Ecological and Biochemical Evaluation of the Kalmyk Cattle Meat When Including Mineral Feed Additives in Fattering Bulls Diet

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Abstract. The article presents the study results of the Kalmyk breed bulls meat chemical composition, that had been fed local non-traditional feed additives — zeolite and salt. The data shows differences in chemical composition of the average sample bulls meat, in the experimental group dry matter was from 27.09 to 31.02%, meat protein was 2.97% higher, and fat was 2.18% higher than the control group. The ratio of protein and fat in both group meat was 0.62-0.64. In studied meat samples was different vitamin content. In the experimental animals meat, B1 vitamin was 26.8% higher, B2 -5.9%, E -2.6%, PP -8.2%. Studies show that the mineral additives in the diet contributes to a greater accumulation of dry matter, nutrients, and vitamins. Under such technology, beef has a great energy density and biological value. The article also reflects the study results of the Kalmyk bulls meat macro- and microelement composition. When analyzing the data, we found that the animals receiving natural feed additives have the best ultimate composition in their meat.

1. Introduction
The beef breeding industry in Yakutia is actively developing. Farms are aimed to increase livestock numbers. However, the feeding level of young fat stock does not provide higher rates of animals' body weight gain, but the intensive animal feeding at feedlots can give better results in meat production. As many researchers note, the Kalmyk bovine meat is marbling, and it has the best gustatory and nutritional qualities.

It is known that meat quality includes nutritional and biological value; organoleptic, structural-mechanical, functional-technological, sanitary-hygienic elements; as well as their intensity degree. Chemical composition determines nutritional value of meat. Changes in chemical composition occur due to the redistribution of meat composition, and the ratio of three elements: moisture, fat, and protein [1-11].

2. Materials and research methods
The research object is the Kalmyk bulls meat at the age of 18 months after inclusion to their diet local mineral feed additives.
2.1. The experimental design
In the experiment was used the Kalmyk bulls meat after 60 days of fattening. Each group received 8-10 kg of meadow hay, 12-14 kg of mixed grass hay, and 2-3 kg of compound animal feedstuff. The diet density was 8-9 fodder units. For 1 feed unit accounted for 10.1 mJ of metabolic energy and 108 g of indigestible protein. The experimental animals received daily additional feed to their main diet, it is 200 g of Suntar zeolite, and 45 g of Kempendiai salt.

We determined chemical composition of the Kalmyk bulls meat average sample on the content of moisture, dry matter, protein, fat, and ash, and studied the vitamin, micro- and macroelement composition in meat.

2.2. Equipment and technologies
The chemical composition of meat was determined via the SpectraStar XT analyzer in the scientific training laboratory of Arctic State Agrotechnological University. The vitamin, macro and microelement composition of meat was studied via the SpectraStar 2200 analyzer in the laboratory of processing agricultural products and biochemical analyzes of Yakutsk Research Institute of Agriculture named after Prof. M.G. Safronov, a subdivision of the Federal Publicly Funded Institution of Science Federal Research Center Yakut Scientific Centre Siberian Branch of the Russian Academy of Sciences.

2.3. Statistical processing
The scientific material was processed via Microsoft Office, Excel, and Statistica 10.0. programs.

3. The research results
The nutritional quality of the experimental group samples was assessed by studying the experimental and control groups' meat chemical composition (table. 1).

| Indicator      | Control          | Experimental     |
|----------------|------------------|------------------|
| Moisture, %    | 64.90±0.26       | 65.60±0.48       |
| Dry matter, %  | 25.77±0.14       | 31.02±0.36       |
| Protein, %     | 15.68±0.24       | 16.90±0.73       |
| Fat, %         | 9.70±0.11        | 10.60±0.53       |
| Ash, %         | 0.89±0.013       | 0.98±0.03        |

Conducted studies indicate that the chemical composition of the bulls average sample is different because of the process of nutrients accumulation in animals’ organisms occurs differently. The amount of dry matter in bulls meat ranged from 27.77 to 31.02%. At the same time, the experimental group meat contains the highest dry matter, which exceeded the control group animals on 5.25%.

The experimental meat samples contained more protein per 1.22%, as well as fat content was higher per 1%. The ratio of protein and fat was 0.62-0.64 in both groups. This is evidence of the meat’s compliance with the requirements of a high-quality food product, moreover, the ratio in the experimental animals was at a high level. The different content of protein and fat in the meat of two groups is reflected in its energy value. The experimental group average sample has a higher energy value.

It should be noted that there are certain differences in the meat vitamin indicator of two groups (table. 2).
Table 2. The vitamins composition in an average sample of the experimental animal’s meat farce, mg / 100g.

| Indicator | Control | Experimental |
|-----------|---------|--------------|
| Vitamin B1 | 0.033±0.003 | 0.033±0.003 |
| Vitamin B2 | 0.18±0.006 | 0.17±0.003 |
| Vitamin E  | 0.39±0.003 | 0.390,003 |
| Vitamin PP | 2.45±0.006 | 2.55±0.050 |

The content of vitamins B1, B2, E, PP is increased in the experimental group meat samples. In that way the vitamin B1 was higher per 26.8%; vitamin per B2 5.9%; vitamin per E 2.6%; vitamin per PP 8.2%.

Thus, the inclusion of mineral additives in diet, and feeding them to the experimental group bulls during fattening contribute to a greater accumulation of dry matter, nutrients, and vitamins. The experimental bull's meat is superior to the energy and biological value of the control group meat.

We also studied the macro- and microelement composition of the average sample of the Kalmyk bulls meat farce when inclusion local mineral feed additives in the diet (Tables 3, 4).

Table 3. The macronutrient composition of the average sample of Kalmyk bulls meat farce, mg / 100g.

| Indicator    | Control / 100 g | Experimental / 100 g |
|--------------|-----------------|----------------------|
| Ca, mg / 100 g | 5.96±0.11       | 6.75±0.45            |
| K, mg / 100 g  | 288.84±1.46     | 296.69±4.71          |
| Mg, mg / 100 g | 17.91±0.15      | 18.64±0.44           |
| Na, mg / 100 g | 49.74±0.82      | 51.72±1.42           |
| P, mg / 100 g  | 178.05±0.84     | 184.38±3.63          |
| Cl, mg / 100 g | 5.96±0.11       | 6.75±0.45            |

Animals receiving mineral feed additives have the best elemental composition. The experimental group meat contains higher calcium per 1.88 mg/100 g, potassium per 19.3 mg/100 g, magnesium per 1.84 mg/100 g, sodium per 5.84 mg/100 g, phosphorus per 14.85 mg/100 g, and chlorine per 2.27 mg/100 g.

The experimental group meat samples have the highest indicators of micronutrient composition. The ultimate composition is Fe - 2.39 mg/100 g, J - 6.63 μg/100 g, Co - 5.50 μg/100 g, Mn - 0.032 mg/100 g, Cu - 173.99 μg/100 g, Mo - 9.71 μg/100 g, F - 60.17 μg/100 g, Zn - 2.97 mg/100 g (Table 4), which is more on 0, 50 - 2.08 - 3.19 - 0.004 - 21.04 - 1.42 - 3.66 and 0.15 mg/100g than in the control group.
Table 4. The micronutrient composition of the average samples of Kalmyk bulls minced meat, mg/100g.

| Indicator | Control  | Experimental |
|-----------|----------|--------------|
| Fe, mg /100g | 1.93±0.03 | 2.1±0.12 |
| J, mcg /100g | 4.71±0.10 | 5.6±0.51 |
| Co, mcg /100g | 2.91±0.31 | 3.9±0.78 |
| Mn, mcg /100g | 0.03±0.0003 | 0.03±0.001 |
| Cu, mcg /100g | 155.67±2.10 | 163.7±5.14 |
| Mo, mcg /100g | 8.45±0.12 | 9.0±0.35 |
| F, mcg /100g | 56.97±0.35 | 58.4±0.90 |
| Zn, mg /100g | 2.84±0.01 | 2.90±0.04 |

4. Conclusions
Thus, the fattening of Kalmyk livestock based on Yakutia's traditional feeding (hay and compound animal feedstuff), and local mineral feed additives allow getting high-quality meat, rich in nutrients.

5. References
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