

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Effectiveness of Using Hydrobarothermally Treated Winter Wheat Grain In Ration Of Lactating Cows.

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ABSTRACT

The article deals with the results of research on studying influence of hydrobarothermally treated winter wheat grain in ration of lactating cows on milk producing activity and blood biomedical measurement in experimental animals. The cows of control group were fed 5 kg of grain mix stock feed (wheat, barley and oats). The cows of control group were fed 7.5 kg of winter wheat grain hydrolysate instead of grain mix. It was found that introduction into the ration of lactating cows the hydrobarothermally treated winter wheat grain promoted to experimental animals producing activity increase: daily milk yield by 2.42%, mass percentage of fat on 0.07%, mass percentage of protein by 0.15; non-fat milk solid by 0.21% ($P < 0.05$). Hydrobarothermally treated winter wheat grain using in ration of lactating cows allowed to ameliorate the physical and bioorganic status of the organism, which showed increase the number of protein in experimental animals blood by 7.53% ($P < 0.05$), in sugar by 27.01%.

Keywords: grain, wheat, fallow, pressure, sugar, cows, milk producing activity, blood.

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INTRODUCTION

Concentrated fodder as grains of cereal and beans crop is used for the ration balance for all animals. The whole grains difficult to digest therefore this grain should be chapped before using. Such method changes the physical form of grain. It is not only easier to chew, but also increase the contact area with the digestive juice of gastrointestinal tract and concentrated feed digestibility is rising [1-3].

Usually feeding grain is used for fodder which has quite big difference in structure and quality with food and seed grains. These feeding grains are attacked by musty and granary pests in the process of storage. Feeding animals of such kind of fodder without any heat treatment can lead to intoxication and production loss. Also such way as boiling, extrusion, micronization, extruding and expansion were used by science and practice [2].

Winter wheat grain grows in almost every agricultural plant, which use for food. Winter wheat grain is not used for feeding because of anti-nutritional quality and special structure of starch grain which form viscous cleave solutions in digestive tract. Extrusion treatment is recommended for negative anti-nutritional quality winter wheat grain [1-6].

Such technology does not work in the conditions of Permskiy kray because of vast technical and power consumption. Comparing parameters of extrusion and hydrobarothermal treatment a demand of amelioration nutritive prosperities of winter wheat grains with help of hydrobarothermal treatment arose. The preceding was taken as a research basis of winter wheat grains with help of hydrobarothermal treatment.

Therefore, the main object is to study the effectiveness of using hydrobarothermally treated winter wheat grain in ration of lactating cows.

METHODOLOGY

Scientific and economic research was conducted on Ural black and white cow breed in the agricultural cooperative "Rossiya" of Kudymkarskiy district of Permskiy kray, which was divided into two groups: control, experimental for solving object view in 2013-2014. Grain mix stock feed (wheat, barley and oats; 5 kg) was used as fodder for cows of control group. Winter wheat grain hydrolizate (7.5 kg) was used as fodder for cows of experimental group.

Cows of experimental group were fed silage – hay- concentrate rations, which are well balanced in macronutrients [7]. Rations were calculated for cows with daily average milk yield 16 kg. These rations included 5kg of legumes – grass hay, 25 kg of clover silage and the relevant quantity of concentrate fodder for each experimental group. One kilogram of dry matter contained the concentration of energy – 94 energetic feed unit, digest protein – 86.7 g., crude fiber – 220.7 g, blood sugar- 52 g in ration of the control group. One energetic feed unit contained 91.8 g of digestive protein, crude fiber – 234 g, blood sugar – 55 g, calcium – 9.58 g, phosphorus – 3.79 g. One kg of dry matter of control group cows rations contained 9.32 mJ of available energy, 81.78 g digestive protein, 220 g crude fiber, 64.46 g of blood sugar. One EFU of ration contained digestive protein 88. 2 g, crude fiber – 238 g, blood sugar – 69.52 g, calcium – 9.88 g, phosphorus – 4.03 g.

Fodder sample selection, blood and milk, and as well as chemical study were carried out with help of common methods [8-12].

Next components were defined in fodder: initial moisture – sample dehydration at 65°C in drying closet; hygroscopic moisture – dehydration under 105°C; total moisture – by calculation; crude protein – by Kjeldahl method; crude fat – by Soxhlet method; crude ash – by ustion method; Nitrogen free extractive substances – by calculation; calcium – by complex metric method; phosphorus – vanadium molybdate method.

Quantity and quality trikes of milk yield on the farm were carried out with help of control milking operation. Selection of milk average sample for analysis carried out ones every month during 2 related days. Weight percentage of fat, weight percentage of protein and non-fat milk solids carried out in milk average (middle) sample with help of milk-quality analyzer Lactan-1-4(210).

Biochemical composition of blood was studied in the beginning and the end of the experiment for animals feeding adequacy and metabolic status control. Blood was taken in the morning for research data and caring out before feeding of three animals from each group. Next components were defined in blood: alkali reserve – titrimetry, crude protein – refractometric method; calcium, phosphorus, blood sugar, carotene – colorimetric method.

Obtained results were treated by biometrical method of N.A. Plohinskiy(1969), E.K. Merkuruyeva (1983) with help of the computer program Microsoft Excel. Dissemblance was valid to P<0.05.

RESULTS

In October 2013, winter wheat grain was steamed and exposed to pressure on the experimental facilities GRK-1200. Laboratory research of concentrated fodder, which are used in the agricultural cooperative “Rossiya” on the chemical compositions were made (table 1).

Table 1. Biochemical composition of concentrated fodders (in bone-dry solids)

Type of cropper	ОЭ, mJ	Crude protein, %	Crude fat, %	Crude fiber, %	Sugar, g	Ca, g	P, g
Rye grain	12.54	10.29	1.55	1.33	43.7-80	0.85	3.71
Rye hydrolyzate	12.30	9.90	1.43	1.32	90.7-152	0.99	3.80
Stock feed of grain mix (wheat, barley and oats)	12.82	10.41	2.48	3.59	64.0	2.44	3.53

As shown in this table biochemical composition of the winter wheat grain was changed after hydrobarothermal treatment. The change lies in increase sugar content from 90.7 to152 g. Such sugar increase connects with the conversion through the dextrinization stages under the influence of high temperature and aquatic medium pressure. However, the long influence of high temperature and pressure lead not only to starch hydrolysate, but protein destruction, to be more exact – free amino acids destruction which valued 3.93%. As a result, fat content was reduced by 8.39% because of hydrobarothermal treatment in hydrolyzate. Fiber was reduced by 0.75%; this led to available energy concentration reducing by 0.24 mJ in 1 kg of dry matter.

As a positive fact, the mineral constituent increased in winter wheat grain hydrolyzate due to the fact of water hardness which was used for hydrolyze. These results matched with conclusions, which were made in the course of earlier studies [3].

It should be noted that sugar content in grain concentrate of the agricultural cooperative “Rossiya” is higher than in average on the Volga Federal District. According to M.P. Kirilova et al., sugar content in 1 kg of grain feed does not exceed 20 g. If there is natural humidity, so the bone-dry solids do not exceed 24 g [15].

Milk productivity analysis of experimental cows showed that including the hydrobarothermally treated winter wheat grain instead of intact fodder in ration of lactating cows led to increase of daily milk yield (table 2).

Table 2. Milk productivity of experimental cows

Index	Group	
	control	experimental
Daily milk yield, kg:		
Before the experiment	13.78±1.14	12.40±0.82
During the experiment	15.72±0.12	16.10±0.08*
In % of control group	100	102.42
Daily milk yield:		
4 % fatness, kg	14.43±0,41	15.14±0.51
basis fatness, kg	16.97±0,38	17.81±0.24*

It was determined that cows daily milk yield of the experimental group during the experiment composed 16.10 kg which is by 0.38 kg or 2.42 % ($P < 0.05$) higher in comparison with the control group. The daily milk yield was calculated as basis fatness, which was received from experimental group and composed 17.81 kg ($P < 0.05$) which is by 0.84 kg or 4.95 % ($P < 0.05$) higher in comparison with the control group.

As a result of the experiment, cow milk had difference in chemical compositions ($P < 0.05$) fat concentration is higher (by 0.07 %) and protein is higher (by 0.15 %) due to hydrobarothermally treated winter wheat grain which was used to feed cows (table 3).

Table 3. Quality indicator of milk

Index	Group	
	control	experimental
Weight percentage of fat, %	3.69±0.01	3.76±0.02*
Weight percentage of protein, %	2.93±0.03	3.08±0.04*
Non-fat milk solids, %	8.41±0.07	8.62±0.15
Total yield:		
milk fat, kg	58.01±0.72	60.54±0.58*
milk protein, kg	46.06±0.86	49.59±1.07*

The weight category of all milk components except for fat is characterized by the quantity of non-fat milk solids and provides receiving of low fat dairy products. Using winter wheat grain in the ration of cows provides increase of concentration grade of non-fat milk solids in their milk. The concentration of non-fat milk solids in the milk of cows of experimental group was by 0.21 % higher than in milk of control group cows.

Cows of control group in total yield of milk fat were higher by 4.36 % ($P < 0.05$), total yield of dairy protein was higher by 7.66 % ($P < 0.05$).

It was found that feeding hydrobarothermally treated winter wheat grain cows of control group asserted influence on some biochemical compositions of blood serum. In analyzing blood biochemical characteristics of experimental cows should be noted that all studied characteristics of blood serum in the beginning of the experiment had no difference in both groups of animals and matched with physiological standard (table 4).

Table 4. Blood biochemical characteristics of experimental cows

Index	Group	
	control	experimental
In the beginning of the experiment		
Crude protein, GM/DL	77.57±1.94	86.40±3.95
Alkali reserve, vol.%CO ₂	43.14±1.91	40.92±1.88
Sugar, mmol/L	2.05±0.18	1.69±0.32
Calcium, mmol/L	2.41±0.13	2.20±0.18
Phosphorum, mmol/L	1.63±0.05	1.50±0.05
Carotin, umol/l	6.62±1.02	7.80±0.86
At the end of experiment		
Crude protein, GM/DL	77.60±1.21	83.44±2.20*
Alkali reserve, vol.%CO ₂	51.61±0.47	49.82±1.47
Sugar, mmol/L	1.74±0.41	2.21±0.22
Calcium, mmol/L	2.58±0.03	2.64±0.06
Phosphorus, mmol/L	1.70±0.15	1.53±0.08
Carotin, umol/l	8.78±0.53	7.12±0.89

Index of animal crude protein both groups in the beginning of the experiment should be physical standard and composed 77.57 – 86.40 GM/DL. At the end of the experiment it was found that crude protein content in cows' blood serum of experimental group have a tendency to increase in comparison with analogue of control group by 5.84 GM/DL or 7.53 % ($P < 0.05$).

At the end of the experiment, sugar content in cows' blood of experimental group increased and composed 2.21 mmol/L which is higher by 27.01 % than in control group.

Balance of cows' mineral nutrition if we take into consideration total calcium contains and inorganic phosphorus in experimental animals' blood serum was within the normal physiological range.

Economical effectiveness estimation of scientific and economic experiment showed that using in lactating cows' feeding of hydrobarothermally treated winter wheat grain allowed increasing the level of profitability milk producing from 10.2 to 14.7 %.

CONCLUSION

Based on the results of the research conducted in sphere of studying of effectiveness of using hydrobarothermally treated winter wheat grain in ration of lactating cows the following conclusions were made:

1. Hydrobarothermal treatment of concentrated fodder is changing its' composition. This treatment increase simple sugar content due to hydrolyze of large carbohydrates. Sugar content in winter wheat grain is increased in 1.5 – 2 times under the influence of high temperature and pressure in aquatic habitat.
2. Including in ration of lactating cows hydrobarothermally treated winter wheat grain promoted to increasing of experimental animals dairy productivity: daily milk yield - by 2.42 %, fat weight percentage– by 0.07 %, protein weight percentage – by 0.15 and Non-fat milk solids – by 0.21 % ($P<0.05$).
3. Using hydrobarothermally treated winter wheat grain in ration of lactating cows allowed to ameliorate physiological and biochemical status at the end of the experiment which appears in increasing in experimental animals blood of crude protein – by 7.53 % ($P<0.05$), sugar – by 27.01 %.

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