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BIOLOGICAL EFFICIENCY AND CHEMICAL COMPOSITION OF COW MILK COW FROM 'BULGARIAN RHODOPE CATTLE' WITH DIFFERENT GENOTYPE

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Abstract

The milk productivity of cows from 'Bulgarian Rhodope cattle', reared on the farm of the Experimental Base of the Research Institute of Mountain Stockbreeding and Agriculture, Troyan and the farm of Deyan Filipov, in the town of Strazhitsa, was analyzed. Milk productivity, physicochemical composition, dry matter, dry fat-free residue (DFR) and energy value of milk were studied. The percentage of dry matter is a generalizing, constant feature that determines the concentration of cow's milk. The live weight of the studied animals was also determined. The biological efficiency and the coefficient of biological sufficiency of milk were calculated by formulas. The physicochemical parameters of milk of the studied animals of both genotypes showed different values. Live weight of cows bred in the area of the town of Troyan is higher than that of those reared in the area of the town of Smolyan by 27.55 kg. The coefficients for biological efficiency and biological sufficiency show that cows with a genotype typical of the region of the town of Strazhitsa gave more food production per 1 kg of live weight.

Key words: *'Bulgarian Rhodope cattle', genotype, milk yield.*

INTRODUCTION

In the mountain and foothill regions of the Republic of Bulgaria relatively few breeds of dairy cattle are raised. A suitable and well-established breed is 'Bulgarian Rhodope Cattle'. It is obtained by complex, reproductive crossbreeding of cows from 'Rhodope Short-horned Cattle' breed with 'Brown Alpine' and 'Jersey' bulls and long-term selection (Vassilev, 1988; Gadzhev and Nikolov, 2008; Gergovska and Panayotova, 2016; Mehandzhiyski et al., 2019).

Evaluations of the biological efficiency of cows and the coefficient of biological sufficiency of milk is the research objective of Bulgarian and foreign scientists as well (Bruthen et al., 1984; Lazarenko and Gorelik, 2002; Davoodi, et al., 2013; Safina, 2018; Minabaev, 2019).

According to Karnauhov & Adrianova (2010) in some countries the nutritional value of milk is determined by the content of dry fat-free residue and protein, not excluding the assessment of productivity in protein and milk fat, because these traits are valuable in energy and biological terms.

Tagirov & Adriyanova (2008) believe that by increasing the blood percentage of the 'Holstein Friesian' dairy breed, in cases of backcrossing with local black-and-white cattle in Russia increases the level of milk productivity and preserves its environmental safety.

Khodyreva (2013) found that the cattle breed has an impact on milk productivity and its quality. When comparing two breeds and their crossings in the Urals, 'Simmental' and 'Holstein Friesian', the latter showed higher milk productivity.

Lim et al. (2020) concluded that milk obtained from 'Jersey' and cows that are crossings of 'Jersey' with other dairy cattle breeds made more efficient, processed dairy products with an appropriate energy status compared to products obtained from processed milk from cows from 'Holstein' breed. Such conclusions are reached by Cvac et al. (1982), Kozhev (2004), Iliev & Mihailova (2014).

The objective of the study is to make a comparative assessment of the biological efficiency and chemical composition of milk obtained from cows of 'Bulgarian Rhodope Cattle' with different genotypes, reared in the

mountain and foot-hill regions of the Republic of Bulgaria.

MATERIALS AND METHODS

The scientific and economic experiment was conducted in the Research Institute of Mountain Stockbreeding and Agriculture in the town of Troyan and the farm of the agricultural producer Dean Filipov, in the town of Strazhitsa, in 2021. The objective of the study were clinically healthy, mature cows raised after the second lactation, which have completed their growth. The groups were formed on the principle of analogues of 20 cows of 'Bulgarian Rhodope Cattle' breed. In the first group were the animals from the farm of RIMSA-Troyan, and in the second from the farm of Deyan Filipov-Strazhitsa. The tested animals were studied and analyzed under identical feeding and raising conditions from a technological point of view. Milk productivity and physicochemical parameters of milk were obtained monthly after control milking: for fat content by Gerber method, for protein and casein by formal titration methods, for dry matter by calculation methods, for DFR in milk analyzer "Milco-Scan 120 B".

Live weight of the cows was determined by a measuring tape for combined measuring of height and weight.

The biological efficiency of cows (BEC) for both groups was determined by the formula of Lazarenko (1990):

BEC=MP x DM/LW

where **MP** is milk productivity for a 305-day-lactation, kg

DM is dry matter content in milk, %

LW is live weight of cows, kg

The coefficient for biological sufficiency (**CBS**) was calculated according to the formula of Lazarenko, Gorelik and Lykasova (2002):

CBS=MP x DFR/LW

where MP is milk productivity for usual lactation, kg

DFR is dry fat-free residue, %

LW is live weight of cows, kg

The coefficient of lactation persistence (**CLP**) was determined by the formula:

CLP= (B-A) x 100/B

where:

A is productivity for a 100-day-lactation, kg

B is productivity for a 305-day-lactation, kg

Energy value EV (kkal) was calculate with the following formulae:

EV (Kkal) = (PR + LACT) x 4 + (F x 4)

Where PR is proteins

LACT is lactose

F is fats.

The results were processed biometrically by the methods of variation statistics using MS Excel and presented in tables.

RESULTS AND RESEARCHES

The obtained data for a 100 day-lactation show higher values of milk fat in cows of the first group, from the region of Strazhitsa respectively 4.28% compared to 4.08% of the second group and higher values of milk protein in the second group in the region of the town of Troyan, respectively 3.35% compared to 3.33% of the first group for the first 100 days of lactation. The milk productivity in the first group is 1185.68 kg, and in the second 1002.76 kg.

Table 1. Milk yield, amount of milk fat and protein in milk of cows of 'Bulgarian Rhodope Cattle' for 100 and 305-day lactation

Indicator	Breed Bulgarian Rhodope Cattle	
	BRC (I gr.) n=20	BRC (II gr.) n=20
First 100 days of lactation		
Milk yield, kg	1185.68 ± 112.35	1002.76 ± 127.21
Milk fat, %	4.28 ± 0.25**	4.08 ± 0.14**
Milk protein, %	3.33 ± 0.12***	3.35 ± 0.05***
For a 305-day-lactation		
Milk yield, kg	3974.37 ± 23.65	3324.37 ± 166.22
Milk fat, %	4.49 ± 0.14**	4.79 ± 0.36**
Milk butter, kg	176.82±40.59	166.24±14.65
Milk proteins, kg	3.29 ± 0.09**	3.86 ± 0.16**
Milk proteins, kg	131.07±31.38	134.42±12.28

*P<0,05, **P<0,01, *** P<0,001

In the following days of lactation there was an increase in the amount of milk fat and protein in the second group in the region of Troyan, respectively by 0.61% and 0.51% and a moderate increase of 0.21% in fat and a decrease in protein by 0.04% in the second group from the region of the town of Strazhitsa.

Figure 1. Bulgarian Rhodope cattle from the farm of Research Institute of Mountain Stockbreeding and Agriculture

The milk productivity for a 305-day-lactation in the first group in the region of the town of Strazhitsa was 3974.37 kg, and in the second group in the region of the town of Troyan was 3324.37 kg, or a significant difference of 650 kg. In terms of biological efficiency coefficient, the first group is superior to the second group by 7.8%.

The achieved results justify good, average values at the level of milk productivity in both analyzed genotypes.

In addition to the quantitative indicators of milk, which are considered above in the study, we will focus on the qualitative indicators related to technology (Bruthen et al., 1984, Lazarenko, 1990).

Table 2. Biological efficiency, coefficient of biological sufficiency, coefficient for lactation persistence and energy value of milk

Indicators	**Breed Bulgarian Rhodope Cattle**	
	BRC (Igr.) n=20	**BRC (IIgr.) n=20**
Milk yield, kg	3974.37±23.65	3324.37±166.22
Dry matter, %	17.85±0.99*	17.71±0.49*
DFR, %	9.46±1.07	10.60±0.41*
Lactose	4.83±0.23**	5.07±0.44**
Live weight, kg	431.8±22.26	459.35±30.54
Sequence of lactation	5±2.87	5±1.00*
BEC	164.29	128.17
CBS	87.07	76.71
CLP	70.17	69.84
Energy value, kkal/100 ml	50.74	51.64

*P<0,05, **P<0,01, *** P<0,001

In terms of biological sufficiency coefficient, the superiority is of the cows from the first group with 8.81% compared to the cows from the second group. The content of DFR (Dry fat-free residue) determines its biological value and the quantitative state of the ratio between dry matter and fat (Lifanova, 2010).

According to the coefficient for lactation persistence, the difference is minimal, 0.43 points or 0.95%, again in favour of the first group of cows in the region of Strazhitsa.

There are no big differences in the energy value indicator: in the second group, in the region of Troyan, the energy value is 51.46 kcal, and in the first group, in the region of Strazhitsa is 50.74 kcal, that's a difference of 0.90 kcal., or 1.01%.

The dairy industry imposes ever higher requirements for milk quality as a raw material for the production of various delicacies and this requires increased responsibilities on the part of breeders and farmers (Lazarenko et al., 2002, Tagirov and Andriyanova, 2008).

The ratio of calcium to phosphorus in mg/kg is shown in Table 3. Calcium is an element that is actively involved in blood clotting, increases the penetration of the substrate into capillaries, synthesizes iron metabolism, increases the body's resistance to infections, participates in metabolic processes, ensures the formation of nerves and muscles. Phosphorus is also an essential element that participates in the synthesis of the protein molecule, regulates osmosis and affects tissue strength and acid-base balance in the body (Minabayev, 2019)

Figure 2. Bulgarian Rhodope cattle in the farm

Table 3. Ratio between calcium and phosphorus mg/kg

Genotype	Milk		
	Ca (mg)	P(mg)	Ratio
BRC (I gr.)	137	1.0	1:0.73
BRC (II gr.)	142	0.91	1:0.64

The ratio of calcium to phosphorus in the first group of cows studied is 1:0.73, and in the second group is 1:0.64, as it is desired in the ideal product to obtain 1:0.75, and this is within expectations.

The present results correspond to and are close to the results obtained in the study on milk by Karnouhov & Adrianova (2010), Khodyreva (2013) and Safina (2018).

CONCLUSIONS

The foot-hill and mountain climatic conditions of Bulgaria are suitable for raising cows from 'Bulgarian Rhodope Cattle' breed. Genotype affects milk productivity and milk quality. Milk productivity was higher in cows raised in the region of Strazhitsa by 650 kg compared to cows raised in the region of Troyan. The physicochemical parameters
of milk of the studied animals of both genotypes showed different values. The live weight of cows raised in the area of the town of Troyan was higher than that of those bred in the area of the town of Strazhitsa by 27.55 kg. The values of the coefficients for biological efficiency and biological sufficiency show that cows with a genotype typical for the region of the town of Strazhitsa get more food production based on 1 kg live weight.

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