16. Pikul J., Leszczyński D.E., Kummerow F.A. 1989. Evaluation of Three Modified TBA Methods for Measuring Lipid Oxidation in Chicken Meat. Journal Agriculture Food Chemistry 37(3), 1309-1313.
17. PN-ISO 2917: 2001/Ap1:2002. Mięso i przetwory mięsne. Pomiar pH. Metoda odwoławcza.
18. PN-ISO 4121:1998. Analiza sensoryczna. Metodologia. Ocena produktów żywnościowych przy użyciu metod skalowania.
19. Salejda A.M., Krasnowska G., Tril U. 2011. Próba wykorzystania przeciwutleniających właściwości ekstraktu zielonej herbaty w produkcji modelowych przetworów mięsnych. Żywność. Nauka. Technologia. Jakość 5(78), 107–118.
20. Sampaio G.R., Saldanha T., Soares R.A.M., Torres E.A.F.S. 2012. Effect of natural antioxidant combinations on lipid oxidation in cooked chicken meat during refrigerated storage. Food Chemistry 135, 1383-1390.
21. Shah M.A., Bosco S.J. Don, Mir S.A. 2014. Plant extracts as natural antioxidants in meat and meat products. Meat Science 98, 21-33.
22. Sierżant K., Pyrkosz-Biardzka K., Gabrielska J. 2012. Właściwości przeciwutleniające naturalnych ekstraktów polifenolowych z wybranych roślin w układach modelowych. Żywność. Nauka. Technologia. Jakość 6(85), 41-53.
23. Simitzis P.E., Symeon G.K., Charismiadou M.A., Bizelis J.A., Deligeorgis S.G. 2010. The effects of dietary oregano oil supplementation on pig meat characteristics. Meat Science 84, 670-676.
24. Statsoft, INC. 2009. Statistica (data analysis software system), version 9.0. Tulsa, OK, USA.
25. Wójciak K.M., Dolatowski Z.J., Okoń A. 2011. The effect of water plant extracts addition on the oxidative stability of meat products. Acta Scientarum Polonorum, Technologia Alimentaria 10(2), 175-188.
26. Żuk B. 1989. Biometria stosowana. PWN, Warszawa.

THE IMPACT OF FEEDING SYSTEM ON PERFORMANCE AND CHEMICAL COMPOSITION OF COWS

W. Sobotka[1], B. L. Gołaś[1], J. Miciński[2]

University of Warmia and Mazury in Olsztyn, Faculty of Animal Bioengineering, Oczapowskiego 5, 10-719 Olsztyn, e-mail: wsob@uwm.edu.pl

[1] – Department of Animal Nutrition and Fodder Science

[2] – Department of Cattle Breeding and Milk Evaluation

***Key words**: dairy cows, feeding system, milk performance, chemical composition of milk*

***Abstract.** The research was undertaken on three farms. On the A-PMR farm research covered dairy cows fed with the PMR system, on the B-TMR farm cows fed with TMR system were examined, whereas in C-TR farm cows fed with the traditional system were examined. Content composition of a feeding dose, milk performance of cattle throughout winter and summer periods were determined in this work. Basing on undertaken research it was stated that cows fed with TMR system were characterised by the highest milk performance in comparison to cows assessed on the other farms. Particularly worthy of attention is also the achievement of high level of milk performance in cows fed in a traditional way. It seems that not only the feeding*

system has an impact on milk performance of cows but the quality of applied feeds in animal nutrition as well. Both protein and fat content in milk were placed on a high level on the analysed farms. In summer, the highest content was achieved on the farm in which the TMR system was applied. In winter the highest values were reached in the herd fed with the PMR system. The number of somatic cells in milk was higher in summer than in winter. The use of TMR system ensured the homogenous feeding dose with properly selected composition. Both the TMR and PMR systems required lower workload than the traditional feeding system.

(Поступила в редакцию 15.06.2017 г.)

Introduction. The lack of a properly balanced feeding dose causes a significant decrease in milk performance and leads to imbalance and instability in milk production. It also causes high losses in body mass, depletion of reserves and disturbances in reproduction. High production demand of dairy cows makes it necessary to use the rational feeding system which will guarantee optimal coverage of animal's nutritional needs (Minakowski and Cichocki, 2006).

In the production cycle of a cow the critical period having an impact on preparation of cows to the lactation is the dry-off. The dry period is hard for cows due to the final moments of parturition, the need to build energetic reserves in the organism, preparation of mammary gland for next lactation, secretion of colostrum, calving and acceleration of metabolism. A cow, due to development of fetus, lowers feed's dry weight intake by up to 35%. This involves the provision of animal with feeds of good quality, with a higher nutrients content.

Table 1 – The impact of feeding mistakes in nutrition of dryed cows on appearance of metabolic and reproduction disorders in early lactation (Litwińczuk and Szulc 2005).

Disorder	Nutritional status		Concomitant disease
	deficiency	excess	
Postpartum paralysis	Ca, Mg, protein	Ca, P, Na, K, vitamin D, energy	difficult parturition, retained placenta, mastitis, abomasum displacement
Difficult parturition	energy, protein	energy	postpartum paralysis, fat cow syndrome
Retained placenta	Se, Cu, protein, vitamins E and A	energy, K	postpartum paralysis, fat cow syndrome, ketosis
Hypomagnesemia	Mg	potassium	postpartum paralysis
Mastitis	Se, vitamins E, A	-	postpartum paralysis, abomasum displacement
Ketosis	protein, energy	energy	retained placenta, abomasum displacement, fat cow syndrome
Abomasum displacement	fiber	energy from concentrated	mastitis, ketosis

		feeds	

Cows are dried 50-60 days before calving. Fetus development is fastest then. In this period, cows have lower nutritional needs and it is necessary to base their nutrition on high quality volumetric feeds, whereas concentrated feeds should be used as an addition as well as vitamin and mineral components carrier. Cows in the process of drying should not be given feeds with high amounts of sodium, potassium and calcium, therefore it is needed to decrease the share of legume plants. Overfeeding of cows in dry period increases their fatness and can lead to calving complication, decrease in feeds intake after calving and lower milk performance.

The perinatal period is one of the most difficult periods connected to energetic deficiencies of a cow. This is a concern especially when the narrowed down period, the so-called transitional period, i.e. 3 weeks before and 3 weeks after calving is the case. Cow's nutrition in the last 3 weeks before calving needs proper balancing components composition of the dose so that the cow maintains an appetite. According to animal condition 1-1,5 kg three weeks before calving, in the second week 2-2,5 kg and in the last week 3-4 kg of concentrated feed is applied. It is worth to increase the share of starch in the dose due to a beneficial impact on rumen papillae. The content of total protein should oscillate between 12-13%. A significant element in the transitional period is to keep low level of Ca, K and Na in order to prevent postpartum paralysis and swelling of mammary gland. The application of niacin or propylene glycol allows to decrease the chance of ketosis, whereas an addition of anion salts counteracts postpartum paralysis (Litwińczuk and Szulc, 2005, Kański 2008).

After parturition, cow does not consume a proper amount of feeds in order to cover the needs of the amount of produced milk, that is why a part of protein, energy and other components is drawn from fat reserves of its own body. It leads to lowering of condition and might as well be the cause of ketosis, fertility disorders and decrease of immunity (Strzetelski et al, 1995).

After calving cow is needed to be supplied with the same feeds which it received before calving. In the first week, the share of concentrated feed should not increase over 6 kg as it may lead to acidosis. Nutrients intake should increase due to an increase in feed intake. An essential element is also the application of concentrated mixes which complement deficiencies of components in the feeding dose. The maximum amount can be applied in 4th-6th week of lactation, when cows consume higher amount of volumetric feeds. The increase in share of concentrated feeds over 50% of the dose might lead to a decrease in fat content of milk, decrease of pH in rumen, digestion disorders as well as acidosis.

Cows after calving have a huge deficiency of energy and need a lot more protein than in the drying period. Content of energy in the feeding dose may be increased by using concentrated feeds (Krzyżewski, 2008) as well as unprotected fat in feeds, by using rapeseed extruders in the amount 2-5% of dry weight or 2-4% of protected fat in the form of foams of calcium fatty acids. The number of protein can be gradually increased by application of a brewery malt, extruded soy or rapeseed meal. In the time of an increased performance exogenous amino acids in the protected form as: lysine and methionine can be applied.

Cows in the period between the 3rd and 7th month of lactation can consume a maximal amount of dry weight, which enables them to rebuild lost reserves. At this time an application of appropriate volumetric feeds of good quality as well as their complementation with concentrated feeds, appropriately to cows performance and the quality of volumetric feeds is recommended (Litwińczuk and Szulc, 2005).

In recent years a significant development and growth in dairy cattle performance occurred. It is connected to a need of developing proper housing conditions and application of properly balanced nutrition. Breeder should look out not only for quantity but quality of milk, fat, protein, lactose, vitamins and mineral components as well (Burgstaller 1985, Radkowska and Radkowski 2013).

The biggest changes due to nutrition occur in fat. Factors deciding of fat content are volumetric feeds, structural carbohydrates concentration as well as level of easily fermenting carbohydrates.

Acetic and propionic acids both have the highest impact on milk's fat production. High fluctuations in content of this component in milk appear with a change in components of nutritional dose.

The content of protein in milk due to nutrition is fluctuating to a much lesser extent. Content of this component in milk mainly depends on the amount of available energy contained in the feeding dose. The decrease in energy concentration in dry weight is reflected in low content of protein in milk. Use of concentrated feeds impacts milk's protein content beneficially by increasing supply of starch and other easily available carbohydrates.

The changes in fat content of milk usually correlate negatively with dairy performance. On the other hand, changes in protein concentration in milk usually correlate positively with dairy performance (Mikołajczak 2006, Minakowski et al. 2006).

Nowadays, three basic feeding systems of dairy cows can be distinguished: traditional, full-dose (TMR – Total Mixed Ration) and partial dose (PMR – Portion Mixed Ration). The traditional system is characterised by a separate feeding with concentrated and volumetric feeds with a high share of

own breeder's work. More modern and fully mechanized solution is the TMR system, which is based on a constant access to full dose ration containing volumetric, concentrated and mineral-vitamin feeds (Rutkowska et al 2012). PMR system is an alternative to the TMR system. In this system cattle is treated as a single technologic group. TMR is prepared for cows of the lowest performance in this herd, whereas concentrated feeds are consumed by cows in feeding stations controlled by the computer. Computer is measuring doses of concentrated feeds to cows according to their performance (Lach 1998).

TMR feeding system is now the most common feeding system of highly efficient cows (Jasińska et al 2011). All of the components of the feeding dose are applied in the form of a single full-dose mix after thorough mixing in the mixer wagon (Podkówka 2004, Jasińska et al 2011). Such system aims to provide a proper amount of balanced feeding dose as well as rational nutrition of cows with volumetric and concentrated feeds during lactation (Sobotka et al. 2011, Szołucha, 2006). Dairy cattle of high productivity performance needs unified feeding throughout a year. Frequent changes of feeds in nutritional doses lower the degree of nutrients utilization and cause disorders in digestion. Important elements in this system are cattle grouping, rational balancing of feeding doses, control of feed intake, appearance of feces as well as dairy performance and milk's chemical composition control. Factors mentioned above are significant, as they have an enormous impact on milk productivity (Podkówka 2004, Wandzel et al. 2008).

In cow's nutrition there is a possibility to use a simplified TMR system - the so-called PMR system. While feeding cows with this system it is needed to use high quality corn silage, cereal-legume mix silage, grassland haylage and beet pulps (Lach and Podkówka, 2000). This system treats dairy cows as one technological group. The feeding dose consists of juicy and dry volumetric feeds, concentrated feeds on the other hand are used depending on dairy cattle performance (Lach 1998, Strzelecki and Osięgowski 2000, Wójcik et al. 2005). PMR is an indirect solution between TMR and the traditional system. It may be used in freestanding barns as well as in tethered barns, in which feed is applied manually or with the use of feeding automate, to each cow individually (Szarek 2010).

The traditional system is a system consuming big amounts of time as well as workforce (Podkówka et al. 1999). Volumetric feeds are applied ad libitum, whereas concentrated feeds are applied depending on dairy performance of cows. They can be applied manually or with the use of automatic trolleys. Daily dose is divided into 2 or 3 grazings (Węglarz 2003).

In the traditional feeding system balancing of feeding dose is all about mixing structural and energetic feeds with protein feeds as well as feeds of

better structure. Concentrated feeds are applied as supplementation in order to compensate for shortages of protein or energy (Kruczyńska 2010).

Traditional feeding system is often connected to pasture grazing, thus lowering the possibility to feed cows rationally. The amount of dry weight consumed by cattle mostly depends on botanical composition of fleece, plants development phase and fertilization. A major factor is also a proper grazing time. Early green fodder contains low amount of dry weight, raw fiber and energy, whereas too much protein. Feeding of dairy cattle with such a lichen often leads to indigestions, diarrheas, disappearance of rumination as well as might cause milk performance decrease and lowering of fat and protein in it. In order to prevent such unfavorable occurrences it is needed to provide cattle with an additional carbohydrate feed such as hay, straw, beet pulps and molasses (Kamieniecki 2001, Litwinczuk and Szulc 2005, Krzywiecki 2006, Wasilewski 2006).

The aim of this work was to determine the impact of traditional as well as TMR and PMR systems on milk performance, basic chemical composition and hygienic quality of dairy cows milk.

Materials and methods. The research was undertaken on three farms marked as A, B and C dealing with dairy cattle breeding. The period of research was from October 2011 to October 2012. Farm A is located in Makowski county, Mazowieckie district. It occupies the area of 60 ha. For 15 years milk produced on the farm is being sold to Dr Oetker company from Maków Mazowiecki. On the farm A there is a freestanding barn for 45 pieces of cattle and tethered barn for 26 pieces. Milking of cows takes place in the milking hall of "fish-spear" type for 8 stations. The barn is under milk usability control with the use of A4 method. Farm B is located in Kolno county, Podlaskie district. Milk from this farm is sold to the Local Milking Cooperative in Piątnica. Farm's area is 171,8 ha. Arable land consists of 75 ha. On this farm 130 dairy cows are kept in the free standing barn, without bedding. Milking is performed twice a day with the use of "fish spear" type milking hall with 14 stations.

Farm C is located in Ostrołęcki county, Mazowieckie district. Farm's area is 25 ha, of which majority consists of grasslands as well as pastures. Milk produced on the farm is given to the Mlekpol Milking Cooperative in Grajewo. Farm C keeps 33 dairy cows in tethered system. In the barn there are 2 rows of stations as well as a feed corridor. Cows drink water from automatic drinkers. Feed is applied directly to the feeding table out of the trailer. Laying stations are filled with straw and are systematically cleaned. Manure is removed by scrapers directly onto the slab plate located just behind the barn. Milking is performed on stations, twice a day with the use of wireless milker – bubble type.

Feeds used in dairy cattle nutrition on farms A, B and C are volumetric feeds most often from own production as well as concentrated feeds bought on the market. The mix of grasses and legumes is mowed during the flowering phase and then dried until the dry weight reaches about 40%. It is then raked onto cylinders and thanks to the press collected and formed into bales (farms A and C). On the B farm collected and cut raw material is brought together and spread on prismatic passage on which pickled material is precisely kneaded by a telescopic loader and a tractor. Such feeds are fully prepared on their own. Silage made from full corn plants is collected in milk-waxy seed maturity, of 35% dry weight content. It is cut into chaffs of about 1,2cm long. The seed is crushed thus making its digestibility easier. The plant is transported from the field to the farm where it is stored and precisely kneaded by tractors equipped with telescopic loaders. After careful pressing the prism is covered with 2 layers of foil and showered with sand. An average yield of corn in farms oscillated on a similar level and was approximately 50 tones from hectare.

Concentrated feed consists of barley meal. Feeds bought on the market are a supplement of own produced nutritional doses. For herd A the Unimilk Pro mix was bought whereas for herd B it was Krowa KSEM complementary mixture. Protein concentrate, feed's yeasts, melase as well as soy and rapeseed meals plus mineral additives were also bought on the market.

On farm A in dairy cattle feeding the PMR system is used. In this system a $8m^3$ mixer wagon with a vertical helix responsible for cutting and mixing of components is used. Mixing lasts 15 – 20 minutes. A tractor, which is aggregated to the mixing wagon as well as loader which is loading silage are both used for feed preparation. The composition of a feeding dose on the feeding table is destined to cover the needs of cows producing 20kg of milk daily. The feed is prepared once a day and applied after early milking. The leftovers are removed from the feeding table. Thanks to feeding stations concentrated feeds can be used in the nutrition of cows in lactation.

On farm B cows are fed with the TMR system which is prepared with the use of frontal loader where components of a nutritional dose are placed into the mixer wagon. Mixing lasts about 20 minutes. The feed is prepared once a day and applied after early milking.

On farm C cattle is fed with the traditional system (TR). In winter cattle is kept in the barn where they receive properly balanced feeding dose in the morning as well as in the evening. Throughout the day volumetric feed is applied, showered with concentrated feed. In the summer cows are on the pasture for about 3 hours and then they are fattened in the barn with corn silage, haylage and concentrated feeds.

In this research the following were determined:

- Composition of feeding dose for dairy cows,
- Nutritional value of the dose,
- Requirements of dairy cattle for dry weight, energy, total protein in dependence of body weight, performance and fat content in milk,
- Quality of silage (organoleptic assessment),
- Cattle productivity in winter and summer season,
- Quality of milk (number of somatic cells)
- Burden of production of 1 liter of milk at the expense of the feed.

Results and Discussion. In Table 2 components of feeding doses prepared for dairy cattle in the analysed herds were presented. Good dairy performance of cows as well as high protein and fat content is an evidence of a properly composed dose. Data contained in table 2 shows that volumetric feeds are major share of the dose. The highest percentage share is for corn silage, in farm A it is as high as 51%, in farm B 54,8%, whereas in farm C 57,7%. Concentrated feeds of own production or bought on the market are treated as supplements. Supplementary feed mixes used in farms A and B as well as rapeseed and soy meals used in farm C are all very important. The composition of applied feeding doses is enriched by protein concentrates of 38% and 46% protein content. On B farm, in order to increase feed intake, regulate acid economy of the stomach as well as supply protein and vitamins (especially B group) feed's yeasts are used. On farm C melase, which consists of saccharose is used as a supplement. Therefore the calculated average feeding dose for 1 cow in the A-PMR herd is 44,8 kg, in B-TMR herd it is 47,1kg whereas in C-TR farm it oscillates at around 43,3kg.

On chart 1 is shown an average daily cow performance during summer feeding. In the A-PMR herd an average daily performance of 1 cow was 21,8 kg of milk. In B-TMR herd the performance was higher and reached 23,3kg of milk. On C-TR farm in which cows were fed traditionally, dairy performance was highest and shaped up at about 25,4 kg of milk.

Podkówka (2004) and Sobotka et al. (2011) claim that higher dairy performance can be achieved with the use of TMR or PMR systems than with the use of traditional feeding. Data above shows that not only the feeding system has a big impact on dairy performance. The ability to reach high production results in dairy cattle breeding depends on proper feeding, animal welfare, proper herd management and genetics as well (Dymnicka et al. 2004, Podkówka et al. 2004).

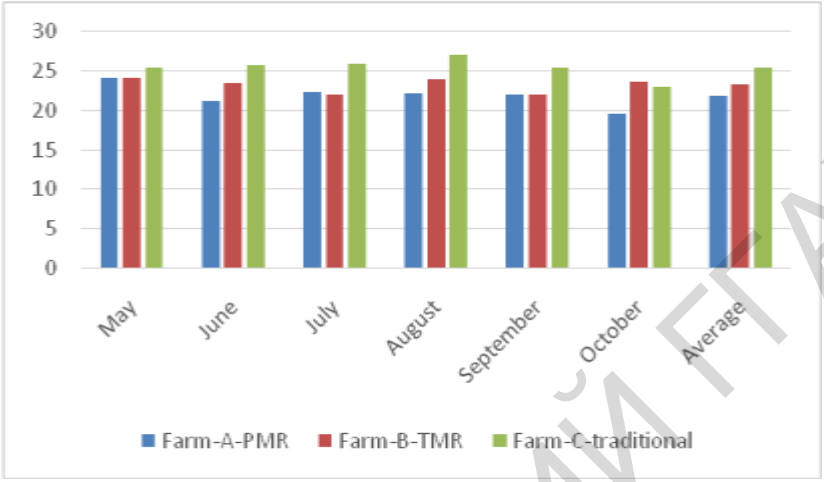

Chart 1 – Average daily performance of cows on farms in summer period.

Table 2 – Composition of feeding dose for dairy cattle.

Dose components	Farms								
	A-PMR			B-TMR			C-TR		
	[kg]	[%]	In summary [kg]	[kg]	[%]	In summary [kg]	[kg]	[%]	In summary [kg]
1	2	3	4	5	6	7	8	9	10
Grass haylage	14	31	630	12	25.5	1560	15	34.6	495
Corn silage	23	51	1035	25	53	3250	25	57.7	825
Barley straw	1.0	2.22	45	-	-	-	2.0	4.4	66
1	2	3	4	5	6	7	8	9	10
Grain meal: barley	-	-	-	4.0	8.5	520	-	-	-
Supplementary feed mix: A-Unimilk Pro B-Krowa Ksem	5.0	11	225	4.0	8.5	520	-	-	-
Protein concentrate: -Aminotek 46% -Promilk 38%	1.7	3.7	76.5	2.0	4.2	260	1.0	2.3	33
Feed yeasts	-	-	-	0.1	0.2	13	-	-	-
Melase	0.11	0.24	4.95	-	-	-	0.1	0.2	3,3
Rapeseed meal	-	-	-	-	-	-	1.0	2.3	33
Rapeseed soy meal	-	-	-	-	-	-	1.0	2.3	33
n summary	44.8	100	2024	47.1	100	6058	43.3	100	1429

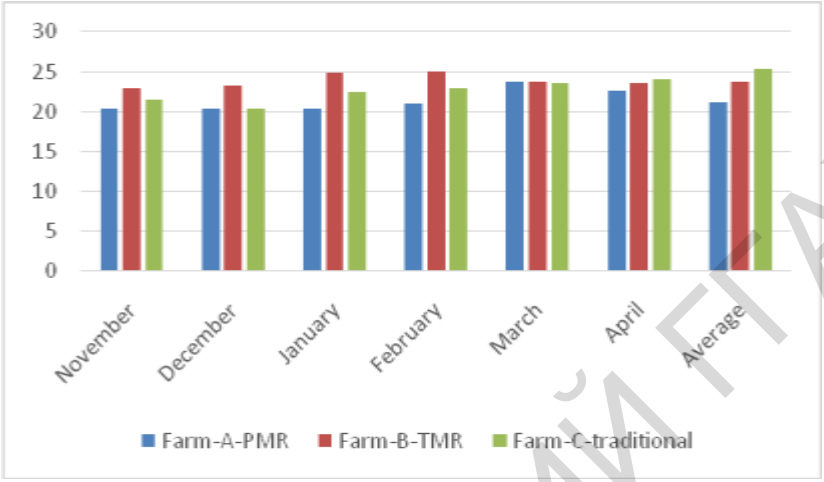

Chart 2 – Average daily performance of cows on farms in winter period.

According to data presented on chart 2, in winter time the highest daily milk performance was achieved by cows from the B-TMR herd (23,7 kg). In C-TR herd it averaged at around 22,8 kg of milk. Whereas on the A-PMR farm the lowest daily performance amounting 2,1kg of milk was reached.

In the work it was shown that the average milk performance of 1 cow for whole summer and winter feeding period amounted on A-PMR farm 21,5 kg of milk, on B-TMR farm 23,7 kg, whereas on C-TR farm 23,3 kg of milk.

Such thesis is confirmed by Sobotka et al. (2011) research in which it was proved that the highest milk performances are achieved with the use of TMR system.

It is worth underlining that with the traditional feeding high dairy performance can also be achieved. It is possible however the dose has to be properly balanced. High dairy performance achieved on C-TR farm in which the traditional system was used speaks for it.

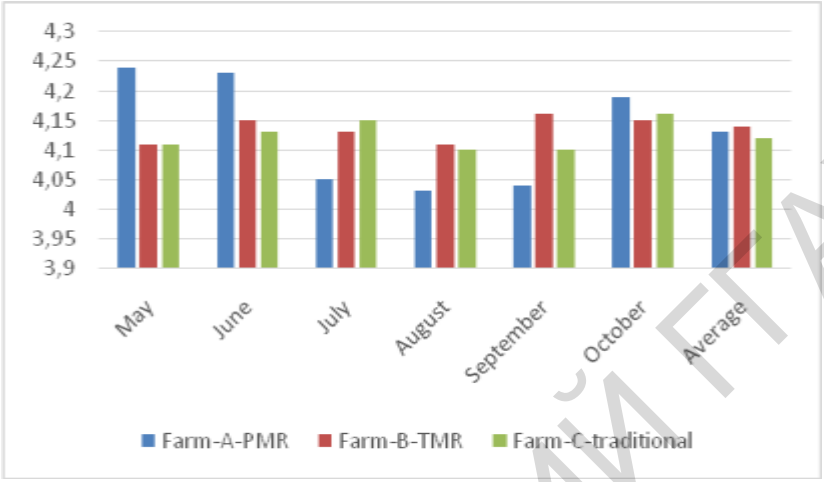

Chart 3 – Fat content (%) on farms in summer period.

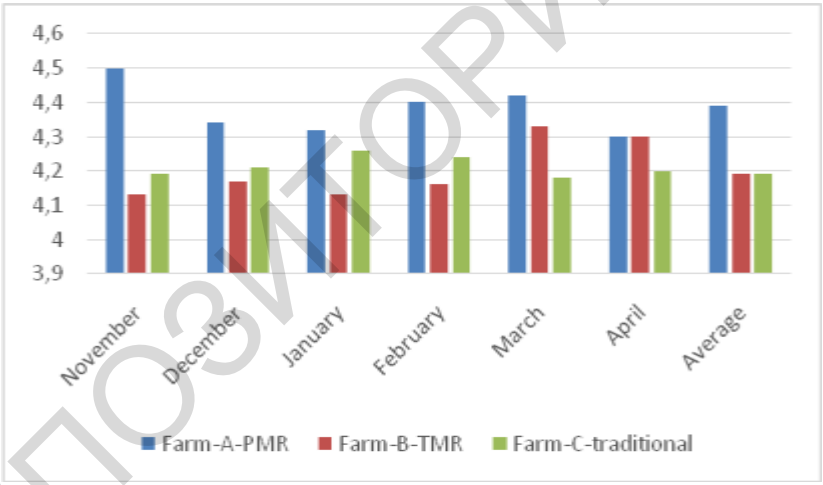

Chart 4 – Fat content (%) on farms in winter period.

Basing on the charts shown above it can be clearly seen that the amount of fat on the analysed farms is at high level. The biggest differences appear on A-PMR farm both in winter and summer periods. This is due to fluctuations of fiber level in the feeding dose. On B-TMR and C-TR farms fat content does not change rapidly and oscillates in 4,12-4,2% range. An average content of this component in milk during summer in the examined herds is on the same level. Obtained results correspond with the results ob-

tained by Pasternak et al. (2005) as well as Nowak and Wylęgała (2003), in which it was shown that in cows fattened with a big amount of concentrated feeds before calving an increase in dairy performance occurs with a simultaneous increase in fat content.

Chart 5 – Protein content (%) on farms in summer period.

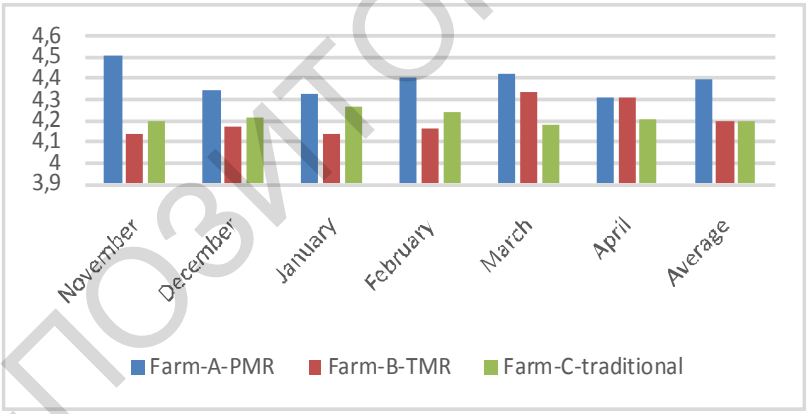

Chart 6 – Protein content (%) on farms in winter period.

On B-TMR farm higher average protein content in milk was achieved during summer feeding, which shaped up to be 3,39%. In winter period the highest values were recorded on A-PMR farm. The average protein amount was 3,4% in this period. Content of protein in C-TR herd was lower in comparison to results obtained on different farms. It was probably caused by the insufficient amount of energy in the feeding dose, as a properly balanced feeding dose, in terms of energy and protein, is a main condition of a proper

lactation course, health of animals as well as proper milk composition. Achieved results correspond to the results obtained in Kaczmarczyk et al. (1997) and Sabik et al. (2003) studies.

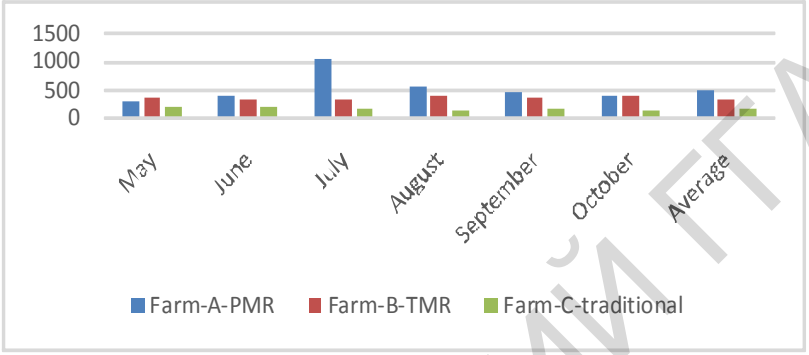

Chart 7 – Somatic cell count on farms in summer period

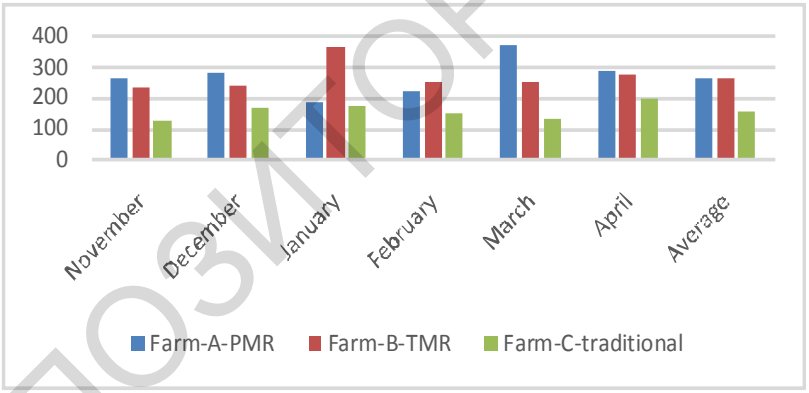

Chart 8 – Somatic cell count on farms in winter period

Many factors decide of protein level in milk. It might depend on lactation phase, season of year and age of cows. Nevertheless, proper nutrition plays a great role, especially the proper amount of energy in the feed. It has an impact on an intense rumen microflora growth, which is a source of microbiological protein (Szymańska 2002).

Number of somatic cells in milk corresponded to the extra class of milk. In research it was presented that on B-TMR and C-TR farms, both in

winter and summer feeding periods, the number of somatic cells did not exceed the optimal standard of about 400 000/ml (Regulation of the Minister of Agriculture and Rural Development). On C-TR farm the number of somatic cells was lower in comparison to the number of cells in milk on farm B. In A-PMR herd during summer feeding the number of somatic cells exceeded optimal standards as it reached as high as 479 000/ml. Main reason for that was probably a subclinical mastitis. As Ziemiński et al. (2004) and Malinowski (2001) state the number of somatic cells in milk is not only an indicator of hygienic quality of milk, but it is a proof of a health state of udder.

In summary, it can be assumed that the number of somatic cells in milk was definitely higher in the analysed farms in summer than in winter period. Obtained results correspond to the results achieved by Litwińczuk et al. (1997).

In table 3 three feeding doses were presented in winter period for dairy cows in A-PMR, B-TMR and C-TR herds, whereas in table 4 feeding doses in summer period for cows in the analysed farms. Achieved results show that feeding dose for cows in B-TMR herd, both in winter and summer periods, exceeded by 1,5kg the demand for dry-weight, 729g for total protein and 9MJ for net energy. In A-PMR herd, in winter period and summer as well, the need for dry weight was exceeded by 0,75kg, whereas for total protein in winter period by 511g and in summer period by 426g. Whereas in C-TR herd, during summer the need for dry weight was exceeded by 1,3kg and for total protein by 250g. In winter period, however, a small deficiency of dry weight and total protein occurred.

Both in A-PMR and C-TR herds a small net energy deficiency was shown. In relation to data contained in table 1 it can be assumed that there is a possibility of a better balancing of nutritional dose for dairy cattle in the assessed farms. In order to lower total protein excess it would be needed to lower the share of high protein feeds in dose, especially protein concentrates as well as supplementary feed mixes. In order to decrease the energy deficiency in the dose applied to cows in the analysed herds it would be needed to use cereal mix.

Table 3. Feeding dose for cows in winter period, of average body weight 600 kg, 4% fat content, daily milk performance: A-PMR farm (21kg), B-TMR (24kg), C-TR farm (23kg)

Type of feed	A-PMR				B-TMR)				C-TR			
	Feed intake (kg)	Intake of			Feed intake (kg)	Intake of			Feed intake (kg)	Intake of		
		dry weight (kg)	total pro-tein(g)	energy (MJ)		dry weight (kg)	total protein (g)	energy (MJ)		dry weight (kg)	total protein (g)	energy (MJ)
Grass silage	14	5,35	812	27,3	12	4,9	696	23,4	15	5,7	870	29,2
Corn silage	23	4,5	460	24,4	25	4,8	500	26,5	25	4,8	500	26,5
Barley straw	1	0,8	39	2,01	-	-	-	-	2,0	1,75	78	4,0
Barley	-	-	-	-	4,0	3,5	440	27,4	-	-	-	-
A-Unimilk + B-Krowa	5	4,3	800	32,5	4,0	3,4	720	28,8	-	-	-	-
Aminotek 46% protein	-	-	-	-	1,0	0,8	460	6,5	1,0	0,8	460	6,5
Promilk 38% protein	1,7	1,4	646	11,05	1,0	0,8	380	6,5	-	-	-	-
Feed yeasts	-	-	-	-	0,1	0,8	43	0,57	-	-	-	-
Melase	0,1	0,8	9,3	0,46	-	-	-	-	0,1	0,8	9,3	0,46
Rapeseed meal	-	-	-	-	-	-	-	-	1,0	0,9	195	11,6
Soy meal	-	-	-	-	-	-	-	-	1,0	0,8	303	9,2
In summary	44,8	17,1	2766	100,7	47,1	19	3239	119,6	45,1	15,55	2415	110,26
Requirement		16,4	2255	101,4		17,5	2510	110,6		16,9	2425	107,6
Difference		+0,75	+511	-0,6		+1,5	+729	+9		-1,35	-9,7	+2,6

Table 4. Feeding dose for cows in summer period of body weight 600 kg, 4% fat content, daily milk performance: A-PMR farm (22kg), B-TMR (24kg), C-TR (25kg).

Type of feed	A-PMR				B-TMR				Gospodarstwo C-TR			
	Feed intake (kg)	Intake of			Feed intake (kg)	Intake of			Feed intake (kg)	Intake of		
		dry weight. (kg)	total protein . (g)	energy (MJ)		dry weight (kg)	total protein (g)	energy (MJ)		dry weight (kg)	total protein (g)	energy (MJ)
Green forage	-	-	-	-	-	-	-	-	20	3,5	900	22,4
Grass haylage	14	5,35	812	27,3	12	4,9	696	23,4	10	5,7	870	29,2
Corn silage	23	4,5	460	24,4	25	4,8	500	26,5	20	4,8	500	26,5
Barley straw	1	0,8	39	2,01	-	-	-	-	2,0	1,75	78	4,0
Barley	-	-	-	-	4,0	3,5	440	27,4	-	-	-	-
A-Unimilk Pro + B- Krowa	5	4,3	800	32,5	4,0	3,4	720	28,8	-	-	-	-
Aminotek 46% P	-	-	-	-	1,0	0,8	460	6,5	1,0	0,8	460	6,5
Promilk 38% P	1,7	1,4	646	11,05	1,0	0,8	380	6,5	-	-	-	-
Feed yeasts	-	-	-	-	0,1	0,8	43	0,57	-	-	-	-
Melase	0,1	0,8	9,3	0,46	-	-	-	-	0,1	0,8	9,3	0,46
Rapeseed meal	-	-	-	-	-	-	-	-	1,0	0,9	195	11,6
Soy meal	-	-	-	-	-	-	-	-	1,0	0,8	303	9,2
In summary	44,8	17,1	2766	100,7	47,1	19	3239	119,6	55,1	19,05	2845	110,26
Requirements		16,4	2255	101,4		17,5	2510	110,6		17,75	2595	113,8
Difference		+0,75	+511	-0,6		+1,5	+729	+9		+1,3	+250	-3,5

Summary. Basing on the undertaken research it is possible to form the following conclusions and generalizations:

1. The highest milk performances were achieved with the use of TMR feeding system, then the traditional. It was confirmed that in majority the quality of applied feeds has an impact on cow dairy performance as well.

2. On the analysed farms a high content of both fat and protein was achieved. In summer time the highest protein and fat level was achieved in the herd fed with the TMR system. In winter time however, the highest protein content of protein and fat was achieved by using the PMR system,

3. A beneficial influence of the traditional system on somatic cells content in milk was reported,

4. The use of TMR system in dairy cattle nutrition allowed to produce milk of the same level and of similar chemical composition, independently of season,

5. Both TMR and PMR systems needed bigger amount of work than the traditional feeding system.

REFERENCES

1. Bujanowicz-Haraś B., Matras J., Wojtasik J. 2004. Wpływ bilansowania mineralnego żywienia krów mlecznych w okresie letnim na wydajność oraz wybrane składniki mineralne krwi i mleka. Rocz. Nauk. Zoot., T. 31, z. 2:251-264.
2. Burgstaller G. 1985. Żywienie bydła. Państwowe Wydawnictwo Rolnicze i Leśne, Warszawa, 84-106.
3. Cichocki M., Wroński M., Szydłowski R. 2007. Użytkowość mleczna krów żywionych z zastosowaniem systemu TMR lub PMR. Acta Sci. Pol., Zootechnica 6 (2): 15-20.
4. Dymnicka M. 2007. Wpływ żywienia krów na skład i jakość mleka. Bydło: 18-27.
5. Dymnicka M., Łozicki A. 2004. Wpływ sezonu żywienia oraz wysokości produkcji mleka na poziom wybranych wskaźników biochemicznych we krwi krów. Roczniki Naukowe Zootechniki, (S. 19): 51.
6. Gnyp J., Kowalski P., Tietze M. 2006. Wydajność mleka krów, jego skład i jakość cytologiczna w zależności od niektórych czynników środowiskowych. Ann. UMCS, sec. EE, 3: 17-26.
7. Grela E.R. 2001. Dodatki w żywienie bydła. 9-17: 149-159.
8. Grodzki H. 2002. Hodowla i użytkowanie bydła. Wydawnictwo SGGW, Warszawa, 173-179.
9. Horst R.L., Goff J.P. 2005. Dawki pokarmowe dla krów mlecznych w okresie okołoporodowym. Cz. II., Magazyn weterynaryjny14(97): 57-59.
10. Januś E. 2008. Choroby okołoporodowe krów mlecznych cz. I- Ketoza. Hodowca Bydła 3: 28-30.
11. Januś E. 2008. Choroby okołoporodowe krów mlecznych, zapalenie wymienia i poporodowe zapalenie macicy. Hodowca Bydła 8: 28-29.
12. Jasińska M., Łyczko K., Dmytrów I., Mituniewicz-Małek A. 2011. Porównanie właściwości fizyko-chemicznych mleka krów żywionych systemem TMR w wybranych gospodarstwach regionu zachodniopomorskiego. Roczniki Naukowe Polskiego Towarzystwa Zootechnicznego, t.7(3): 75-84.
13. Kamieniecki H. 2001. Chów zwierząt z zoohigieną. Akademia Rolnicza w Szczecinie, 205-208.
14. Kański J. 2009. Tłuszcz w dawce moda czy konieczność? Hodowca Bydła 9: 52-55.
15. Klebaniuk R. 2006. Żywienie krów mlecznych a mastitis. Bydło: 12-15.

16. Kowalski Z.M. 2003. Zasady grupowego żywienia krów mlecznych. Zeszyty Naukowe Przeglądu Hodowlanego 71: 5-13.
17. Kruczyńska H. 2008. Pasze i mieszanki treściwe dla krów mlecznych. Bydło: 8-11.
18. Kruczyńska H. 2008. Pasze objętościowe suche, strukturalne. Bydło: 12-15.
19. Kruczyńska H. 2010. Pasze i mieszanki treściwe w żywieniu bydła. Bydło: 13-15.
20. Kruczyńska H. 2010. Sezonowa zmiana żywienia krów mlecznych. Bydło: 10-13.
21. Kruczyńska H. 2010. Wymagania i żywienie krów w zależności od okresu fizjologicznego i produkcyjności. Bydło: 9-13.
22. Kruczyńska H. 201. Pasze objętościowe- pastwisko i zielonki. Bydło: 8-11.
23. Kruczyńska H., Mitke A., Tylkowska E., Kozłowska-Hałas J. 2006. Wydajność i skład mleka wysokowydajnych krów żywionych dawkami pełnoporcjowymi (Total Mixed Portion-TMR). Prace i Materiały Zootechniczne 63: 49-57.
24. Krzyżewski J. 2008. Pobranie suchej masy przez krowę dlaczego tak ważne? Hodowca Bydła 8: 4-8.
25. Krzyżewski J. 2011. Optymalne żywienie krów wg technologii TMR wcale nie jest łatwe. Hodowca Bydła 11: 16-21.
26. Krzyżewski J. 2013. Postępowanie z krowami zasuszonymi. Hodowca Bydła 1: 10-15.
27. Lach Z. 1998. System „PMR" w żywieniu wysokoprodukcyjnych krów. Zeszyty Problemowe Postępów Nauk Rolniczych, z. 462: 221-230.
28. Lach Z., Podkówka W. 2000. Wydajność i skład chemiczny mleka krów żywionych w systemie PMR. Zeszyty Naukowe Przeglądu Hodowlanego 51: 109-118.
29. Litwińczuk Z., Szulc T. 2005. Hodowla i użytkowanie bydła. Państwowe Wydawnictwo Rolnicze i Leśne, Warszawa, 259-290.
30. Malinowski E. 2001. Komórki somatyczne mleka. Medycyna weterynaryjna 57 (1): 13-17.
31. Mikołajczak J. 2006. Żywienie bydła. Wydawnictwo Uczelniane Akademii Techniczno-Rolniczej w Bydgoszczy, 195-202.
32. Minakowski D. 2008. Pasze przemysłowe znaczenie w żywieniu bydła. Hodowca Bydła 2: 6-11.
33. Minakowski D., Cichocki M. 2006. Żywieniowe uwarunkowania stabilnej produkcji mleka. Hodowca bydła 12: 14-19.
34. Minakowski D., Tywończuk J., Purwin C., Lipiński K. 2006. Składniki mleka na tle żywienia krów. Hodowca Bydła 1: 22-27.
35. Nowak W., Wylęgała S. 2003. Prawidłowe żywienie krów podstawą opłacalności produkcji mleka. Symp. Hod. Bydła, Środa Wielkopolska, 12-15.
36. Pasternak A., Krzywiecki S., Iwanicka J., Osięgłowski S. 2005. Wpływ ilości paszy treściwej w dawkach w okresie okołoporodowym na wyniki produkcyjne i zdrowotność krów. Zeszyty Naukowe Akademii Rolniczej we Wrocławiu, nr 529: 109-114.
37. Podkówka W., Podkówka Z. 2004. Żywienie wysoko wydajnych krów w systemie TMR. Zeszyty Naukowe Przeglądu Hodowlanego 74: 9-23.
38. Radkowska I., Radkowski A. 2013. Wykorzystanie pastwisk w produkcji mleka o podwyższonej wartości odżywczej. Hodowca Bydła: 58-61.
39. Radkowska I., Radkowski A., 2013, Zmiany wydajności oraz składu mleka w zależności od warunków utrzymania. Hodowca Bydła 3: 6-9.
40. Rozporządzenie Ministra Rolnictwa i Rozwoju Wsi z dnia 18 maja 2005 roku zmieniające rozporządzenie w sprawie wymagań weterynaryjnych dla mleka oraz przetworów mlecznych (Dz. U. Nr 96, poz. 819).
41. Ryś R. 1993. Normy żywienia bydła i owiec systemem tradycyjnym.
42. Sablik P., Kamieniecki H., Pilarczyk R. 2003. Poziom mocznika i białka w mleku w ocenie prawidłowego zbilansowania dawki pokarmowej dla krów mlecznych. Zeszyty Naukowe Przeglądu Hodowlanego 68(1): 99-106.

43. Sobotka W., Miciński J., Wróblewski P., Zwierzchowski G. 2011. Wpływ systemu żywienia tradycyjnego i TMR na pobranie paszy przez krowy, ich wydajność, skład mleka i jego jakość higieniczną. Roczniki Naukowe Polskiego Towarzystwa Zootechnicznego, t.7(4): 87-96.
44. Szymańska A. M., 2002, Użytkowanie krów holsztyńsko fryzyjskich w warunkach polskich. Wydawnictwo NEGATYW w Bydgoszczy, 97-105.
45. Stamirowska-Krzaczek E., 2013, Znaczenie pasz pozyskiwanych z użytków zielonych w produkcji mleka. Hodowca Bydła 3: 25-29.
46. Staszak E., 2010, Wpływ żywienia na podstawowy skład chemiczny mleka krowiego. Bydło: 22-25.
47. Staszak E., 2011, Sianokiszonki w żywieniu bydła. Bydło: 20-22.
48. Sweenson C., Svendsen J., Svendsen L.S. 1997. Integrowany chów bydła. Wydawnictwo SGGW, Warszawa, 49-58.
49. Szark J. 2010. Chów bydła mlecznego. Wielkopolskie Wydawnictwo Rolnicze, Poznań, 137-186.
50. Szołucha J. 2006. Żywienie TMR i wóz paszowy, czyli spojrzenie przez lupę na niektóre aspekty żywienia TMR i niezbędne do tego celu urządzenie-wóz paszowy. Bydło: 18-19.
51. Wandzel K., Kański J. 2008. Dlaczego wybrać TMR? Hodowca Bydła 2: 18-23.
52. Węglarz A. 2003. Hodowla Bydła. Wydawnictwo AR Kraków.
53. Wasilewski Z. 2006. Pastwiskowe żywienie krów mlecznych w aspekcie ich coraz większych wydajności. Wieś Jutra 3 (92): 33-34.
54. Wójcik J., Pilarczyk R., Czerniawska-Piątkowska E., Ostrowski W., Zawadzka M. 2005. Porównanie wydajności oraz składu mleka krów żywionych systemem TMR lub PMR. Rocz. Nauk. Zoot., Supl., z. 22: 641-644.
55. Zawadzki W. 2008. Fizjologiczne podstawy żywienia zwierząt. Wydawnictwo Uniwersytetu Przyrodniczego we Wrocławiu, 265-269.
56. Ziemiński R., Adamski M., Krym J., Czarnik U., Zabolewicz T., Walawski K. 2004. Wydajność i skład mleka krów wysoko wydajnych w zależności od zawartości komórek somatycznych i kolejnej laktacji. Zeszyty Naukowe Przeglądu Hodowlanego 74: 209-214.

GENDER-RELATED CORRELATIONS BETWEEN THE WEIGHT OF SELECTED MUSCLES AND CARCASS LEAN AND FAT CONTENT IN BROILER CHICKENS

K. Tomaszewska, M. Mikołajczak, D. Murawska, W. Makowski, E. Wilkiewicz-Wawro, D. Michalik

Department of Commodity Science and Animal Improvement, Faculty of Animal Bioengineering, University of Warmia and Mazury, Olsztyn, Poland, e-mail: katarzyna.tomaszewska@uwm.edu.pl

Abstract. *The objective of this study was to determine the applicability of the weight of selected wing, leg and breast muscles for estimating the content of lean meat and skin with subcutaneous and intermuscular fat in the carcasses of broiler chickens. The experimental materials comprised 40 carcasses of Ross 308 chickens (20 males and 20 females) slaughtered at 42 days of age. During carcass dissection, 17 muscles were removed from the right wing and the right leg. Breast muscles were separated from the breast portion. Coefficients of simple correlation between muscle weight and selected slaughter quality parameters were calculated. The results of the*