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The Influence of the Feed Additives on Sheep Fat Tissue Composition and Properties

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THE aim of the study was to undertake comparative evaluation of chemical composition and physical properties of the fat tissue of the Romanov sheep breed on condition of separate and joint use of natural additives "Glaukonit" and probiotic "Biogumitel". A positive effect of their use has been established. The young stock consuming the tested additives at the dose of 0,1 g per 1 kg of live weight surpassed on weight of internal fat and carcass fat of control analogs by 0,04-0,21 kg (9,09-47,73%) and 0,12-0,29 kg (6,38-15,44%). The content of dry matter and chemically pure fat was higher in the fat tissue of the ram hogs of experimental groups in internal fat by 0,03-0,72% and 0,20-0,60%, subcutaneous fat by 0,02-0,08% and 0,04-0,15%; intermuscular fat by 0,09-0,22% and 0,05-0,13%, respectively. Internal fat had the greatest energy value, intermuscular fat had the lowest energy value, and subcutaneous fat took an intermediate position. In all cases, the ram hogs of experimental groups were in the lead and surpassed the control on the energy value of internal fat by 0,08-0,25 mJ (0,23-0,70%); intermuscular fat by 0,01-0,04 mJ (0,03-0,12%); subcutaneous fat by 0,02-0,06 mJ (0,06-0,18%). An increase in the iodine value in the fat samples of the experimental groups was established. All changes occurring in the fat tissue of young sheep were within the regulatory limits and corresponded to the breed characteristics. At all stages of research the maximum effect was achieved due to by joint use of tested additives.

Keywords: Ram hogs, Sorption additives, Probiotic additives, Fat, Composition, Value.

Introduction

The maintenance of the diversity of biological resources for food purposes can be considered as the basis of nutrient biodiversity which is necessary to meet the needs with essential nutrients [1-3].

So, lamb production and processing in the Southern Urals is particularly promising for increasing the raw material base. This region of Russia in meat industry accounts for about 3% of produced meat. To some extent this will solve the problem of raw meat deficiency [4-9, 26].

In Russia unique wool-and-meat producing Romanov sheep has been bred for more than 100 years. These animals are well adapted to local climatic and forage conditions. Also they are characterized by high fertility, precocity and earliness. Their meat has high taste, low caloric value, high biological value and digestibility [10, 11]. Maximum realization of animal productive capacity can be achieved only with nutritious feeding [12-15]. To do this, it is proposed to enrich their diet with domestic feed additives of sorption and probiotic action.

An important role in animal nutrition plays a balanced diet for previously non- standardized mineral elements such as silicon. It creates special electrically charged colloidal systems that have the ability to absorb viruses and pathogens that

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are unusual for animals and remove them from the body. At the same time, normal intestinal microflora (lactic acid and bifidobacteria) do not have the ability of "sticking" with colloidal systems of silicon and remains in the intestine [16, 17].

In 1998 in European Union countries the Commission on Agriculture voted to ban the use of antibiotics as growth promoters in animal breeding. Due to this fact, there was the need of finding alternative ways of achieving high productivity of agricultural animals. To date there are developed means that can be divided into 3 groups: probiotics, prebiotics and synbiotics. Special attention should be paid to preparations containing microbial mass of live spore-forming bacteria of Bacillus subtilis 12B, Bacillus subtilis 11B strains sorbed on activated carbon particles. In addition to these spore cultures, the studied preparation contains a growth promoter of natural origin Gum-90 [12, 15].

There were no data on the joint use of preparations with different properties. This prompted the study of their influence on the composition and properties of fat tissue of ram hogs. This fact determined the relevance and timeliness of research in both practical and theoretical terms.

Materials and Methods

We carried out scientific and economic experiments on ram hogs of Romanov breed in PFE (Peasant farm enterprise) of IE (Individual entrepreneur) Turchin A. V. in Ishimbaysky district of the Republic of Bashkortostan in the period from 2016 to 2017. Four groups of ram hogs with 20 animals in each group were selected from twin lambs. The young stock of control group got the basic diet, I experimental group got in addition sorption and mineral additives at the dose of 0.10 g per 1kg of live weight, II experimental group got probiotic additive at the same dose, III experimental group got both additives together. To study the chemical composition of fat tissue at the age of 12 months, a control slaughter of 3 ram hogs from each group was carried out by the method of All-Russian Institute of animal breeding (1978). Iodine number was determined by Gueble method and the melting point was determined by capillary method.

The animals were treated according to the instructions and recommendations of Russian Regulations, 1987 (Order No.755 on 12.08.1977 the USSR Ministry of Health), as well as "The Guide for Care and Use of Laboratory Animals (Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council, National Academy Press Washington, D.C. 1996)". In the course of the studies, efforts were made for minimizing animal suffering and the number of used samples.

The digital material obtained in the experiment was processed by the method of variation statistics of Microsoft Office with the determination of difference reliability at three probability levels by Student's method.

Results

It is known that the fat is localized in different areas, and therefore it got different names. There is internal raw fat, as it is deposited near the internal organs and it is called, respectively, kidney suet, intestinal, mesenteric, superficial, deposited in the subcutaneous tissue. Subcutaneous fat protects the meat from drying out, promotes long-term storage of carcasses in frozen form and acts as an indicator of good finish. Intermuscular fat tissue is a part of muscle fiber and its presence determines the meat tenderness [18].

The analysis of the obtained data shows that the activity of fat deposition in ram hogs of the control and experimental groups was different (Table 1).

It is established that the ram hogs of the experimental groups surpassed their herd-mates in weight of internal fat and carcass fat. Their superiority in weight of internal fat over animals of I experimental group was 0,04 kg (9,09%); of II experimental group was 0,11 kg (25,00%) and of III experimental group was 0,21 kg (47,73%). The ram hogs of the control group by weight of subcutaneous and intermuscular raw fat were inferior to experimental analogues of I group by 0,08 kg (5,83%) and 0,04 kg (7.84%); II group by 0,14 kg (10,22%) and 0,08 kg (15,69%); III group by 0,15 kg (10,95%) and 0,13 kg (25,49%).

The ram hogs of all experimental groups had the greatest yield of subcutaneous raw fat. The superiority of ram hogs of the control group over the herd-mates of the experimental groups was from 0,70 to 4,89% in the value of the studied indicator. A different pattern was observed according to the content of intermuscular fat in the carcass of young animals. The ram hogs of I experimental group surpassed the herd-mates from the control group by 0,01%; of II experimental group by 0,13% and III experimental group by 0,68%. According to internal fat yield, the leading position was occupied by young animals consuming sorption and probiotic additives jointly. Their leadership over the basic herd-mates was 4,20%; over I experimental group was 3,51%; over II experimental group was 2.21%.

It is known that the fat quality is determined by its components. It was found that internal fat tissue was characterized by the highest concentration of dry matter, subcutaneous fat was characterized by the lowest one, intermuscular fat occupied an intermediate position.

Regardless of the fat tissue topography in the body, the young stock of the control group was inferior in dry matter weight ratio to herd-mates of the experimental groups (Fig. 1).

Thus, the advantage of ram hogs of experimental group over the young animals of the control group at the age of one year old according to dry matter weight ratio in the internal fat tissue was 0,30-0,72%, in subcutaneous fat was 0,02-0,08%; in intermuscular fat was 0,09-0,22%.

A greater amount of chemically pure fat is concentrated in the fat tissue of young animal experimental groups. So, this difference in internal fat was 0,20-0,60%, in subcutaneous fat was 0,04-0,15%; in intermuscular fat was 0,05-0,13%. In all cases, ram hogs consuming sorption and probiotic additives together were in the lead.

Intergroup differences in protein content were insignificant and unreliable.

Previously established differences in the chemical composition of fat tissue of different distribution affected the energy value (Table 2).

Internal fat had the greatest energy value, intermuscular fat had the lowest energy value, and subcutaneous fat took an intermediate position. It should be noted that in all cases ram hogs consuming studied additives were in the lead. The difference in internal fat was 0,08-0,25 mJ (0,23-0,70%); in intermuscular fat was 0,01-0,04 mJ (0,03-0,12%); in subcutaneous fat was 0,02-0,06 mJ (0,06-0,18%) respectively.

Physico-chemical and chemical properties of fats are largely determined by the ratio of their saturated and unsaturated fatty acids. With the predominance of saturated acids, the fat has a solid consistency, a relatively high melting point and a low iodine number, which indicates the presence of ethylenic bonds in the fatty acids in the carbon skeleton. Iodine number is an indirect indicator of the amount of unsaturated fatty acids in the fat. The more of them the more valuable fat [27].

The analysis of intergroup differences shows that the physical properties of fat of different distribution were within physiological range. At the same time, there is an increase in the iodine number in the fat samples of the experimental groups which indicates an increased biological value.

Thus, the chemical composition and physical properties of the internal, subcutaneous and intermuscular raw fat tended to change under the influence of different feed background. All changes occurring in the fatty tissue of young sheep were within the regulatory limits and corresponded to the breed characteristics.

Discussions

Introduction to the diet of Romanov sheep sorption and probiotic additives at the dose of 0,1 g per 1 kg of live weight contributed to the optimal distribution of fat tissue in the body of young animals. Thus, ram hogs consuming the studied additives jointly were in the lead according to the absolute weight and relative content of intermuscular fat tissue. As a result, meat products were characterized by succulence, due to the fat distribution in the layers of intramuscular connective tissue.

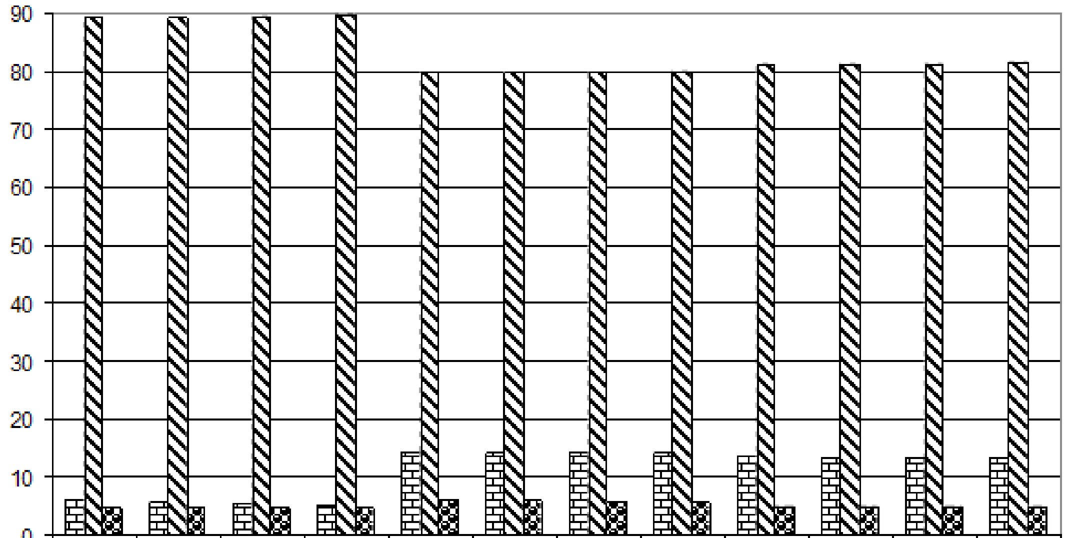
Similar distribution of fat tissue in the body of young sheep was in studies of D. A. Andrienko. He conducted studies in ram hogs, wether lambs, gimmer hogs of the Stavropol breed in the Southern Ural region.

Data analysis of the chemical composition of fat determined the superiority of young animals in experimental groups over the herd-mates of control group in dry matter and fat weight ratio leading to an increase in their energy value.

It should be noted that the fat samples of ram hogs consuming additives were characterized by a large iodine number which indicated their increased biological value.

TABLE 1. The pattern of fat tissue distribution in the body of young sheep

Group	Carcass fat						Internal fat		Overall fat	
	total		including subcutaneous		including interrmuscular					
	kg	%	kg	%	kg	%	kg	%	kg	%
Control	1,880,01±	81,19	1,370,01±	59,02	0,510,01±	22,17	0,440,01±	18,81	2,320,01±	100
I	2,000,01±	80,50	1,450,01±	58,32	0,550,01±	22,18	0,480,01±	19,50	2,480,01±	100
II	2,100,01±	79,20	1,510,02±	56,90	0,590,02±	22,30	0,550,02±	20,80	2,650,02±	100
III	2,170,01±	76,99	1,520,01±	54,13	0,640,01±	22,85	0,650,01±	23,01	2,820,02±	100



	Internal				Subcutaneous				Intermuscular			
	Control	I	II	III	Control	I	II	III	Control	I	II	III
moisture	5,95	5,72	5,48	5,23	14,17	14,15	14,11	14,09	13,51	13,42	13,38	13,29
Fat	89,13	89,33	89,52	89,73	79,75	79,79	79,84	79,90	81,30	81,35	81,38	81,43
Protein	4,61	4,63	4,68	4,72	5,82	5,78	5,76	5,72	4,91	4,93	4,95	4,89

Fig. 1. Control group

The motivation for the use of sorption additives in pig feeding is evidenced by the work of scientists E. M. Ermolova [16], in cow feeding by the work of T. N. Chuikina [19], in calf feeding by the work of V. Kmet [20], sheep feeding by the work of I. N. Ponomarenko [8], the use of probiotic additives in rabbit feeding by the work of E. E. Kurchaeva [21], mare feeding by the work of N. M. Gubaidullin [22], in bull calf feeding by the work of V. I. Kosilov [23], A. V. Andreeva [24], in gosling feeding by the work of F. Khaziahmetov [25].

Conclusions

The analysis of the research results allows us to conclude that the combined use of sorption and probiotic additives in sheep feeding contributes to a better distribution of fat tissue in the body, increasing the amount of chemically pure fat with increased biological value. The use of lamb fat from the young Romanov breed can be one of the ways to obtain high-quality meat raw materials for the production of special food.

TABLE 2. Energy value and physical properties of raw fat

Indicator	Group			
	control	experimental		
		I	II	III
internal				
Energy value of 1 kg of fat, mJ	35,50	35,58	35,66	35,75
Gueble number	30,590,14±	30,650,21±	30,720,04±	30,780,23±
Melting t, ^{0}C	42,360,16±	42,310,23±	42,230,17±	42,140,22±
intermuscular				
Energy value of 1 kg of fat, mJ	32,05	32,06	32,08	32,09
Gueble number	32,770,20±	32,790,07±	32,840,54±	32,890,08±
Melting t, ^{0}C	40,460,17±	40,420,27±	40,400,25±	40,360,10±
subcutaneous				
Energy value of 1 kg of fat, mJ	32,50	32,52	32,54	32,56
Gueble number	34,030,54±	34,060,45±	34,100,64±	34,130,08±
Melting t, ^{0}C	41,240,98±	41,290,36±	41,340,71±	41,390,24±

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