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INFLUENCE OF DAIRY COWS FEEDING ON THE CONTENT OF UREA IN MILK
СҮТТІ СИЫРЛАРДЫ АЗЫҚТАНДЫРУДЫҢ СҮТ ҚҰРАМЫНДАҒЫ МОЧЕВИНА МӨЛШЕРІНЕ ӘСЕРІ
ВЛИЯНИЕ КОРМЛЕНИЯ МОЛОЧНЫХ КОРОВ НА СОДЕРЖАНИЕ МОЧЕВИНЫ В МОЛОКЕ

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Abstract

The article shows the results of the feedinglevel and the health status of dairy cows in a commercial dairy farm on the content of the main components in milk (fat, protein, urea). The research goal was to investigate the milk productivity and milk composition of cows, to analyze the level of feeding and the content of basic nutrients in the diet of the farm. The object of the research was Holstein cows in the amount of 483 heads of Aina Dairy Farm LLP. The studies were carried out according to generally accepted zootechnical methods using modern equipment for conducting analyzes and interstate and state standards. An increase in the norm of the content of crude protein in the dairy cows' ration to 17.4% of dry mattergot to an increase in the content of urea level by 2.3% in comparison with the norm in the milk of cows of the first group, while the content of urea level in the milk of the second group remained within the limits valid values.

Keywords. Milk productivity, fat, protein, urea, feed, chemical composition, nutritional value**.**

Introduction

In the Republic ofKazakhstan there is a large number of dairy cattle with high genetic potential for milk production. However, its being carried out with the observance of the basic techniques of a dairy herd feeding, keeping and breeding, one of which is the Dairy Herd Improvement program implementation that means regular control milking with the collection of individual milk samples from each dairy cow and subsequent analysis of the content of fat, protein, urea and other components [1,2,3]. Subsequently, according to the results of the chemical analysis of milk, reports and recommendations on feeding and keeping livestock are drawn up. Thus, the analysis of control milking data and milk composition is important not only for breeding work, but also for making daily managingformetabolism control of animals, adjust rations for protein and energy content, and animal health. The fact that milk composition and quality

reflect the influence of many internal as well as external factors, the most important of which is feeding dairy cows, has been used in the practice of dairy herd improvement programs in Western Europe and North America since the last century, and currently, the implementation can significantly reduce the risks of animal health disorders (acidosis, ketosis, mastitis, vitamin deficiency, etc.). At present, ICAR - the International Committee for Animal Registration [3] acts as the regulator for selection and breeding work and programs for improving the dairy and combined cattle breeds.

As you know, the use of high-yielding animals for milk production is economically more profitable than low-yielding ones. But keeping highly productive animals implies increased demands on the management of feeding and keeping. The rationing of feeding diets should be implemented considering the level of productivity of animals and control of the animalscondition. At the same time, the rations' completeness control can be ensured by zootechnical and veterinary-biochemical methods, the main of which are: analysis of the feed quality, balance of diets, the state of metabolism; study of the body's responses, biochemical parameters of blood, urine, milk, etc. The most accessible and regular of them is the milk composition analysis, since samples can be taken on a regular basis from each animal during milking control. It is well known that the milkfat content decreases with a deficit in the diet of energy, fiber, protein, easily fermentable carbohydrates. And the analysis of urea level in milk, as shown by the experience of implementing dairy herd improvement programs, is an effective tool for assessing the balance of the diet in terms of protein and energy. Thus, the control of indicators of the milk composition for high-yielding cows allows feeding rations optimization [4,5].

The research results presented in this work were carried out within the framework of grant financing of the program of the Ministry of Education and Science of the Republic of Kazakhstan under the budget program 217 "Development of Science", subprogram 102 "Grant financing of scientific research", according to the priority "Sustainable development of the agro-industrial complex and safety of agricultural products" under the project AR08956241 "Indicators of the usefulness of rations for feeding dairy cows."

The goal of the research was to observe the level of milk production, the composition of milk of cows, feeding and the content of basic nutrients in the diets of the basic farm.

In the course of the research, the set goal was achieved, and the results are presented in this article.

Materials andmethods of research

The research experiment has been implemented in Aina Dairy Farm LLP, a dairy farm in Akmola region, where the average annual milk yield per cow is more than 7500 kg of milk. The cows are kept loosely. The objects for research are the milking Holstein cows with the data on milk performance. The goal of the research was the effect of crude protein level in the rations of high yielding cows on the level of urea content in milk. In this

terms, the work was to analyze the rations of feeding dairy cows, analyze the results of control milking and data on the fatcontent , protein and urea levels in milk. Milking cows (up to 100 days after calving) were selected for research. First group received the ration with the higher rapeseed meal content (+0,5 kg) that brought to the higher content of crude protein in the ration up to 17,4 % DM. Second group received the ration with the crude protein content having 16% DM in accordance with the NRC-2001 norms of feeding.

The nutritional requirements for dairy cattle (hereinafter NRC-2001) were assessed under the editorship of the Dairy Cattle Nutrition Subcommittee of the Animal Nutrition Committee of the US Board of Agriculture and National Resources. These standards use the latest achievements of scientists from the United States of America in feeding highly productive lactating and dry cows, young cattle. And as international practice shows, feeding livestock in accordance with these standards has now reached an average of about 8500 kg per cow in the USA, and in some large farms (from 800 to 3000 cows) the average milk yield per cow is more than 10,000 kg.

Sampling of feed was done in accordance with the standards of GOST 27262-87. Sample preparation for analysis was doneusing the standards of GOST ISO 6498-2014. Testing of the chemical composition of feed were carried out using an NIRSDS-2500 infrared analyzer manufactured by FOSS Analytical (Denmark). Indicators of the content of FNE, Exchange energy and feed units were carried out by the calculation method. Determination of dry matter was carried out by a two-stage determination method according to GOST 31640-2012. Stern. Methods for determining the dry matter content.

Testing of the chemical composition of feed were implemented using an NIRSDS-2500 infrared analyzer manufactured by FOSS Analytical (Denmark). Indicators of the content of NFE, exchange energy and feed units were carried out by calculation method.

The content of nitrogen-free extractives was calculated by the formula:

$$NFE = 1000 – (CP + CF + CFb + RA), \text{ где}$$

NFE - the content of nitrogen-free extractive substances, g per 1 kg;

CP is for Crude Protein, grams in 1 kilogram of DM;

CF is for Crude Fat, grams in 1 kilogram of DM;

CFbis for Crude Fiber, grams in 1 kilogram of DM;

RA is for Raw Ash, grams in 1 kilogram of DM.

The calculation of the metabolizable energy content in roughage (hay, hay cutting, haylage, straw, silage up to 50% moisture, and other roughage) was determined by the formula developed by the All-Union Scientific Research Institute of Animal Husbandry (VIZh):

$$ME_{cattle} = 0,0212 \cdot CP + 0,020486 \cdot CF + 0,00159 \cdot CFb + 0,0105 \cdot NFE, \text{ where}$$

CP is for Crude Protein, grams in 1 kilogram of DM;

CF is for Crude Fat, grams in 1 kilogram of DM;

CFb is for Crude Fiber, grams in 1 kilogram of DM;

NFE - the content of nitrogen-free extractive substances, grams in 1 kilogram.

The calculation of the content of metabolizable energy in succulent feed (root crops, high moisture silage) was determined by the formula:

$$ME_{cattle} = 0,0151 \cdot CP + 0,01378 \cdot CF + 0,00328 \cdot CFb + 0,01265 \cdot NFE$$

The calculation of the content of metabolizable energy in concentrates (grain of cereals and legumes, turf, flour) was defined by the formula:

$$ME_{cattle} = 0,02085 \cdot CP + 0,01715 \cdot CF - 0,001865 \cdot CFb + 0,01226 \cdot NFE$$

The counting of the content of metabolizable energy in the technical waste of the processing industry (oilcakes, meal, grains, grains, dry root crops, bran, etc.) was determined according to GOST R 53900-2010 according to the formula:

$$ME_{cattle} = 0,02157 \cdot CP + 0,01667 \cdot CF - 0,003772 \cdot CFb + 0,01074 \cdot NFE$$

Milk sampling was carried out in accordance with the requirements of ST RK ISO 707-2011 (ISO 707: 2008, IDT) Milk and dairy products. Sampling Guide.

The search of milk chemical composition has been implemented in the laboratory. Testing center of "Kazakh Research Institute of Livestock and Forage Production" LLP on the CombiFossFT + milk analyzer manufactured by FOSSAnalytical (Denmark) in accordance with GOST 32255-2013. This milk analyzer allows you to obtain more than 20 indicators of the composition of which the main ones are: dry matter, dry skimmed milk residue, milk fat, milk protein, lactose, ketone bodies (acetone, aceto-acetic acid, beta-hydroxybutyric acid), urea, etc.

Results

The number of cows inAina Dairy Farm LLP is represented by the Holstein breed of cattle. Mature cows showed average daily milk yield28 kg of milk, with a3.8% fat content in milk. The farm uses two rations for feeding dairy cows with a content of crude protein level more than 17% DM, and withcrude protein level less than 17% DM (table 1).

The ration includes the following forage: corn silage, rapeseed cake, haylage of cereal and leguminous grasses, barley grain. To keep at the same level high productivity and prevent metabolic disorders, protein-vitamin-mineral supplements are added to the diets of cows. According to modern recommendations, the concentration of metabolizable energy (CME) in the dry matter of the ration of fresh cows with a milk yield more than 30 kg per day should be at least 10.9 MJ / kg, and crude protein - 16.5-17.0%. In the experiment, the rations of the cows were mainly balanced in terms of nutrients, but the crude protein

content differed - 17.4% DM and 16.0% DM.

Table 1 - Rations for feeding dairy cows with different levels of crude protein

Nameoffeed	Daily provision, kg / head / day		+/– deviation
	Group 1 (CP> 17%DM)	Group 2 (CP<17%DM)	
Cornsilage	17	17	0
Grain-beanhaylage	21	21	0
Barleygrain	5,4	3,4	+ 2,0 kg
Rapeseedcake	2	1,5	+ 0,5 kg
Salt	0,1	0,1	0
Chalk	0,1	0,1	0
Dietcomposition			
Metabolizable energy, MJ	180,3	154,9	+ 25,4 MJ
Drymatter, kg	17,8	15,47	+ 2,33 kg
Crudeprotein,% DM	17,4	16,0	+ 1,0%
NDK,% DM	24,64	27,89	– 3,25%
Starch,% DM	22,59	20,08	+ 2,51%
Sugar,% DM	2,66	2,48	+ 0,18%
Crudefat,% DM	3,85	3,83	+ 0,02%
Calcium,% DM	0,53	0,59	– 0,06%
Phosphorus,% DM	0,40	0,39	+ 0,01%
Potassium,% DM	1,41	1,53	– 0,12%
Sulfur,% DM	0,17	0,17	0
Sodium,% DM	0,24	0,28	– 0,04

The rumen should function properly and should maintain normal amount of fat in milk, that's why the ration must contain sufficient fiber with a suitable physical structure. Concentrate increasing the in the ration lowers rumen pH. Lack of fiber leads to a less forming of volatile fatty acids, in particular acetic acid, which is necessary for the milk fat synthesis. The presence of bulky feed leads to a relatively higher rumen pH and high cellulolytic activity and there is a close relationship between dietary crude fiber content, pH, and the ratio of acetic acid to propionic acid [1.4]. Fiber in the diet determines the chewing ability formation, as a result, the saliva formation that has the role of a buffer substance. Fiber also affects the rate at which stomach contents pass through the digestive tract. The turnover of the plane trap depends on it. If the fiber amount in the ration is increased, the gastrointestinal tract slows down, feed intake decreases, and, as a result, productivity decreases as well. Proteins and carbohydrates are the main

nutrients support growth of rumen microorganisms [2,5].

In recent years, the method for the determination of neutral (NDC) and acid-detergent (ADC) cellulose has become widespread. Using these indicators, the relative feed value and the amount of substances supplied with the feed are determined. According to the content of NDC, the potential eatability of the ration (rumen filling) by animals is analyzed by the rumen capacity. The recommended content of NDC in the diet is not less than 28%. The digestibility of NDC in the rumen and, in general, in the digestive tract of cows is also low, therefore, an increase in the NDCconcentration in the ration is accompanied by a concentrationdecrease of metabolic energy in it [5].

The results of the milk analysis by the content of fat, protein and urea obtained from cows with different levels of crude protein in the observed rations are presented in Table 2. that the urea level content in the milk of the first group is above the upper limit of the norm - 32.3 ± 0.2 mg /%, which may indicate an excess of protein in the diet.

Table 2 - The content of protein and urea in the milk of cows Aina Dairy farm LLP

Indicator	Milk Content		Ratio fat / protein	Urea, mg /%
	Fat, %	Protein, %		
Norm	3,1-5,0	3,2–3,6	1,1-1,5	15,0–30,0
Group 1	3,75 ± 0,03	3,5 ± 0,03	1,07	32,3 ± 0,2
Group 2	3,82 ± 0,04	3,35 ± 0,02	1,14	27,7 ± 0,25

It can be seen from the results in Table 2, the crude protein increase in the ration of dairy cows to 17.4% DM led to an increase in the urea content by 2.3% in comparison with the norm in the milk of cows of the first group, while the content of urea in milk The 2nd group remained within the acceptable values. Thus, the results of our study confirm the early studies on the possibility of using the urea indicator as an indicator of the availability of diets for raw protein.

Discussion of results and conclusion

In dairy farming, a clear system of monitoring the health of animals and the completeness of feeding rations is needed, based on regular analysis of the quality of feed, biochemical parameters of blood, urine and milk, etc. Milk urea in this respect provides a reliable and reliable guideline for rationing rations in terms of crude protein content and in rations.

Researchers found out that the protein content in milk may show themetabolic energy consumption level by lactating cows, and in this regard, it was proposed to use it as an indicator of the supply of energy to diets [6,7]. It was revealed that the protein content had a linear dependence on the level of energy supply, regardless of the stage of lactation.

In addition to the need for constant monitoring of milk urea and milk protein, many studies show the need for constant monitoring of the level of ketone bodies in milk, as the

main indicator of ketosis in the animal's body [8,9].

The analysis of individual milk samples taken from the dairy herd of Aina Dairy Farm LLP shows that the content of the main components of milk is within the physiological norm. However, ranking the flock by fat / protein ratio tends to bias this ratio towards less than 1.1: 1, which often occurs with diets rich in energy and poor structure (concentrate feeding). A fat / protein ratio of less than 1 may indicate a threat of rumen acidosis (if the value is low). The risks of acidosis are also confirmed by the data in Table 5 - the urea content in milk is above the threshold value defined at 30 mg / 100 ml, and is caused by the high content of crude protein in the ration of dairy cows.

The dairy herd inAina Dairy Farm LLP, shows a generally accepted observation: between the milk yield level and the content of protein and fat in milk, there is a weak negative relationship at the level of - 0.1, and there is a slight positive relationship between fat and milk content.

There is practically no connection between the urea content and the milk yield (- 0.002), which gives reason to believe that the supply of raw protein and metabolic energy in the diet is more influenced by the content of urea in milk.

Similar studies were obtained by Papusha N.V. [10] carried out on black-and-white cows inViktorovskoye LLP, Kostanay region, to study urea in milk as an indicator of the usefulness of feeding cows. The research results showed that 44.1% of cows in the studied herd are unproductively using feed protein, protein conversion is ineffective, which leads to overconsumption of concentrated feed, a decrease in the level of urea in milk (below 15 mg/%).

Thus, for the results of implemented researches, the following conclusions may be done:

1 The analysis of individual milk samples taken from the dairy herd of Aina Dairy Farm LLP shows that the main milk components content is within the physiological norm. However, cows ranking by fat / protein ratio tends to bias this ratio towards less than 1.1: 1, which often occurs with diets rich in energy and poor structure (concentrate feeding). A fat / protein ratio of less than 1 may indicate a threat of rumen acidosis (if the value is low).

2 The study of the rations for feeding dairy cows of Aina Dairy Farm LLP showed that the concentrate-silage-haylage type of feeding is used. The diet basically meets all the nutritional and energy needs of the animals.

3 An increase in the norm of the content of crude protein in the dairy cowsration to 17.4% DM led to a higher level in the content of urea by 2.3% in comparison with the norm in the milk of cows of the first group, while the content of urea in the milk of the second group remained in limits of acceptable values. Thus, the results of our study confirm the early studies carried out on the possibility of using the urea indicator as an indicator of the provision of diets for raw protein.

4 The use of milk indicators as indicators of the completeness of feeding is quite justified, since already at the initial stage of research, the influence of the level of crude protein

on the urea content in milk was established, as well as a shift in the fat / protein ratio of less than 1.1: 1 with a high proportion of concentrated feed in diet7

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СҮТТІ СИЫРЛАРДЫ АЗЫҚТАНДЫРУДЫҢ СҮТ ҚҰРАМЫНДАҒЫ МОЧЕВИНА МӨЛШЕРІНЕ ӘСЕРІ

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Түйін

Бұл мақалада сүт құрамындағы негізгі компоненттердің (май, ақуыз, несепнәр) құрамы бойынша тауарлы сүт фермасындағы сауын сиырлардың азықтандыру деңгейі мен денсаулық жағдайының нәтижелері келтірілген. Зерттеудің мақсаты - сиыр сүт өнімділігі мен сүтінің құрамын зерттеу, шаруашылық рационындағы азықтандыру деңгейі мен негізгі қоректік заттардың құрамын талдау болды. Зерттеу объектісі «Айна сүт фермасы» ЖШС-нің 483 бас мөлшеріндегі голштин сиырлары болды. Зерттеулер жалпы қабылданған зоотехникалық әдістер бойынша жүргізілді және мемлекетаралық және мемлекеттік стандарттар бойынша талдау жүргізуге арналған заманауи қондырғылар қолданылды. Сүтті сиырлардың рационында шикі ақуыздың нормасының 17,4% ҚЗ дейін жоғарылауы бірінші топтағы сиырлардың сүтіндегі нормамен салыстырғанда мочевина мөлшерінің 2,3% -ға ұлғаюына әкелді, ал екінші топтағы сүттегі мочевина мөлшері қолданыстағы шектерде қалды.

Кілт сөздер. Сүт өнімділігі, май, ақуыз, несепнәр, азық, химиялық құрамы, қоректілігі.

ВЛИЯНИЕ КОРМЛЕНИЯ МОЛОЧНЫХ КОРОВ НА СОДЕРЖАНИЕ МОЧЕВИНЫ В МОЛОКЕ

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Аннотация

В данной статье приведены результаты уровня кормления и состояния здоровья дойных коров в товарном молочном хозяйстве по содержанию основных компонентов в молоке (жир, белок, мочевина). Целью исследований явилось изучение молочной продуктивности и состава молока коров, анализ

уровня кормления и содержания основных питательных веществ в рационе хозяйства. Объектом исследований были коровы голштинской породы в количестве 483 головы ТОО «Молочная ферма «Айна». Исследования проводились по общепринятым зоотехническим методикам с применением современного оборудования для проведения анализов и межгосударственных и государственных стандартов.Повышение нормы содержания сырого протеина в рационах дойных коров до 17,4% СВ привело к увеличению содержания мочевины на 2,3% в сравнении с нормой в молоке коров первой группы, в то время как содержание мочевины в молоке 2-ой группы осталось в пределах допустимых значений.

Ключевые слова. Молочная продуктивность, жир, белок, мочевина, корм, химический состав, питательность.