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ORIGINAL ARTICLE

Influence of the level feeding high-productive cows on obtaining biosafety products

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It was showed that the investigated factors “the feeding level” and “the level of concentrates in the ration” as independent, affect the protein content in milk at the level of ή^2=3.7%, 2.3%, and the yield of milk protein-ή^2=12.3%; 10.2% accordingly. These factors, also, have almost the same influence on studied indices not only as a separate factor, but also in combination with other factors. The other side, if we consider these factors as independent, they have an influence on the protein content in milk 3 times (cattle feeding) and 4 times (the level of concentrates) less than on the yield of milk protein. During the analysis of the inflence of the feeding level together with other studied genetic and non-genetic factors the most influential pairs of factors in both variants were “father-cattle feeding” pair. Also, the feeding level together with genetic factors like “breed combination” and “mother’s productivity” had a large degree of influence. Thus, factor “the level of concentrates in the ration” conjointly with the factor “father” affects protein content in 1.2% more than “the feeding level” factor. A similar tendency is observed at factors “breed combination” and “mother’s productivity”, where the difference makes 0.7% and 0.1% accordingly. Regarding the yield of milk protein, according to the results of the studies, factors “the feeding level” and “the level of concentrates in the ration” independently affect the index mentioned above 3-4 times more than in pairs with other genetic and feed factors with a high degree of defined confidence. The pair of “calving month-the level of concentrates in the ration” turned out to be doubtful and with a very small level of influence. All the other pairs of factors have a definite influence on both the protein content and its quantity.

Keywords: Protein content; yield of milk protein; adenqute nutrition; level of concentrates in the ration; milk; breeding cattle; degree of factors impact

Introduction

The main an area of focus of cattle-breeding is to increase the productivity of animals, including cows.

It depends on the higher milk yields due to the efficient feeding and keeping of the breeding cattle as well as on improving the breeding resources based on a number of features, primarily on the milk content.

The higher the protein and fat content in milk, the greater the variety of dairy products from its processing. Thus, increasing the protein content in milk should be one of the goals (Ernst et al., 2008; Paliy, 2016). The protein content and milk protein yield also depend on both genetic and non-genetic factors (Petrukhina, 2014; Zaitsev et al., 2015).

Some of these can not be kept under control while others can be managed by crop breeders and experts in technology. Cattle feeding is one of the major non-genetic factors affecting the protein content. Adequate nutrition is another important factor influencing the milk composition including the fat, protein and vitamin ingredients (Esaulova, 2017; Samokhina et al., 2018).

Balanced and adequate feeding based on the sufficient amount ofsugars, protein, microelements and vitamins enables to increase the milk protein content to by 0.3-0.4% or even more (Latysheva et al., 2015).

The milk content and its nutritional level remain, however, within a genetically-dependent range of values considering that the milk content is impacted mostly by the cattle genetic features, provided the cattle feeding and keeping are adequate (Nanka et al., 2018).

Lower levels of protein in milk under the daily milk yield of 35-49 kg are caused by insufficient energy levels in the food rations, which is a typical situation at the beginning of the lactation period (Britvina et al., 2017; Kharko et al., 2017; Churilova et al., 2015). Inadequate dairy cow feeding usually results in the lower values of certain nutritional ingredients including fat, protein and vitamins. If the cows’ forage contains lower than necessary levels of digest protein (under 95-100 g per 1 feeding unit), the milk protein level also decreases. Higher amounts of protein in the forage cause a higher content of protein in milk; however, excessive protein is bad for cattle and is not economically efficient (Grigorieva et al., 2017). A considerably share of

forage protein is wasted or may even cause problems with cattle's health when high levels of protein in forage are combined low energy levels. Onaverage, 30% or less of forage protein gets to the digestive system unchanged. Bacterial protein synthesisrequires not only NH3 and energy but also the availability of minerals, particularly Ca, P, Mg, and others(Fedorova et al., 2014; Martynova et al., 2014; Zybets et al., 2000; Sobolev et al., 2010).
Modification ofthe content ofnutritional components and forage composition can influence the dairy protein amount. The impact of the protein contained in forage on milk production depends on the following features:

- metabolic energy concentration in forage;
- crude protein level;
- rate of its disintegration in the rumen.

The last of the characteristics mentioned is the most important as it supports the effective utilization of nitrogen in the body, due to the rumen microflora's support of the amino acid and protein synthesis (Milostiviy et al., 2017; Gracious et al., 2017). A direct correlation between the dairy protein levels, adequate feeding and the metabolic processes in the rumen has been observed. The mammary gland acts as the major consumer of glucose, which is derived in cows' bodies from the propionic acid, with its higher levels in the rumen improves the utilization of nitrogen and increases the dairy milk content. Rumen bacteria activity depends on the microelement content, and adding them maintains microbiological processes in the rumen, which ensure the formation of the best possible number of milk ingredient precursors and thus increase the dairy protein levels. Thus, selenium is added as a microelement to the bovine cattle-feeding ration, with the aim of ensuring a better digestion of the nutrients in the rumen. The reduction of selenium-containing compounds occurs in the rumen involving microflora enzymes, which makes this element necessary for the process (Yuniper et al., 2006). Adding selenium to the mixed fodder can result in higher milk quality.
The milk producing ability nowadaysis estimated focusing on the protein dairy content and the yield of milk protein. Therefore, the research of how protein levels depend on the major genetic and non-genetic relevant factors, estimating the degree of these factors' impact, their relation and the potential of utilizing these relations is of considerable academic and pragmatic interest.

Material and methods

Used in the article is the Ukrainian black-and-white dairy breed of cows. The cost of poops per cow per year was maintained at 20, 40, 60 and 80 centners fodder units per year (c.f.u/year).
The ration and the level of concentrates were used as an influencing factor, and the protein content in milk and the yield of milk protein were used as the dependent factor.
The analysis was performed using the general linear model procedure (General Linear-GLM General Factorial) using computer standard statistical software package SPSS 16.0. For each fixed factor, standard indicators of the protein content in milk and the yield of milk protein were determined. As these indicators were used the number of lactations (n), arithmetic average ($\overline{X}$), arithmetic average error ($S_{\overline{X}}$), standard deviation (σ).
The degree of influence of the studied factors was also determined during their action, both independently and in conjunction with other determining factors, on the protein content and the yield of milk protein.
The obtained graphs, dependencies of protein content and milk protein yield on the studied factors were analyzed for adequacy, determination, accuracy and reliability with according the methodology by M.A. Plochinskiy (1970.)
The criterion for the accuracy of the description of real data by the regression equations was the coefficient of determination R^2, which made it possible to estimate part of the total dispersion of the protein content and the yield of milk protein, which can be described using these equations.
According to this criterion, out of 106 potential equations, we chose the ones that most adequately described the real dependence of the protein content and the yield of milk protein on the studied parameters (the level of feeding, the level of concentrates). With a confidence level of P less than 0.95, the data in the work were not used from the analysis.
The coefficient of determination denotes a numerical estimate of the dispersion of productive traits, which is due to the variance of the factor under study (the so-called "explained" variance) (Afifi et al., 1982).
The determination of the influence of several factors on the effective indicator was carried out using two-factor analysis of variance.

Results

The main factors, such as feeding conditions, keeping animals and increasing their genetic potential resources the growth of animal productivity and milk content in them (Martynova et al., 2014; Paliy et al., 2018). By improving these factors, the greatest result can be achieved.
In examiming from diagram directed (Figure 1) of dependency relation of the protein content on the feeding level it will be seen increasing of an expects indexs investigated. The description was subject to 3,7 % dynamics of the protein content given the high degree of reliability P=0,999 that it was detected by protein analysis while the standard error of the mean was SE=0.1638%.
And with a higher level of feeding (up to 80 centners. Feed units per year) the protein content in milk may be higher compared to a low feeding level (40 centners of food) by 0.11%. Regarding the yield of milk protein, 12.3% of the variability of the yield of milk protein (R^2=0.1228, P=0.999) was described, while the standard error of the average was SE=40.755 kg.

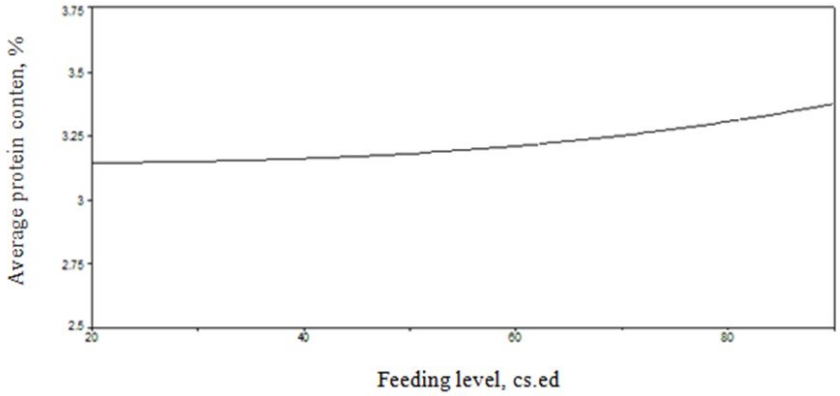

Figure 1. The dependence of the protein content and of the feeding level, c.f.u./year.

An important factor determining the composition and properties of milk, as well as its suitability for processing into dairy products, is the quantity, quality and ratio of individual feeds in the diet of animals (Gavrilenko et al., 2002; Levitskaya, 2017).
In all countries with developed dairy cattle there is a regulation in the feeding of dairy cows.
The regulation of the number of individual feeds in the diet of dairy cows is explained by the fact that with uniform feeding worsens the composition and technological properties of milk.
This question was studied earlier, as a result of which scientists concluded that the main factor affecting the protein content is the overall nutritional value of the rations (Knyazeva et al., 2008). The adequate nutrition of cows ensures of the production of milk of the composition, which is due to heredity (Gusarov et al., 2018; Tsjupko, 2014).
The total underfeeding or deficiency of at least one feeding element leads to a decrease in milk yield and protein content in it. For example, if in the diet of digestible protein cows is less than the norm (the norm is 95-100 g per 1 feed unit), the protein content in milk also decreases.
The content of digestible protein, the amount of protein in milk can be reduced to 2% with insufficient feeding, on the contrary, it increases slightly with increasing protein content in the diet (Alekseev et al., 2018). The main suppliers of energy for ruminants are carbohydrates represented in the feed in the form of crude fiber, starch and sugar, therefore it is necessary to include in the ration of the diet of cereals, pulp, dry, fodder syrup.
In this case, the level of sugar should be 10-12% in dry matter, and starch should be 1.5-2.0 times higher, that is, 15-25% (Milostiviy et al., 2017).
The optimal content of feed for the first third of lactation should be considered 35-40%, the second third-25-30%, and the last third -15-20% in dry matter. A large quality of feed (over 50% in dry matter, or 450-600 g per 1 kg of milk) does not contribute to an increase in milk yield and protein.
Increasing A-, D-, E-vitamin security of rations of highly productive cows by 35-50% (in relation to existing standards) allows increasing milk yield by 4.3-6.8%, and the amount of milk protein-by 4.8-7.7%.
The graph of the yield of milk protein on feeding level is presented in Figure 2.

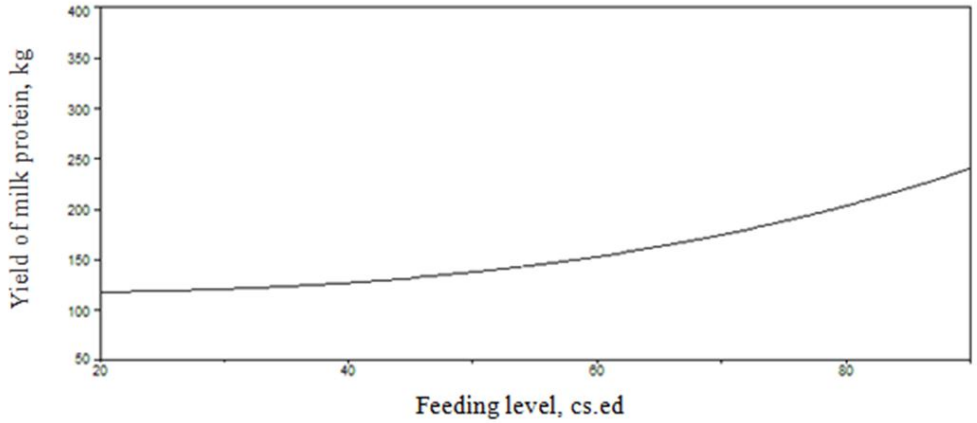

Figure 2. The dependence of the yield of milk protein and of the feeding level, c.f.u./year.

Analyzing the data of the graph (Figure 2), which shows the dependence of the yield of milk protein on the level of feeding, one can observe a similar dependence as in the protein content in milk.
When feeding cows at a level of from 40 to 50 c. food per year, the yield of milk protein can be expected only by 5.2-8.6 kg and with a higher level of feeding up to 80 kg. food the yield of milk protein may be higher compared to a low feeding level (40 centners of food) per 63.2 kg.
When studying the dependence of the protein content and milk protein yield on the level of feeding, the dependence of the studied parameters on the level of concentrates in the diet was also analyzed. It was established that the dynamics of the protein content in milk from the level of concentrates describes 2.3% with the standard error SE=0.163% and the degree of

reliability P>0.999.
The graph of protein content in the milk of cows, depending on the level of concentrates in the diet, is presented in Figure 3.

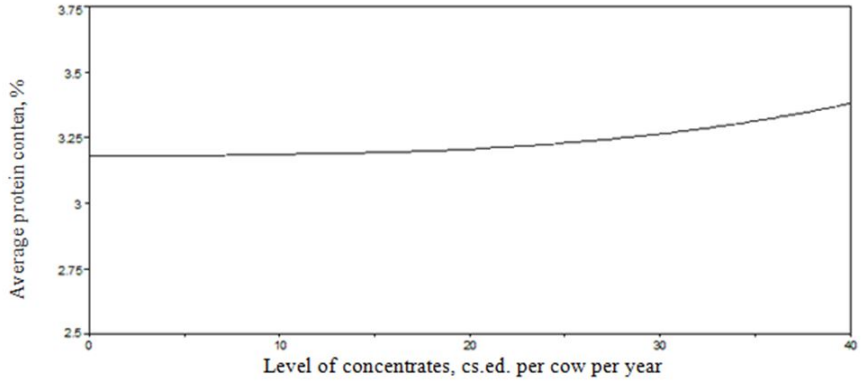

Figure 3. The influence of the level of concentrates in ration on of protein content in milk.

In analysis the above graph (Figure 3), the dependence of the protein content on the level of concentrates in the diet, it is clear that the higher the level of concentrates, the higher the protein content.
With an increase in the level of concentrates in the diet from 20 to 25 c. food per year we can expect an increase in protein in milk by 0.018%, and with an increase in the level of concentrates from 35-40 q. food per year-by 0.05%.
The dependence of the milk protein yield on the level of concentrates in the diet can be described by the equation y=125.56+1.868x. This equation describes 10.2% of the variability in the yield of milk protein (R2=0,1018, P>0,999). The standard error was SE=41.39 kg of milk protein.
Graphically, the dependence of the yield of milk protein on the level of feeding with concentrates is shown in Fig. 4..

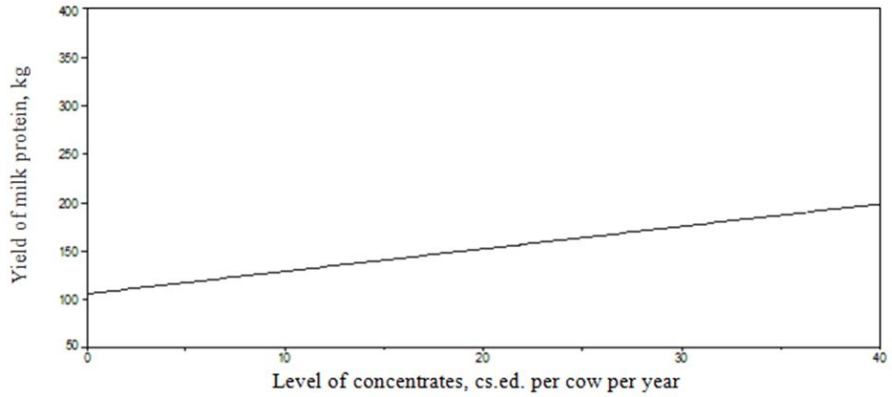

Figure 4. The influence of the level of concentrates on the yield on of milk protein.

As shown in the graph (Figure 4) of the dependence of the yield of milk protein on the level of concentrates in the diet, it was found that with an increase in the level of concentrates, the yield of milk protein increases evenly.
If there are concentrates in the ration at the level of 20-25 centners per unit of food per cow per year, the yield of milk protein can be expected to increase by 9.3 kg, and with an increase in concentrates in the ration to 40 centners. food the yield of milk protein per cow per year may increase by 27.9-37.2 kg compared with the level of concentrates in the diet of 20-25 kg food per cow per year.
It is well known that the level of feeding, including the level of concentrates, has a considerable influence on all the productive indicators of animals, including the protein content of cows.
Thus, the studied factor «feeding level» as an independent factor influences the protein content in milk at the level of $\acute{\eta}^2$=3.7%, and on the yield of milk protein $\acute{\eta}^2$=12.3%.
A series of two-factor analyzes were carried out on the combination influence of the indicators on the level of feeding, the level of concentrates and other factors studied to determine the degree of mixed influence of the level of feeding with other determining indicators on the protein content and the yield of milk protein (Tables 1 and 2).

Table 1. The combined effect of the factor "feeding level" with other factors.

Factors	**Protein content, %**		**Yield of milk protein, kg**	
	degree of factors impact, %	**reliability level**	**degree of factors impact, %**	**reliability level**
Feeding level	3.7	>0.999	12.3	>0.999
Father-feeding level	4.9	>0.999	3	>0.999
Breed combination-feeding level	3.5	>0.999	1.9	>0.999

Mother's productivity-feeding level	1.6	>0.999	0.1	>0.99
Breed-feeding level	0.7	>0.999	0.8	>0.999
Lactation number-feeding level	0.3	>0.999	0.1	>0.95
Month of calving-feeding level	0.2	>0.99	0.3	>0.999

Table 2. The combined effect of the factor "level of concentrates in the ration" with the studied genetic and non-genetic factors.

Factors	**Protein content, %**		**Yield of milk protein, kg**	
	degree of factors impact, %	**reliability level**	**degree of factors impact, %**	**reliability level**
level of concentrates in the ration	2.3	>0.999	10.2	>0.999
Father-level of concentrates in the diet	6.1	>0.999	3.7	>0.999
Breed combination-level of concentrates in the ration	4.2	>0.999	1.6	>0.999
Mother's productivity-level of concentrates in the ration	1.7	>0.999	0.1	>0.99
Calving number-level of concentrates in the ration	1	>0.999	0.2	>0.95
Breed-level of concentrates in the ration	0.4	>0.999	1	>0.999
Month of calving-level of concentrates in the ration	0.1	<0.95	0.3	>0.999

From the tables below you can see, these factors, also, have almost the same influence on studied indices not only as a separate factor, but also in combination with other factors. The other side, if we consider these factors as independent, they have an influence on the protein content in milk 3 times (cattle feeding) and 4 times (the level of concentrates) less than on the yield of milk protein. During the analysis of the inflence of the feeding level together with other studied genetic and non-genetic factors the most influential pairs of factors in both variants were "father-cattle feeding" pair. Also, the feeding level together with genetic factors like "breed combination" and "mother's productivity" had a large degree of influence. Thus, factor "the level of concentrates in the ration" conjointly with the factor "father" affects protein content in 1.2% more than "the feeding level" factor. A similar tendency is observed at factors "breed combination" and "mother's productivity", where the difference makes 0.7% and 0.1% accordingly.

Regarding the yield of milk protein, according to the results of the studies, factors "the feeding level" and "the level of concentrates in the ration" independently affect the index mentioned above 3-4 times more than in pairs with other genetic and feed factors with a high degree of defined confidence. The pair of "calving month-the level of concentrates in the ration" turned out to be doubtful and with a very small level of influence. All the other pairs of factors have a definite influence on both the protein content and its yield..

Conclusions

Therefore, the research of how protein levels depend on the major genetic and non-genetic relevant factors, estimating the degree of these factors' impact, their relation and the potential of utilizing these relations is of considerable academic and pragmatic interest.

As a result of this work, it was found that such factors as "feeding level" and "the level of concentrates in the diet" in the increase of protein content and milk protein yield play an important role.

As independent factors, they have a significant impact: the level of feeding-12.3%, the level of concentrates-10.2% on the yield of milk protein; the protein content in the milk of cows is 3.7% and 2.3% accordingly.

Also these factors also influence together with other factors studied by us.

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