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Nutrient And Energy Digestibility In Cows Fed The Energy Supplement «Felucen».

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ABSTRACT

The paper presents a comparative assessment of the consumption of fodder, nutrients and energy by cows of the Black motley breed fed various doses of the Felucen energy supplement. The study results are reported as promising. The study reveals increased indices of digestibility of dry matter by 0,62-1,78%, of organic matter by 0,77-2,22%, of crude protein by 0,91-3,77%, of raw fat by 0,91-3,16%, of crude fiber by 1,79-2,28%, of nitrogen - free extractives by 0,40-1,71% in cows of test groups compared to animals of the control group. The supplement is proved as efficient based on the data on the use of feed energy for milk production. For example, the energy index for milk synthesis in cows of the 2nd -4th test groups was by 3,7-5,9 MJ (2,92-4,65%) higher than that of the control group. It is recommended that the energy supplement «Felucen» be introduced in the diet of Black motley breed cows at a dose of 300 g per animal per day.

Keywords: cows, Felucen, digestibility, energy.

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INTRODUCTION

The Russian milk market currently features potential opportunities for its quick growth. This is due to the fact that Russians are provided with milk and dairy products at about 81%. Exports from other countries and increased number of livestock on home dairy farms may fill in the gap of 6 million tons of raw milk [1, 2].

The population of the Russian Federation are active consumers of dairy products. However, it should be noted that there has been a 40% decrease in milk consumption while the rate of 340 kg per year is recommended [3].

Increasing dairy cattle yields might be the way to address the problem. In this regard the issues of improving the livestock management and feeding conditions appear urgent [4-7].

Adding new feed and biologically active supplements to the diet of lactating cows may raise milk production and improve milk quality [8-11].

Currently specialists offer a variety of feed additives with a wide action range. A group of energy supplements, in our view, deserves particular attention. These supplements are efficient in preventing energy and nutritional imbalance, avoiding metabolic disorder of lactating cows, which is often likely to immediately come on after calving. At this stage the cows suffer from a sharp decrease in the concentration of progesterone and an increase in estrogens and glucocorticoids. As a result the consumption of dry matter is reduced while milk production is increased. Thus, an «energy gap» occurs when the energy incoming with the feed-stuff becomes insufficient to cover for the animal's energy needs [12-15].

Energy supplement «Felucen» is one of a large group of biologically active additives. It was created by Russian specialists of the «Capital-Prok» company. Its balanced composition contains plant proteins and fats, carbohydrates, amino acids, vitamins, macro and microelements. Adding the supplement to the diet of Black motley breed cows is expected to increase the energy value of the diet, make up for the elements the body is lacking, as well as to restore metabolism. The supplement is sure to improve functioning of the digestive system and digestibility of feed that will lead to better productive qualities of animals in the long run.

Thus, the comprehensive study on the use of the Russian energy supplement «Felucen» at different doses in the diet of Black motley cows is considered as relevant and of definite scientific and practical interest.

MATERIALS AND METHODS

Both science and farm-based and physiological experiments were done in Chekmagushevsky District of the Republic of Bashkortostan in Volga (Privolzhsky) Federal District of the Russian Federation in 2016-2017.

Full-grown cows of Black motley breed were used in the experiment. The animals were divided into 4 groups of 12 animals on an analogue group basis. All animals were kept in identical housing and management conditions. Only feeding parameters differed. The diet of the 1st (control) group cows was standard as used on the collective farm «Geroy» and was based on various grasses, cereal and legume hay, corn silage, concentrated feed-stuff, beet molasses and fine salt. Cows of the 2nd, 3rd and 4th test groups received the supplement «Felucen» at a dose of 250 g, 300 g and 350 g per animal, respectively, additional to the standard diet. The supplement is a dry granule product, so it was added dry to the diet, by mixing it with the grain mixture. Given that the tested supplement contains ultra pure salt, standard salt was excluded from the diet of experimental groups.

Chemical parameters of the feed, residual feed and feces were analysed on a standard practice basis in an independent certified experimental center of the Federal State Scientific Center for Biological Systems and Agritechology of the Russian Academy of Sciences. An analysis sample of the concentrated feed was within 200-250 g; of the rough feed within 400-500 g. The samples were stored at 2-3 °C.

The consumption of nutrients during the reference period was estimated based on the data of the chemical analysis of feeds and residual feed. The cows were kept in separate shed boxes during these days. Nutrient digestibility ratings were determined based on the amount of nutrients eaten, feces and urine and their chemical composition.

Sampling of milk was carried out daily throughout the physiological experiment.

The energy content in the diets was calculated using regression equations of the VIZh (developed at All-Russia Institute of Animal Breeding) (A.P. Kalashnikov et al., 1985).

Animals were kept in accordance with instructions and recommendations of the Russian Regulations, 1987 (Order of the USSR Ministry of Health No.755 on 12.08.1977) as well as «The Guide for Care and Use of Laboratory Animals (Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council, National Academy Press Washington, D.C. 1996)». The study was conducted in conditions aimed to minimize animal suffering and reduce the number of used samples.

RESULTS

Our observations have shown that various doses of the Felucen supplement lead to an increase in the nutritional value of the diet and, accordingly, to a difference in the feed intake and nutrient intake (Figure 1).

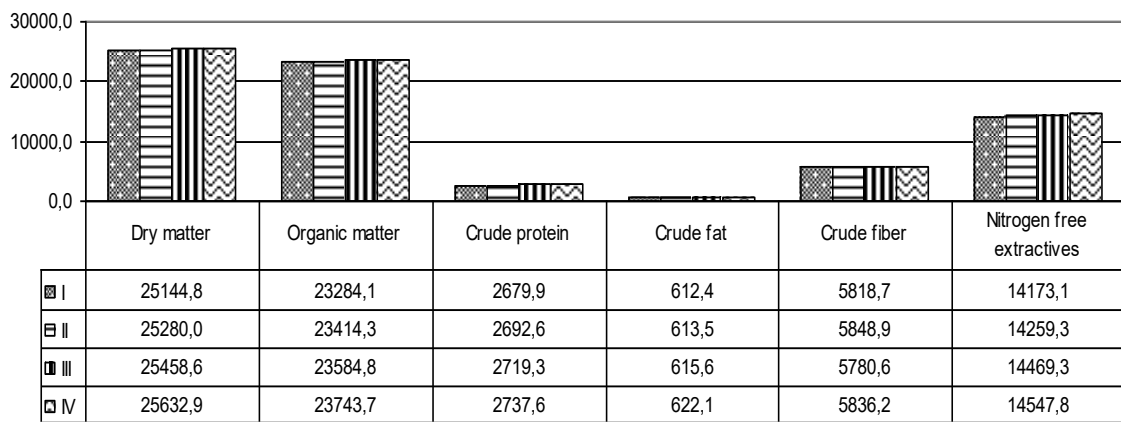


Figure 1: Nutrients taken in by test animals, g (average per 1 animal per day).

For instance, consumption of dry matter was greater by 135,2-488,1 g (0,45-1,94%), of organic matter – by 130,2-459,6 g (0,56-1,97%) of crude protein – by 12,7-57,7 g (0,47-2,15%); of crude fat – by 1,1-9,7 g (0,18-1,58%), nitrogen-free extractives (BEV) – by 86,2-374,7 g (0,61-2,64%) in cows of the test groups than in the animals of the control group.

A similar tendency was found in digested nutrients. Their mass is determined by the difference between substances fed to cows and substances eliminated from the body with feces (Figure 2).

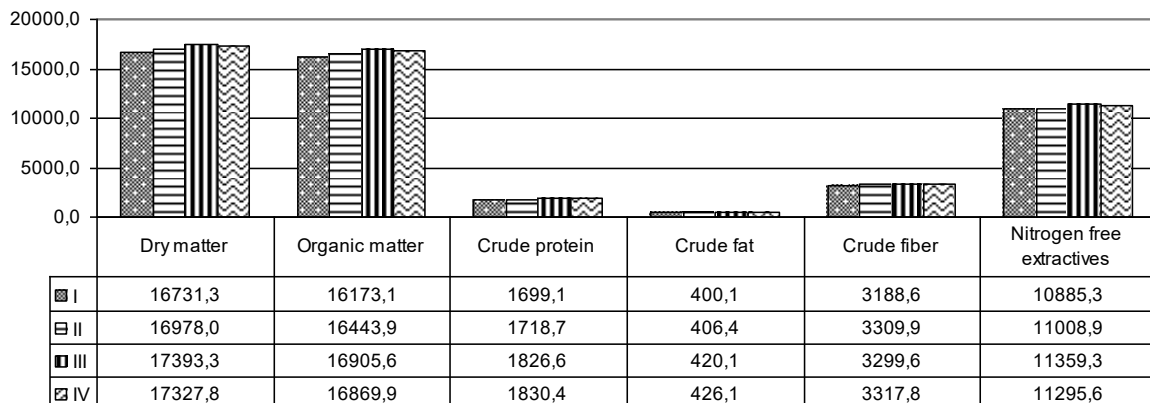


Figure 2: Nutrients digested by test animals per day, g (average per 1 animal).

Cows of all test groups revealed higher indices in digestibility of dry matter by 246,7-662,0 g (1,47-3,96%); of organic matter by 270,8-732,5 g (1,67-4,53%); of crude protein by 19,6-131,3 g (1,15-7,72%); of raw fat by 6.3-26.0 g (1,57-6,50%); of crude fiber by 121,3-129,2 g (3,80-4,05%) and of nitrogen-free extractives by 123,6-474,0 g (1,14-4,35%) than the control group animals.

Data of the physiological experiment indicate unequal consumption and digestibility of nutrients which affected the digestibility ratings (Figure 3).

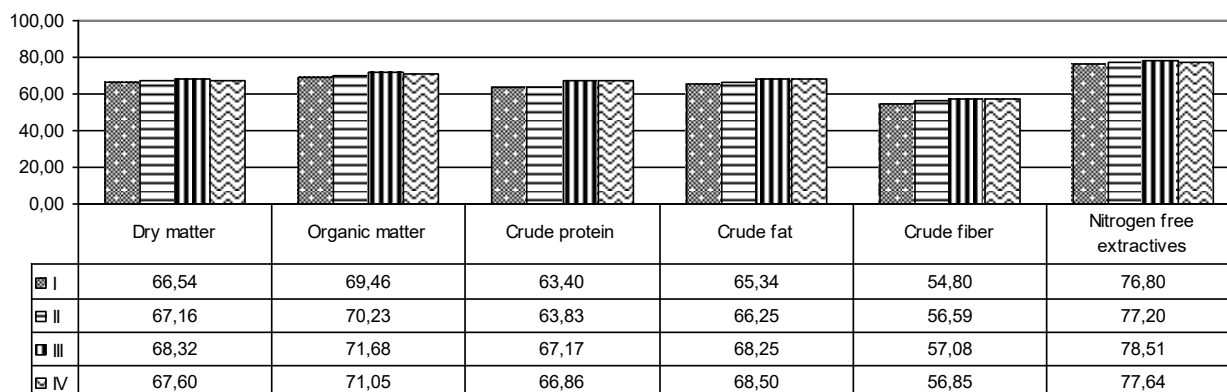


Figure 3: Dietary nutrient digestibility ratings, %.

It was found that cows when fed the diet with the energy supplement Felucen had the highest nutrient digestibility rating. For instance, cows of the 2nd group had higher digestibility ratings of dry matter by 0,62%, of organic matter by 0,77%; of crude protein by 0,91%; of raw fat by 0,91%; of raw fiber by 1,79%; of nitrogen-free extractives by 0,40% than the control group cows. Animals of the 3rd group showed the difference in the same ratings by 1,78%; 2,22%; 3,77%; 2,91%; 2,28%; 1,71% and animals of the 4th group – by 1,06%; 1,59%; 3,46%; 3,16%; 2,05% and 0,84%, respectively.

The obtained data indicate a high level of oxidation-reduction processes resulting from balanced mineral and vitamin diet in cows of the test groups compared to the control group cows. Furthermore, the greatest nutrient digestibility ratings were observed in the group of cows fed the supplement at a dose of 300 g per animal per day.

Nutrients that enter the body of animals with feed are known to build body tissues, produce milk as well as serve as a source of energy. The energy balance is the basis for evaluating changes taking place in the body of cows.

Positive effect on energy exchange in the body was marked in cows of Black motley breed fed the diet combined with different doses of the tested energy supplement (Table 1).

As one can see, cows of the test groups consumed the greatest amount of the total nutrient energy. The value of the studied index was by 2,4-8,5 MJ (0,22-1,88%) higher in the test group cows than in the animals of the control group. In the test groups the 4th group was the leader in consuming energy, exceeding the 2nd and the 3rd group by 6,1 MJ (1,34%) and 3,3 MJ (0,72%), respectively.

Cows of the test groups demonstrated top indices in digestible energy. This index was higher by 5,8 MJ (1,97%) greater in animals of the 2nd group, by 18,5 MJ (6,29%) in animals of the 3rd group and by 18,0 MJ (6,12%) in cows of the 4th group than in the control group animals.

Table 1: Consumption and digestibility of nutrient energy in cows, MJ.

Index	Group			
	I	II	III	IV
Energy taken in:				
protein	64,2	64,5	65,1	65,6
fat	24,4	24,4	24,4	24,7
fiber	116,7	117,3	115,9	117,0
nitrogen free extractives	247,5	249,0	252,6	254,0
Total	452,8	455,2	458,0	461,3
Energy passed out with feces:				
protein	23,7	22,8	20,8	21,2
fat	11,0	10,8	10,1	10,2
fiber	58,4	57,5	54,8	55,6
nitrogen free extractives	65,4	64,0	59,5	62,0
Total	158,5	155,1	145,2	149,0
Digested	294,3	300,1	312,8	312,3

The research analysis indicates that the energy supplement «Felucen» results in an increased digestibility ratings of nutrient energy in the diet (Figure 4).

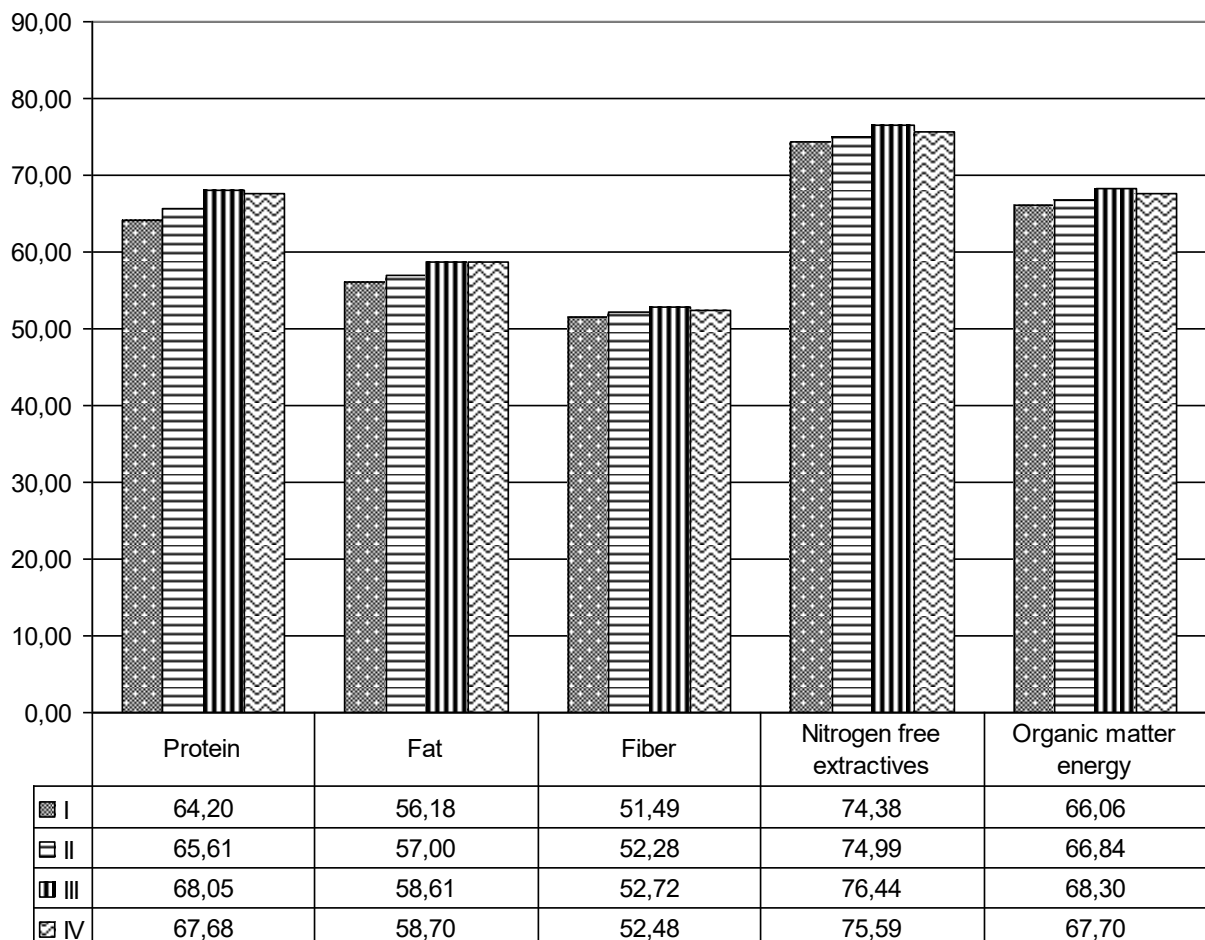


Figure 4: Dietary nutrient energy digestibility, %.

Digestibility of protein energy was by 1,41% greater (64,20%) in cows of the control group than in the 2nd group; by 3,85% than in the 3rd group and by 3,48% than in the 4th group. Similarly, energy digestibility of fat, fiber, nitrogen-free extractives and organic matter increased. For instance, the value of fat digestibility rose by 0,82%; 1,43% and 2,52% in cows of the 2nd, 3rd and 4th groups; the value of fiber digestibility rose by 0,79%; 1,23% and 0,99%; the value of nitrogen-free extractives digestibility increased by 0,61%; 2,06% and 1,21%; the value of organic matter digestibility increased by 0,78%; 2,24% and 1,64%, respectively.

Animals of the 3rd test group demonstrated the best digestibility of nutrient energy. They exceeded the animals of the 2nd and 3rd groups in digestibility of protein energy by 2,44% and 0,37%; of fiber energy by 0,44% and 0,24%; of nitrogen-free extractives energy by 1,50% and 0,85% and of organic matter energy by 1,46% and 0,60%, respectively.

Differences in the nutrient feed intake affected all indices of energy consumption (Table 2).

Table 2: Consumption and dietary energy use features, MJ ($\bar{X} \pm S_{\bar{x}}$).

Index	Group			
	I	II	III	IV
Energy: gross energy	452,8±2,13	455,2±1,84	458,0±1,64	461,3±1,46
Digestible energy	294,3±2,19	300,1±1,96	312,8±1,63	312,3±1,38
Urine and methane	47,7±0,41	45,5±0,35	54,9±0,42	54,8±0,34
Exchange energy	246,6±1,39	254,6±1,51	257,9±1,15	257,5±1,22
incl. for life maintenance	53,5±0,42	53,2±0,41	53,1±0,35	53,3±0,44
Energy for over maintenance	193,1±1,06	201,4±0,74	204,8±1,06	204,2±1,18
Energy for milk production:	126,8±0,82	130,5±0,92	132,2±1,02	132,7±0,97
incl. daily milk yield energy	88,1±0,21	91,5±0,26	94,1±0,32	93,0±0,29
Animal growth energy	66,3±0,24	70,9±0,31	72,6±0,18	71,5±0,15
Exchange energy concentrated per 1 kg of dry matter	9,81±0,11	10,07±0,21	10,13±0,14	10,0±0,17
Rating, %:				
Energy exchange rate	54,46	55,93	56,31	55,92
Energy exchange- based animal growth rate	26,88	27,85	28,15	27,77

Animals fed the diet with the tested supplement demonstrated the greatest indices of gross energy. The value of gross energy increased by 2,4-8,5 MJ (0,53-1,88%). A similar tendency was pointed out in digestible energy. The digestible energy value stood at 294,3 MJ in cows of the control group, which was by 5,8 MJ (1,97%); 18,5 MJ (6,29%) and 18,0 MJ (6,12%) lower than in animals of the 2nd, 3rd and 4th test groups.

The established intergroup distribution indicates that the energy of diets and feed nutrients is spent on physiological processes in the animal body and milk production.

The value of exchange energy for life maintenance was somewhat lower in cows of the experimental groups than in the control group cows. The difference was 0,2-0,4 MJ (0,38-0,75%). Energy values for over-maintenance, milk synthesis and growth demonstrated an opposite tendency. Energy value for over maintenance was by 8,3 MJ (4,30%) greater in cows of the 2nd group, by 11,7 MJ (6,06%) in cows of the 3rd group, by 11,1 MJ (5,75%) in cows of the 4th group than in cows of the control group. Energy value for milk synthesis was by 3,7 MJ (2,92%) greater in cows of the 2nd group, by 5,4 MJ (4,26%) in cows of the 3rd group, and by 5,9 MJ (4,65%) in cows of the 4th group than in cows of the control group. Energy value for animal growth was higher by 4,6 MJ (6,94%) in the 2nd group, by 6,3 MJ (9,50%) in the 3rd group animals and by 5,2 MJ (7,84%) in the 4th group cows than in the control group animals.

The energy exchange rate reached 54,46% in animals of the control group which was by 1,46-1,85% lower than in cows fed the diet with the Felucen energy supplement, the exchange energy based animal

growth rate was 26,88% in animals of the control group, which was lower by 0,89-1,27% than in cows fed the diet with the Felucen energy supplement.

CONCLUSIONS

The energy supplement «Felucen» in the diet of lactating cows proves efficient in providing better use of feed energy to produce milk. The best effect is achieved when the supplement is added to the diet at a dose of 300 and 350 g per animal per day.

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