ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

The Impact of Germinated Grains on Metabolism in Cows.

Sergey Yu Smolentsev*, Ivan N Polikarpov, Natalya O Burova, Faina I Gryazina, and Nadezhda A Kislistina.

Mari State University, Lenin Square1, Yoshkar-Ola city, 424000, Russia

ABSTRACT

The paper presents the results of using germinated barley grains in the rations fed to freshly calved cows. The study revealed an improvement in the basic metabolic processes in cows that had been given 0.5 kg of germinated grains daily during3 months immediately after calving. The monitoring of protein, carbohydrate, fat, and mineral metabolism showed positive changes in the animals of experimental group. Their blood serum concentrations of glucose and album ins increased while the bilirubin level declined. The changes detected in the animals' blood biochemical profilesled to the conclusion about the beneficial effect of germinated barley grains on the synthetic ability of the liver, as well as on pigment metabolism. The milk producing ability in the experimental animals increased by 5.9%. The findings of the study indicated the adequacy and feasibility of using germinated grain in dairy rations, given that it is easy to prepare and inexpensive.
Keywords: cows, lactation, metabolism, biochemical parameters, germinated barley grain.

**Corresponding author*

ISSN: 0975-8585

INTRODUCTION

Metabolic disorders in high producing cows are widespread on many farms and lead to economic losses resulting from a decrease in the livability, reproduction efficiency, and productive lifetime of dairy cattle. The main causes of the early departure of animals from the herd include diseases of organs of the reproductive system (35.1%), metabolic disorders (24.0%) and limb diseases (15.8%) [1]. Thus, the health condtion of cows within the initial two months after calving shall be considered as one of the major factors determining the levels of morbidity and livability among the breeding stock. In early lactation, high producing cows are often unable to maintain a positive energy balance which causes metabolic disorders such as ketosis, hypocalcaemia, hypovitaminosis, acidosis, hypoovarianism, etc. [2].At the beginning of the lactation phase, the milk production is high, and the energy in take from the ration feeds appears insufficient to support the energy balance of the animal's body. In this case, fatty acids from the fat depot zones of the body are actively derived to synthesize milk triglycerides [3]. In order to optimize the diets fed to freshly calved cows, a variety of methods have been proposed for preparing grain components including germination, flattening, and extruding which allow the enhancement of nutritional value and absorbency of feeds [4, 5].

MATERIALS AND METHODS

The study aimed to investigate the impact of germinated (sprouted) barley grains on metabolic processes in freshly calved cows. The research was carried out over the time period from December 2016 to April 2017 on the dairy farm "Milk Products" located in the Sovet sky District of the Mari El Republic. The study involved cows of the Black-and-White breed, aged 4-5 years, their body weights ranging from 480 kg to 510 kg. The milk productivity of the cows during their previous lactation period was 6260 – 6480 kg. The cattle maintaining system of stall-pasture and tie-up housing is practiced on the farm.

Germinated barley grains in the amount of 0.5 kg per animal were given to the cows daily for three months immediately after calving. The animals were divided into two groups of 6 cows. Animals from the experimental group were fed sprouted grains while the input of concentrates in their diets was reduced by 0.5 kg. Cows of the control group received a full daily diet of concentrates without germinated grains added. The other ingredients of the rations fed to the two groups of animals were identical. 30 and 60 days after germinated grain feeding to the experimental cows started, blood samples were obtained from cows of the experimental and control groups in order to conduct a number of biochemical tests.

The blood serum of the animals was studied in the clinical and biochemical laboratory of the Republican Veterinary Laboratory. Off-the-shelf reagent kits were utilized for carrying out the tests in accordance with standardized procedures.

RESULTS

The results of the studies are summarized in the table.

Table: Biochemical parameters of the blood serum of cows that were fedgerminated grain

Parameters	30 days after the start of the experiment		60 days after the start of the experiment	
	Experimental group	Control group	Experimental group	Control group
Total protein, g/L	69.9±1.7	88.7±5.2	82.6±1.8	89.6±2.6
Albumin, g/L	22.8±1.1	23.4±1.7	30.9±3.2	27.1±0.5
Globulins, g/L	47.2±0.7	65.3±4.2	51.7±4.3	62.5±2.5
Urea, mmol/L	5.6±0.6	9.4±1.4	7.8±1.2	9.7±1.6
Creatinin, µmol/L	76.1±4.4	71.5±4.0	74.3±8.1	66.1±2.8
Bilirubin, µmol/L	2.7±0.8	5.5±1.2	2.4±0.6	4.6±1.5
Alanineaminotransferase, IU/L	33.4±10.2	23.8±4.7	32.8±4.4	31.4±3.6
Aspartateaminotransferase,I	118.7±12.7	102.2±10.6	110.3±3.5	86.9±8.3

U/L				
Alkalinephosphatase, IU/L	74.8±15.1	76.6±22.3	80.1±9.8	110.5±30.6
Amylase, IU/L	35.4±5.0	38.2±4.7	52.4±2.1	45.6±3.8
Glucose, mmol/L	2.4±0.4	2.0±0.4	2.9±0.2	2.2±0.2
Cholesterol, mmol/L	3.7±0.2	4.4±0.8	6.8±0.6	5.8±0.4
Calcium, mmol/L	3.0±0.0	2.8±0.1	2.8±0.1	2.8±0.1
Phosphorus, mmol/L	1.5±0.2	1.9±0.1	2.1±0.1	2.3±0.2
Ca/P	2.2±0.3	1.5±0.1	1.3±0.1	1.2±0.1

The estimation of the content of total protein and its fractions in the cows' blood serum during the experiment showed changes in the concentrations of albumins and globulins. Thus, the level of albumin proteins in cows of both groups 1 month post-calving was relatively low, which was associated with a high synthetic function of the liver during this period as well as the priority synthesis of milk proteins for which serum albumin is an amino acid supplier [6]. Two months after the experiment started, an increase in the proteins of this fraction was recorded in both experimental and control groups (by 26.2% (P <0.005) and 13.5%, respectively).

By measuring the concentration of globulins, it was found that this parameter in the control group was 1.4 times (P <0.05)as high as that in the experimental group at the first stage of the experiment and 1.2 times at the second. The urea concentration changes varied in dynamics in the two groups. In the experimental one, the level of urea increased from 5.63 ± 0.55 to 7.83 ± 1.16 mmol / L. In the control group, the urea concentration remained at almost the same level30 and 60 days after the beginning of the study while, however, exceeding, at both stages, the values of the parameter in the experimental group (1. 68 and 1. 24 times, respectively) and the established normative limits. The elevation of this parameter in the control group indicates both an excess of dietary protein and an increase in catabolism which may be a consequence of increased breakdown of tissue proteins. The latter is indirectly proved by the dynamics of the activity of transaminases - alanine aminotransferase and aspartate aminotransferase enzymes. Thus, if catabolic processes are more intense in cows of the control group, then the animals should exhibit a lower activity of the transamination enzymes as compared to that in the cows of the experimental group. Indeed, transamination processes do not lead to the formation of ammonia; in these reactions, nitrogen is retained in the composition of amino acids which only change their qualitative profiles. The findings of the study show that the energy metabolism status was better in the cows of experimental group. The data contained in the table indicate that it was as early as one month after the launch of the study when the parameter values tended to rise, and after two months a statistically significant increase(P <0.05) of the glucose concentration was recorded in cows of the experimental group as compared to the control (2.92 ± 0.24 and 2.18 ± 0.21 mmol / L, respectively). Arise in the glucose concentration, from 2.4 ± 0.4 to 2.62 ± 0.29 mmol / L, was also observed in this group throughout the experiment.

The experimental and control groups of animals displayed pronounced differences in the dynamics of cholesterol concentration. There was increase in the cholesterol content from 3.67 ± 0.22 to 6.8 ± 0.57 mmol / L, while the parameter changed to a lesser extent in the control group and was 4.39 ± 0.82 and 5.8 ± 0.4 mmol / L. In the course of the experiment, differences between the groups were also observed with regard tobilirubin concentrations in the blood serum. At the first stage, this parameter in the control group was twice as high as that in the experimental group, and at the second stage it was 1.88 times (P <0.05) higher.

A decrease in the bilirubin level was found in the blood serum of experimental animals as compared with the control group. Bilirubin concentration declined by half 30 days after the start of feeding germinated barley grains. This tendency could still be observed two months after calving. An increase in the activity of alkaline phosphatase occurred in the control animals two months after the start of the experiment. The increase by 27.5% as compared with the experimental group may indicate a disturbance in mineral metabolism as well as excessive secretion of the enzyme by epithelial cells of the bile passages and gall bladder. As the table data show, the calcium level in the blood serum of cows from both groups was quite high over the time span of the experiment. Calcium and phosphorus are known to be antagonists with respect to the transport channels ensuring the intestinal absorption of the elements[7,8]. Therefore, excess calcium caused a decrease in the intake of phosphates from the intestine.

The study of amylase concentrations found varying degrees of enzyme activity. Thus, in the experimental group the parameter increased 1.48 times (P <0.001), while the increase in the experimental group was only 1.19 times (P> 0.05). As is known, germinating seeds are rich in oligosaccharides, which are products of the partial hydrolysis of reserve amylum [9,10]. It cannot be excluded that the plant enzyme of α-amylase which carries out this hydrolysis was absorbed into blood in the intestine.

CONCLUSION

Based on the research outcomes obtained, a conclusion can be made about the beneficial effect of germinated barleygrains on the metabolic status in freshly calved cows. In regard to the animals that had received sprouted grains, the blood proteinogram was quicker to restore due to improved protein synthesizing function of the liver; catabolism signst ypical of the physiological phase under investigation were less pronounced. The optimization of the energy metabolism was observed as well as that of the carbohydrate, fat, and mineral metabolism. The evaluation of milk production in cows under study during three months of lactation allowed for the following findings: the average daily milk yield of the animals from the experimental group was 28.8 liters, or 5.9 % more than the average yield of 27.1 liters in the control group. Thus, the use of germinated barley grains allows for increased milk yields and improved metabolism in cows while not being associated with significant material costs. The process of grain germination is feasible on any farm. The only facility necessary to carry out the process is a tile- or concrete-floored room where the temperature regime of 18 ° - 22 ° C can be maintained. The grains should be pre-soaked in a barrel during one day, then put onto the floor in a layer of about 10 cm and agitated at regular intervals. The germination time is 3 days; barley grains from one batch may be fed during one day. The grains are considered to be prepared for feeding when sprouts grow 0.5-1 mm long. It is expedient to divide the room intended for grain germination into several areas. To provide 100 cows with sprouted barley grains, about 50 kg of grains should be used in one batch, with every followinggrain batch laid down for germination on a daily basis.

REFERENCES

[1] Zhang H et al.Field Crops Research 2017; 215: 1-11
[2] Manzeke MG et al.Field Crops Research 2017; 213: 231-244
[3] Zuber SM et al.Soil and Tillage Research 2017; 174: 147-155
[4] Manatt RK et al.Environ. Res. Lett. 2013; 8:035037 doi:10.1088/1748-9326/8/3/035037
[5] Stefanski R, Sivakumar M. IOP Conf. Series: Earth and Environmental Science 2009; 7: 012016 doi:10.1088/1755-1307/7/1/012016
[6] Maheswari M et al.The Indian Nitrogen Assessment 2017:175-186
[7] Cao X et al.Ecological Indicators 2015; 55: 107-117
[8] Martínez-Romero A et al.Agricultural Water Management 2017; 192: 58-70
[9] Singh YV et al.Rice Science 2013; 20: 129-138
[10] Semenov EIet al. Research Journal of Pharmaceutical, Biological and Chemical Sciences 2016; 7(1): 1860-1868.