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Impact of Extruded Feed Supplements on The Productivity of Lactation Cows

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THE production of new fortified feed supplements and concentrates, balanced by the organic nutrients content, takes one of the leading positions in agriculture manufacture. Food production waste has recently been one of the forms of an accessible source of biologically active substances (oilcake, oil meal, molasses, treacle, etc.). Proper processing of these raw products allows you to use it in obtaining highly nutritious feed supplements with a high content of protein, minerals, vitamins, and sugars. Food waste does not harm the animal's body; it was found; they have easily processed and high biological value. This work is presents the formulation of a new extruded feed supplement, using it in the main ration of lactation cows increases the productivity of the animal by 10-12%. The mass protein fraction in the obtained milk was in 9-11% higher comparative to milk from cows without receiving an additional feed supplement in their rations. It is proved that the developed extruded feed supplement does not adversely affect the body of lactation cows, which is confirmed by a research of the morphological blood composition.A supplementation dairy cow with 3 kg per cow daily for 15 days of our studded concentrated mixture is recommended.

Keywords: Waste, Lactation cows, Extruded, Feed supplement, Productivity.

Introduction

Today dairy breeding remains the most challenging area of animal husbandry for all agriculture [1]. However, dairy cattle breeding are one of the most promising sectors in Russia, so it forecasts an accelerated rise in this sector soon.

The cattle diet and feeding standards are the main conditions to ensure the maximum animal productivity and high-quality milk production and dairy products, which are risk-free to the human [2,3]. A high milk productivity level achieved by feeding rules by 60% [4] and by the 20% according to breed [5]. Correct nutritious feeding allows providing up to 15,447 litres of milk in the lactation period. So, the progress in the extruded feed production is the basis for the sustainable development of the highly productive cattle breeding [6,7].

Today, there is a tremendous amount of feed, feed supplements, and concentrates for cattle at the Russian market that increases the feed and nutritional values of rations and animal productivity. However, it is worth mentioning that the largest manufacturers of feed supplements are representatives of foreign countries, which consequently leads to the high cost of the proposed products [8,9]. Because of this, only significant agricultural holdings can afford high-quality feed supplements, while small farms are forced to use cheap domestic supplements in the animals' rations, which are inferior in the nutrient balance to imported ones and do not allow them to achieve high productivity.

So remains the goal of increasing high-quality milk and dairy products produce [10] using Russian-made feed supplements to the cattle in the lactation period. They have to contain a high protein, vitamins, minerals, and sugars contain.

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It is possible to increase the nutritional value and reduce the deficiency of the protein [11], mineral components and easily digestible carbohydrates (sugars) in feed supplements using by-products of food processing plants (oil cake and oil meal of vegetable raw materials, beet molasses, etc.) [12,13].

The mass fraction of sugar in grain feed supplements was, several times, inferior to enriched feed supplements [9]. At the same time, ease digested carbohydrates are playing a crucial role in the metabolism andin the normal digestive processes in the animal.A sugars' lack is often observed in the lactation cows' ration. It leads to a failure of the sugar-protein ratio [5], a failure of metabolic processes, and a decrease in milk productivity, as a result.

Beet molasses is a valuable, multi-component waste of sugar production. It has a high viscosity, containing sucrose, soluble non-sugars, and useful microelements [14]. You willcud got up to 6 kg of molasses from the 100kg of processed sugar beets. The chemical composition of molasses: 76-85%Solids ; 46-51%sucrose ; 4-7%betaine ; 4-8% colouring materials ; 4-6% lactic acid; 1.5-2%total nitrogen ; 0.5-2.5%reducing substances ; 0.6-1.4%raffinose ; 0.2-0.5% formic and acetic acids ; 6-11%ash and microelements(Aluminium, Magnesium, Ferrus,Manganese, Cuprum, Silicon).

Beet molasses is actively used in animal feed production forthe enrichment of rough feeds, which has poor content of many biological components. The feed value is 770 feed units per 1 t [15].

Sugar content in feed supplements affects fibre digestibility and fat of the milk. Providing the appropriate amount of easily digested carbohydrates to cows in lactation time is necessary because of significant sugars losses to milk production and foetus growing.

Oil-product industry waste (oil meal and oil cake) is also widely used in the feed supplements production. The high content of proteins, fats, carbohydrates, vitamins, and minerals makes oil meal and oil cake an indispensable tool in farm animal feeding [16].

Rape oil cake is an energy and protein feed for cattle. It is obtained in the process of pressing rapeseed. Rape oil cake is released in the form of a shell or crushed. Its colour can be from grey to light brown.

Some samples of rapeseed oil cake contain 38-40% of protein, balanced in exchangeable and irreplaceable amino acids [17].

The sunflower oil-meal contains 33% more lysine, 2.1 times more cysteine compare to rape oil-cake.However, the content of arginine and tyrosine is lower in sunflower one.

Rape oil-cake is included in the cows' ration in order to increase protein intake. However, this product can also be fed (together with other types of feed) to pigs and poultry.

Rape oil-cake is rich in vitamins and phosphatides, valuable minerals (Kalium, Phosphorus, Sulphur, Calcium, and another macro- and microelements). It contains a mass fraction of crude fibre not more than 16% and ash – not more than 7%. The total energy value is not less than 1.15 of feed units [18].

Feed supplementation with raw materials of high protein content is conditioned by the fact that the protein lack in cattle nutrition in winter can reach up to 50%.There is a decrease in animals' productivity, as a result. So agricultural producers are forced to increase purchase costs [19].

Rational waste food and processed industrial use in feed production allow to ensure the combined total effect and reach a new development level of the dairy manufacture.

Materials and Methods

The following research objects were used:extruded feed supplement;cows of the Holstein Friesian breed (No. 492, 4148, 4316) in a lactation period of the peasant farm Baranov, the Yurginskiy district of the Kemerovo region.

The identification of the quality values of the feed supplement and the productivity of the lactation cows were determined by using the following methods:

Appearance and colour of the feed supplement were determined according to GOST R 51899-2002 "Granulated feed concentrate. The general specification".

The odour of feed supplements was determined by GOST 13496.13-2018 "Feed concentrate. Methods for the determination of smell, pest contamination of grain stocks".

Mass fraction of crude protein in feed supplements was determined by GOST 32044.1-2012 (ISO 5983-1: 2005) "Feed, concentrate, feed concentrate products. Determination of the mass fraction of nitrogen and calculation of the mass fraction of crude protein.Part 1.The Kjeldahl method".

Mass fraction of fat in feed supplements was determined according to GOST 32905-2014 (ISO 6492: 1999) "Feed, feed concentrate, feed concentrate products. Method for determination of crude fat (amended)".

*Mass fraction of crude fibre*in feed supplements was determined according to GOST 31675-2012 "Feed. Methods for determination of crude fibre content using intermediate filtration".

Mass fraction of moisture in feed supplements was determined according to GOST R 54951-2012 "Animal feed. Determination of moisture content".

Mass fraction of calcium in feed supplements was determined by GOST 26570-95 "Feed, feed concentrate, feed concentrate products. Methods for determination of calcium".

Mass fraction of phosphorus in feed supplements was determined according to GOST 26657-97 "Feed, feed concentrate, feed concentrate products. Methods for determination of phosphorus".

Mass fraction of soluble sugars in feed additives was determined according to GOST 26176-91 "Feed, feed concentrate. Methods for determination of soluble and easy hydrolysable carbohydrates".

Mass fraction of ash, insoluble in hydrochloric acid in feed supplements was determined according to GOST 32045-2012 (ISO 5985: 2002) "Feed, feed concentrate, feed concentrate products. Methods for determination of ash insoluble in hydrochloric acid".

Diameter and length of the pellets of feed supplements were determined according to GOST R 51899-2002 "Granulated feed concentrate. General specifications,".

Metallomagnetic impurities and particles in feed supplements were determined according to GOST 13496.9-96,"Feed concentrate. Methods for determination of metallomagnetic impurities".

Cadmium and lead content in feed supplements was determined according to GOST R 53100-2008 "Medicines for animals, feed, feed supplements. Determination of mass fraction of cadmium and lead by atomic absorption spectrometry".

Arsenic content in feed supplements was determined according to GOST R 53101-2008 "Medicinal products for veterinary use, feed, feed supplements. Determination of mass fraction of arsenic by atomic absorption spectrometry".

Mercury content in feed supplements was determined according to GOST 31650-2012 "Medicines for animals, feed, feed supplements. Determination of mass fraction of mercury by atomic absorption spectrometry".

Aflatoxin B1 content in feed supplements was determined according to GOST ISO 14718-2017 "Feed, feed concentrate. Determination of aflatoxin B1 content by high-performance liquid chromatography".

Patulin content in feed supplements was determined according to GOST 28396-89 "Grain raw products, animal feed concentrate. Method for determining patulin".

Deoxynivalenol content in feed supplements was determined according to GOST R 51116-2017 "Feed concentrate, grain, and its processing products. Determination of deoxynivalenol content by high-performance liquid chromatography".

Radionuclides content in feed supplements was determined according to the Methodology for measuring the activity of radionuclides using a scintillation beta spectrometer No. 40090.4G006.

Microbiological safety indicators of feed supplements were determined by the Rules for bacteriological research of feeds approved by the Head Veterinary Administration of the Ministry of Agriculture of the USSR on June 10, 1975.

Mass fraction of non-fat milk solids (MSNF) in milk was determined according to GOST R 54761-2011 "Milk and dairy products. Methods for determining the mass fraction of non-fat milk solids".

Mass fraction of fat in milk was determined according to GOST 5867-90 "Milk and dairy products. Methods for determining fat".

Mass fraction of protein in milk was determined according to GOST 25179-2014 "Milk and dairy products. Methods for determining the mass fraction of protein".

Milk density was determined according to GOST R 54758-2011. Milk and milk processing products.Methods for determining density.

All studies in animals were performed according to International Animal Ethics Committee and local laws and regulations.

Results

Figure 1 gives the results of a chemical analysis of the feeds mostly used in the cows' rations in lactation period(grain haylage, Sudan grass silage, wheat straw, meadow hay, a mixture of concentrated feeds: oats, barley, wheat) at thepeasant farm of Baranov, Yurginskiy district, Kemerovo region.

So, the following standardized ration indicators were established due to the calculations. The energetic feed unit (EFU) content –was in such rate 14.1 and this is below the standard for lactation cows (a live weight of 500 kg, average daily milk yield of 16.8 kg)by 8%., The dry material and crude fibre were higher than unit standard by 5.0% and 8.0% (respectively 16,900 and 4,424 g), but the crude protein and sugar become lower than unit standard by 20.0% and 65.0%, respectively (1,640.6 and 414.6 g). The concentration of calcium and phosphorus was declined too in 2% and 12%, respectively, and contained 91.96 and 54.7 g.

It is a new feed strategy that has to been found. So, several successive steps of producing extruded feed supplements for lactation cows were identified by us.

1. Component dosing according to the traditional formulation on the dispenser, grinding in a mill, imparting a homogeneity mixture in the mixer, followed by feeding into a universal extruder. The moisture content of the mixture before extrusion should be 18-20%.
2. The componentswere milling at a temperature of 200-220°C, the pressure at 4-5 MPa. The transmission time of the raw product through the extruder was 90 seconds and under the influence of the maximum temperature – 5-6 seconds.
3. Grinding the extrudate with a mill and feeding it into the mixer, where vitamin-mineral premix and beet molasses were added to it under pressure with atomization through the nozzles. The molasses was preheated with steam to a temperature of 45-55°C using a steam generator.
4. Component mixing.
5. We are processing the resulting mixture into granules on a granulator.

This producing feed supplement technology provides the utilization of by-products of sugar and oil extract production, reduces the level using of raw grain products in the feed mixtures production, reduces its cost, and eliminates environmental pollution.

Processing the disinfecting of individual supplement's components on an extruder is an effective way to increases the shelf life of the finished feed product.

We selected the formulation of the extruded feed mixture for lactation cows based on the food and processed industrial waste, as a result of the research (Fig. 2).

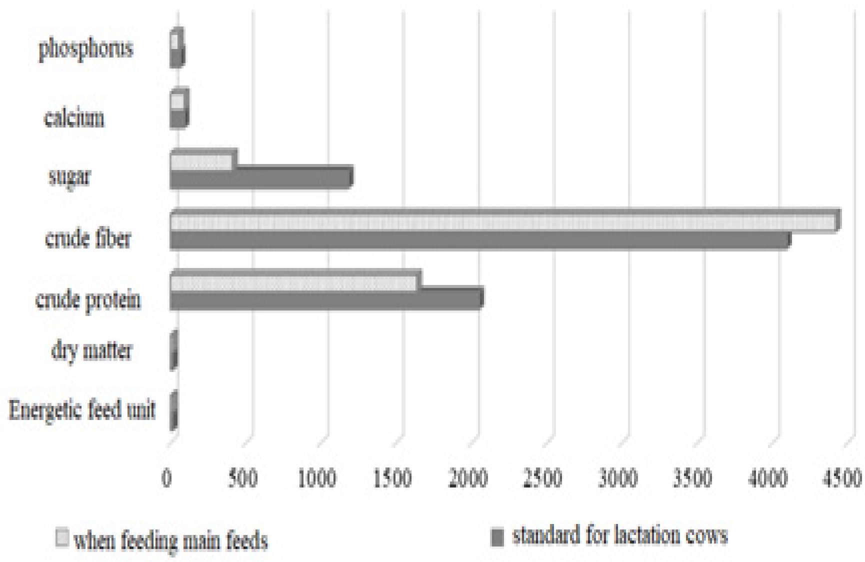

Fig.1. Compliance of the main ration for lactation cows (a live weight of 500 kg) to the feeding standards, g.

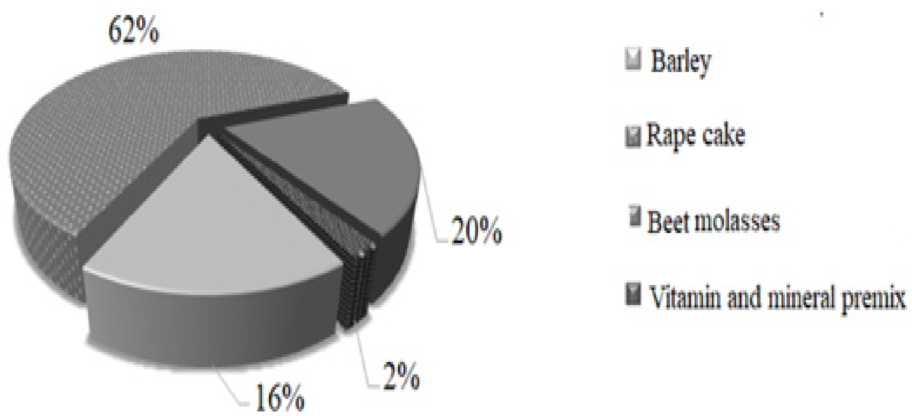

Fig.2. Formulation of feed supplements for lactation cows based on food and processed industrial waste.

These components combine, and their weight ratio allows using the proposed feed supplement in the lactation cows' main ration without including additional sources of sugars, protein, vitamins, and minerals. This feed supplement is balanced in composition, versatile, and easily digestible.

Barley and rape-oil-cake were included in the feed supplement as additional sources of protein, beet molasses – as a source of easily digestible carbohydrates (sugars). Molasses also has been as a binder, while improving the palatability of the feed supplement and increasing its consumption by lactation cows. Vitamin and mineral premix is included in the composition to improve the nutritional value of the feed supplement. Premix allows increasing the content of such nutritional elements as vitamins E, A, D, biotin, Manganese, Cobalt, Phosphorus, Cuprum, Iodine, etc.

The obtained feed supplements were primarily tested for organoleptic characteristics (Table 1). The results of determining quality and safety indicators of developed feed supplements have represented in Tables 2-4.

TABLE 1. Organoleptic indicators of feed supplement.

Name of indicator	Results
Appearance	Cylindrical granules with a matte surface
Odour	Corresponding to a set of benign components, without musty, mouldy and other foreign odours
Colour	Light brown

TABLE 2. Quality indicators of feed supplement for lactation cows.

Name of indicators	Permissible standards	Test results
Moisture content, %	≤12.0	10.8±0.3
Crude protein mass contained,%	≥20.0	23.8±1.2
The fat mass contained%	≥3.0	3.7±0.55
Crude fibre mass contained,%	≤10.0	9.4±1.4
Calcium mass contained,%	≥0.7	1.3±0.12
Phosphorus mass contained,%	≥0.6	0.7±0.13
Soluble sugars mass contained,%	≥10.0	16.7±1.0
Ash mass contained, insoluble in hydrochloric acid,%	≤2.0	1.3±0.2
The granules diameter, mm	4.7-8.7	8.0
The granules length, mm	No more than 2 diameters	16.0

TABLE 3. Safety indicators of feed supplement for lactation cows.

Name of indicators	Permissible standards	Test results
Metallomagnetic impurities (particles up to 2 mm inclusive), mg/kg	≤30.0	20.4±1.4
Metallomagnetic particles, mg/kg:		
• Particles up to 2 mm inclusive	Not allowed	Not found
• Particles larger than 2 mm and with sharp ends	Not allowed	Not found
The content of toxic elements		
Lead mg/kg	≤3.0	0.61±0.25
Arsenic, mg/kg	≤0.5	Less than 0.02
Cadmium, mg/kg	≤0.3	0.08±0.004
Mercury, mg/kg	≤0.05	Less than 0.01
Mycotoxin content		
Aflatoxin B1, mg/kg	≤0.05	Less than 0.002
Patulin, mg/kg	≤0.5	Less than 0.1
Deoxynivalenol, mg/kg	≤1.0	Less than 0.02
Radionuclide content		
Strontium-90, Bq/kg	≤65	14.8±0.74
Caesium-137-134, Bq/kg	≤600	3.1±0.15
The toxin containing		
Toxicity (protozoa)	Not allowed	Not found

TABLE 4. Microbiological quality indicators of feed supplement for lactation cows.

Name of indicators	Permissible standards	Test results
Coliforms, *Klebsiellasps*	Not allowed in 1,0 g	Not found in 1,0 g
Salmonella sps	Not allowed in 25 g	Not found in 25 g
Pathogenic anaerobes	Not allowed in 25 g	Not found in 25 g
Toxin-forming anaerobes	Not allowed in 25 g	Not found in 25 g

The proposed feed supplements have been met the requirements of regulatory documents, according to the presented results,and it could be used inlactation cows feeding. Testing the effectiveness of the feed supplement was made on thepeasant farm Baranov (Yurginskiy district, Kemerovo region) with using cows of the Holstein Friesian breed (No. 492, 4148, 4316), born in 2014, live weight of 500 kg, at 3-4th months of the lactation period.The experimental group cows had got additionally supplemented with the proposed feed supplement (the mass – 3kgper head a day, 15 days). The control group included lactation cows of the same breed without extruded feed supplement added in theirration.

Table 5 shows the daily ration of the control and experimental cows'groups.Urea of A group – 5g and a feed supplement for balancing and enriching the ration of dairy cows were additionally usedin the research time.

The ration of the experimental group fully satisfied the needsof lactation cows in energy, nutrients, macro- and microelements and vitamins.

The results of the cows'milk productivityare presented in Fig. 3 for the control and experimental group.

TABLE 5. Feeding ration of the control and experimental group of lactation cows.

Components, kg	Groups	
	Control	Experimental
Grain haylage	1.5	1.5
Silage	6.5	6.5
Wheat straw	1.0	1.0
Meadow hay	3.0	3.0
Feed concentrate	5.0	5.0
Urea A group	0.005	0.005
Extruded feed supplement	–	3kg per head a day

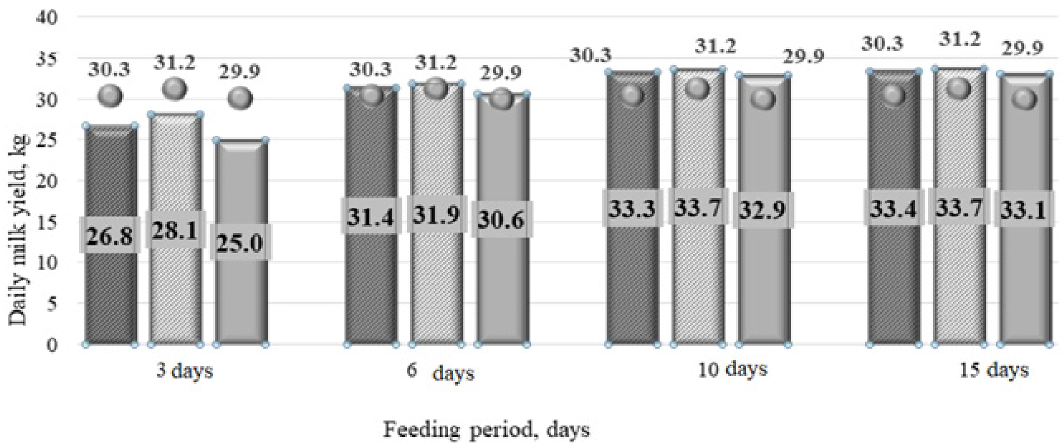

Fig.3. Indicators of milk yield of lactation cows without and after the inclusion of extruded feed supplements in the diet.

The ration changes made a result of the decrease in milk productivity by 11-12% in the first 3 days as a control milking showed. However,the average daily milk yield increased by 10-12% next period compared to the control group.

The results of milk quality assessment to the experimental group animals are presented in Table 6.

A qualitative milk analysis showed that obtained milk from cows without include feed supplement is a light cream-coloured liquid, homogeneous without sediment(after 15 days of feeding). There were no foreign odours or tastes found in milk that was not characteristic of a natural dairy product.

All of the milk from cows of the control and experimental group was a match to all indexes of GOST 31449-2013 “Raw cow’s milk. Special conditions”.Milk fat mass containing was a target from3.82% to 4.00% by different feeding periods.

The protein mass content in milk of the experimental group has been in a stable trend of increase (by 9-11%)compared to the control after the 3rdday of test feeding.

Non-fat milk solidsare an essentialindexof the organicmilk value.This mark is directly related to the high protein-containing in milk and has been increased by 5% to the experimental cows’ group.The calcium and phosphorus mass containing the milk both animal groups did not change.

The general health-condition of cows in both groups was tasted by studiesof their haematological indexes (Table 7).

TABLE 6. Milk quality of an experimental animal group.

Indicator	Groups				
	Control	Experimental			
		After 3 days of feeding	After 6 days of feeding	After 10 days of feeding	After 15 days of feeding
Fat mass contain,%	3.87±0.60	3.82±0.55*	3.99±0.62	3.92±0.61	3.96±0.61
	3.87±0.60	3.86±0.56****	3.89±0.61	3.89±0.61	3.94±0.61
	3.85±0.60	3.85±0.56**	3.84±0.61	3.88±0.60	3.93±0.61
	3.90±0.61	3.79±0.55***	4.00±0.63	3.94±0.61	3.94±0.61
	3.89±0.61	3.89±0.61*****	3.92±0.61	3.91±0.61	3.95±0.61
Protein mass contain,%	2.99±0.09	3.09±0.02	3.18±0.03	3.27±0.04	3.33±0.05
	3.08±0.10	3.11±0.02	3.18±0.03	3.28±0.04	3.30±0.05
	3.02±0.09	3.11±0.02	3.18±0.03	3.23±0.04	3.30±0.05
	3.10±0.10	3.09±0.02	3.20±0.03	3.29±0.04	3.29±0.04
	3.10±0.10	3.12±٠.02	3.19±0.03	3.30±0.05	3.30±0.05
Density, °A	29.37±1.47	29.04±1.45	29.21±١.46	29.25±١.46	29.18±١.45
	29.40±1.47	29.22±1.46	29.22±1.46	29.29±1.46	29.22±1.46
	29.42±1.47	29.10±1.45	29.30±1.46	29.28±1.46	29.34±1.46
	29.36±1.47	29.14±1.45	29.27±1.46	29.25±١.46	29.20±1.45
	29.32±1.46	29.26±1.46	29.30±1.46	29.26±1.46	29.20±1.45
Non-fat milk solids,%	8.38±0.30	8.52±0.16	8.46±0.15	8.40±0.15	8.52±0.16
	8.38±0.30	8.50±0.16	8.48±0.16	8.44±0.15	8.52±0.16
	8.38±0.30	8.48±0.16	8.46±0.15	8.40±0.15	8,50±0.16
	8.38±0.30	8.47±0.16	8.47±0.15	8.43±0.15	8.54±0.16
	8.38±0.30	8.52±0.16	8.53±0.16	8.46±0.16	8.54±0.16
Calcium mass contain,%	0.06±0.01	0.06±0.01	0.06±0.01	0.07±0.01	0.06±0.01
	0.06±0.01	0.06±0.01	0.06±0.01	0.07±0.01	0.06±0.01
	0.07±0.01	0.06±0.01	0.08±0.01	0.07±0.01	0.06±0.01
	0.07±0.01	0.06±0.01	0.07±0.01	0.06±0.01	0.07±0.01
	0.06±0.01	0.06±0.01	0.07±0.01	0.06±0.01	0.06±0.01
Phosphorus mass contains,%	0.07±0.01	0.06±0.01	0.09±0.01	0.08±0.01	0.08±0.01
	0.07±0.01	0.06±0.01	0.07±0.01	0.08±0.01	0.07±0.01
	0.07±0.01	0.07±0.01	0.07±0.01	0.08±0.01	0.08±0.01
	0.06±0.01	0.07±0.01	0.08±0.01	0.08±0.01	0.06±0.01
	0.06±0.01	0.06±0.01	0.08±0.01	0.08±0.01	0.07±0.01

Note:

* Animal identification number :No.492; **No.1652; ***No.4148; ****No.4316; *****No.9262.

TABLE 7. Haematological indexes of lactation cows.

Indicator	Animal identification number				
	492	**1652**	**4148**	**4316**	**9262**
	Control group				
Haemoglobin, g/l	107.26±1.39	107,12±1,39	106.97±1.39	106.99±1.39	107,18±1,39
Erythrocytes, 10^{12}/l	6.45±0.08	6,74±0,08	7.01±0.09	6.84±0.09	6,48±0,08
Leucocytes, 10^{9}/l	7.19±0.09	7,15±0,09	7.15±0.09	7.14±0.09	7,16±0,09
	After 3 days of experimental feeding				
Haemoglobin, g/l	107.40±1.39	107,00±1,39	107.14±1.39	106.94±1.39	106,96±1,39
Erythrocytes, 10^{12}/l	6.82±0.09	6,74±0,08	6.90±0.08	6.80±0.09	6,52±0,08
Leucocytes, 10^{9}/l	7.02±0.09	7,18±0,09	7.20±0.09	7.18±0.09	7,18±0,09
	After 6 days of experimental feeding				
Haemoglobin, g/l	106.88±1.38	107,06±1,39	107.12±1.39	107.20±1.39	106,96±1,39
Erythrocytes, 10^{12}/l	6.78±0.08	6,80±0,08	6.58±0.07	6.70±0.09	6,55±0,08
Leucocytes, 10^{9}/l	7.10±0.09	7,14±0,09	7.12±0.09	7.12±0.09	7,17±0,09
	After 10 days of experimental feeding				
Haemoglobin, g/l	107.16±1.39	107,16±1,39	107.06±1.39	107.22±1.39	107,07±1,39
Erythrocytes, 10^{12}/l	7.00±0.09	6,78±0,08	6.84±0.08	6.88±0.08	6,60±0,08
Leucocytes, 10^{9}/l	7.21±0.09	7,18±0,09	7.14±0.09	7.08±0.09	7,20±0,09
	After 15 days of experimental feeding				
Haemoglobin, g/l	107.08±1.39	107,10±1,39	107.00±1.39	106.94±1.39	107,10±1,39
Erythrocytes, 10^{12}/l	6.94±0.09	6,78±0,08	6.93±0.09	6.89±0.09	6,57±0,08
Leucocytes, 10^{9}/l	7.09±0.09	7,14±0,09	7.14±0.09	7.19±0.09	1,15±0,09

The feeding of enriched feed supplementhad an insignificant effect on the blood indexes, as the table-data of studiedparameters shows. Haematological indexes were in standard rates in a time of all experiments.

Discussion

Our data was the same as literature science info.Analysing the data provided, the following conclusions can be drawn:

-The ration of lactation cows is unbalanced in protein (by 20-25%) and sugar (by 50-60%). Animal productivity has decreased by 25-30% because of this [20].

-The cows' unbalanced feeding, as usual for local farm corporations, leads to a failure of the calcium-phosphorus ratio, opposite the normal range of 1.5-2:1 [21].It is the maximum important to prevent complications after calving.So, the necessity to correct cows' rations becomes so essential. To make it with concentrate supplements is easier. We used the dry extrusion method (ETT-700/45KFSO type extruder)for the production of new enriched feed supplements based on the food and processed industrial waste.

The extrusion of the grain component and plant waste under the influence of pressure and temperature provides a complete change in the structure of components of the raw product and an increase in their nutritional value [22].It makes it possible to obtain a high-quality feed supplement to satisfy the animal's need in biologically active substances and minerals. A large amount of the necessary to animals'nutrients become no change because of a rather short timeto high temperaturescomponents exposed [23].The identified by us successive steps of extruding feed supplements for lactation cows has been according to data of authors [24,25].

The enrichment extruded supplements give it possible to gethigher milk productivity and milk fat and protein mass containing in it. Not only can this affect the fat content but the housing conditions of the animal and the type of feeding, etc. too.

Conclusions

We have presented the production technology of an extruded feed supplement from food and industrial waste, as a result of carried out research. It included in the main ration of lactation cows Holstein Friesian breed.

Using extruded feed supplements in the ration of lactation cows helps to increase milk yield by 12%, improve the milk quality (the protein content increased by 9-11%).

Worth to mention that an extruded feed additive based on waste from the food and processing industry does not change the blood composition of the animal and ensures that all the most important indicators are kept within the normal range.

So, we can pick out such advantages of the proposed extruded feed supplement:

1. Product has microbiology safety;
2. High nutrients digestibility of the grain and protein components contained in the supplement duetousing of dry extrusion processing;
3. Elimination or significant reduction containingcomplicated digested initial components of the concentrate because of extrusion;
4. The ability to balance the lactation cows' rationin sugar, protein, minerals, and vitamins to help increasingcattle's productive qualities.

Recommendations

According to the studies and the results obtained according to their results, this feed additive based on food and processing industry waste for lactating cows can be recommended as an addition to the main diet of animals at 3-4 months of lactation for 10 days in the amount of 3.0 kg/head per day, which will allow the farm to increase the yield of milk and the quality of milk produced in several times. The introduction of a feed additive into the main diet of lactating cows for more than 10 days is not advisable, since in the future milk yield and milk quality indicators practically do not change.

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Conflict of interest

The authors declare no conflict of interest.

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