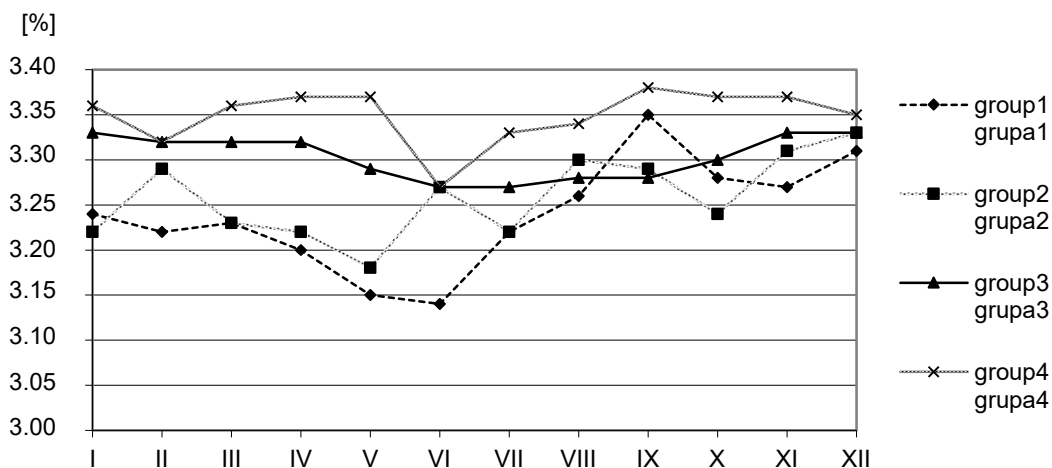


Fig. 2. Average percentage of protein in milk in particular months of the year
Ryc. 2. Średnia procentowa zawartość białka w mleku w poszczególnych miesiącach roku

Table 2 and Fig. 3 show the development of the average number of somatic and bacterial cells and the number of somatic cells in each month of the year in milk from individual groups of suppliers. The number of somatic and bacterial cells was equalized and satisfactory in all groups, which is a testimony to the good microbiological quality of the milk produced. In particular months of the year, the number of somatic cells was also fairly even, with a slight increase in summer months, with the exception of group 4. Cellular decline was observed in the autumn months. Brzozowski et al. (1999) report that SCC in the summer months is usually higher than in other seasons. Pilarska (2014), however, found significant differences in the number of SCC between the winter and summer seasons, depending on the assessment year. The number of TBC was generally satisfactory and very level in milk from suppliers of different production scales. Kobus and Kmiecik (2006) reported higher bacterial counts and a small percentage of milk fat (up to 3000 kg) per month compared to large producers (over 100,000 kg of milk).

Table 2. Average SCC and TBC in individual supplier groups
Tabela 2. Średnia SCC i TBC w poszczególnych grupach dostawców

Group Grupa	Number of milk suppliers Liczba dostawców	SCC			TBC [%]		
		\bar{x}	s	v [%]	\bar{x}	s	v [%]
1	60	195	49	25.12	78	5.49	7.04
2	60	230	40	17.39	79	5.65	7.15
3	60	199	37	18.59	78	6.50	8.33
4	36	229	70	30.57	77	15.48	20.10
Total ogółem	216	211	50	23.70	78	8.25	10.58

SCC – Somatic Cell Counts (thousands of cells) – liczba komórek somatycznych (w tys.), TBC – Total Bacteria Counts – ogólna liczba bakterii.

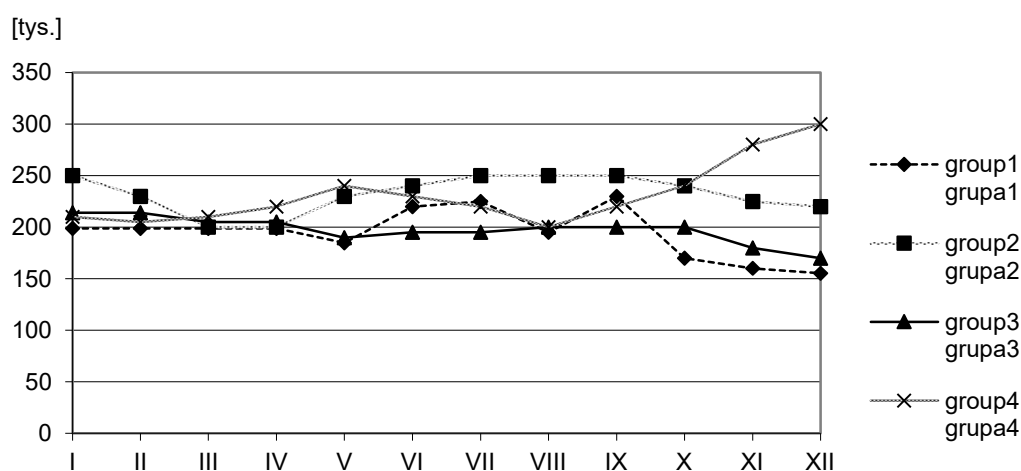


Fig. 3. Average number of somatic cells (in thousands) in particular groups of suppliers, including months
Ryc. 3. Średnia liczba komórek somatycznych w mleku w poszczególnych grupach dostawców, z uwzględnieniem miesięcy

Table 3 shows the production and composition of milk during summer and winter feeding periods. The production volume during the summer period was higher (by about 18%), which indicates that the seasonality of production still exists. The situation has improved because, according to Wójcik et al. (1997, 1998), the amount of milk bought in the summer was more than double that of the winter feeding period. The reason for this situation may be the inferior quality of preserved feeds produced by traditional methods in smaller farms. The improvement was mainly due to the improvement of the quality of feeds preserved especially in larger farms (TMR feeding), which ensures good alignment and rhythm of production throughout the year. As expected, a slightly higher percentage of fat and protein was in the wintertime, while the number of somatic and bacterial cells was similar, indicating good hygiene in obtaining, storing and transporting milk to the dairy plant.

Table 3. Production volume and composition of milk during summer and winter feeding periods
Tabela 3. Wielkość produkcji oraz skład mleka w okresach żywienia letniego oraz zimowego

Period Okres	Milk Ilość mleka [kg]	Fat content in milk Zawartość tłuszczu w mleku [%]	Protein content in milk Zawartość białka w mleku [%]	SCC [thous. – tys.]	TBC [thous. – tys.]
Grazing season Pastwiskowy (V–IX)	10400	3.82 SD 0.15	3.26 SD 0.09	216 SD 51.63	79 SD 9.96
Winter period Oborowy (X–IV)	8568	3.97 SD 0.16	3.29 SD 0.1	208 SD 49.52	77 SD 6.64

SD – standard deviation – odchylenie standardowe.

Other explanations see Table 2 – Pozostałe objaśnienia zob. tab. 2.

CONCLUSIONS

The percentage of fat and protein was fairly even in all groups, but slightly higher in the milk supplied by suppliers from the fourth group (sales above 15.000 kg per month). This was probably due to a greater share of modern feeding systems (TMRs). The microbiological purity of milk was similar in all groups, highlighting the small LKS and OLB, which shows the good health of cows and proper milking hygiene. The number of somatic cells and the overall number of bacteria was well below the limit of the extra class. The seasonality of production has been observed. In pasture seasons, average deliveries were 18% (1832 kg) higher than during winter feeding. It seems appropriate to continue to specialize farms and introduce in more productive flocks a perennial preserved feed feeding system (TMR).

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Abstract. The purpose of the conducted studies was the assessment of the quality of raw milk purchased by the dairy plant, including the purchase volume, the quality of the raw milk and the seasonality of its purchase. Farms were divided by the amount of milk produced: 1 group to 5000 kg of milk per month; 2 groups 5001–10 000 kg of milk; 3 groups of 10 001 to 15 000 milk per month; 4 group over 15 000 kg of milk per month. A slightly higher percentage of fat in milk from group 4 was found. The microbiological purity of milk was similar in all groups, highlighting the small LKS and OLB. The existing seasonality of production has been observed. The production volume during the summer period was about 18% higher. It seems appropriate to continue to specialize farms and introduce in the bigger farms the full-year feeding system (TMR).

