Biochemistry of meat and organs of fat-tailed sheep of Central Asia

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Abstract. The article presents materials on biochemistry of meat, curd fat, liver and longest back muscles of Hissar and Hissar-Kyrgyz sheep. Curd (fat-tailed) sheep of Central Asia are of great national and economic importance, as they have high meat and fat productivity and early maturity. In the post-embryonic period of ontogenesis of Curd sheep, biological laws of growth and development forming meat and fat productivity, quality and nutritional value of mutton depending on breed, methods of intensive growing and fattening, level of feeding are investigated, and also biologically expedient and economically effective terms of intensive growing and fattening of sheep for meat are established. Our research on studying the formation of meat productivity of fat-tailed sheep have shown that in conditions of intensive growing of young sheep up to 2.5-5.0 months of age, it is possible to achieve such a ratio of tissues and chemical composition of meat in the carcass, which produces high quality products.

1 Introduction

Age-related changes in proteins are of the greatest interest to researchers because, on the one hand, proteins are the most active and vital substances of the organism and, on the other hand, they have great nutritional value.

P.N. Serebryakov (1950) attaches great importance to age-related changes in the proteins of the animal organism and believes that if they are studied in their genesis, it will make it possible to elucidate the essence of breed formation much more quickly and accurately.

In terms of the content of creatine in muscle tissue, which is a component of nitrogenous extractive substances, the Tsigai 24.3 per cent, Vyatka 25.6 and Romanovskaya 9.4 per cent have a clear advantage [1-5].

Muscle tissue is the most valuable part of the carcass, it contains vital amino acids: arginia, histidia, lysia, valia, methionine, tryptophan, citin and others, as well as a complex of mineral compounds and vitamins.

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M.Y. Solovey and V.A. Ektov (1957), studying the growth of pig musculature, came to the conclusion that muscle fibres increase in the postembryonic period. According to these authors, the number of muscle fibres in the primary muscle bundles of the longest muscle of the back in Mirgorod pigs, at birth was on average 16.5 fibres, at the age of 1 month - 28.4 and at 6 months of age - 66.6 fibres. After 6 months of age, the number of fibres in the bundles decreased. High energy of growth of various tissues in young animals is a direct manifestation of the basic law of life of organisms, i.e. "striving" as quickly as possible to reach its constant mass, which is ultimately aimed at the preservation of the species.

This is favoured by the high level of metabolism in young organisms, when the process of assimilation prevails over dissimilation. According to V.N. Nikitin (1960), with age the "growth synthesis" and the ability of the organism to utilise its capacity for the formation of new protoplasm and its proteins fall sharply. The reason for this condition is the association of tissues with nucleic acids and their overloading with lipoid phosphorus.

Numerous studies of non-agricultural animals have established that the younger the animal, the more it is able to deposit nitrogen in the body (P.D. Wheat, 1955; P.V. Demchenko, 1959). It has been noted that at a higher level of protein nutrition, young animals utilise feed protein more fully, depositing more nitrogen in tissues.

Nitrogenous extractive substances are known to contribute to better digestibility of meat in the human body. Studies have shown that there are differences in the content of these substances between sheep breeds. The greatest diameter of muscle fibres of the longest muscle of the back is characterised by sheep of Romanovskaya and Oparinskaya breeds. They surpass their counterparts of Tsigai breed by 1.8 per cent and Vyatka breed by 7.1 per cent. This index, apparently, is conditioned in sheep of Romanovskaya breed, in comparison with Vyatskaya and Tsigai breeds, having the greatest meatiness of muscle tissue, the least loss of muscle tissue mass during cooking and its digestibility (A.A. Veniaminov, 1982).

In this regard, the establishment of the age of biological maturity of the organism, acquires special relevance, is of great scientific and practical importance, and also contributes to the acceleration of the creation of new and improvement of breeding and productive qualities of turkey sheep in Kyrgyzstan, scientific justification of the terms of use of animals, early diagnosis of animal productivity, taking into account their adaptation to modern production technology [6-8].

2 Materials and methods of research

The experimental part of the work was carried out in the farm "Tagai-Tilek" of Suzak district of Jalal-Abad oblast.

Biochemistry of meat, curd fat, liver and longest back muscles of Hissar and Hissar-Kyrgyz sheep was the material of research work.

Five lambs from each group were selected for the study at the time of weaning from their mothers. Counting was carried out by group method.

The experimental sheep stock was under normal feeding and housing conditions for these farms.

The nutritional value of meat was determined by the ratio of quality protein index, essential amino acids to substituted amino acids.

At sheep slaughter, the live weight before slaughter, the weight of steamed carcass and chilled carcass, rump and internal fat were determined.

Average samples of meat, turkey fat and liver were taken to study physiological and biochemical parameters.

Research methods recommended by scientific and methodological commissions of VASKHNIL, VIZh, VNIIOK, 1970, 1978, 1989 were used in the work.

3 Results of the study

Numerous studies on farm animals have shown that the younger the animal, the more nitrogen it is able to deposit in the body, and this ability decreases with age. In addition, it has been noted that at high levels of protein nutrition, young animals utilise protein more fully and deposit more nitrogen in tissues. (P.V. Demchenko, 1959; I.A. Makar, 1977).

N.V. Kurilov and others (1978) note that the liver easily loses and accumulates proteins, while in muscle tissue these processes occur more slowly. The increase in protein activity may be due to forced transition to vegetable fodder and a certain direction of metabolic processes.

S.A. Kazanovsky (1986) writes that the analysis of nitrogenous fractions in the organs of Caucasian sheep breed allowed to establish a general tendency of increasing with age the content of total and residual nitrogen. However, according to his data, the changes in nitrogenous fractions had a wave-like character. Thus, in the liver tissue after an insignificant decrease in protein nitrogen in the first life of lambs there is an increase in its concentration at one month and two months of age.

Tables 1 and 2 show data on the content of total nitrogen and its fractions in muscles in Hissar and Hissar-Kyrgyz sheep. They are also shown in Figures 1-4.

Table 1. Content of total nitrogen and its fractions in meat and muscles of the long back in Hissar sheep (in grams).

Indicators	Nitrogen	Age in months				
		1.0	2.5	5.0	7.5	12.0
Average meat sample	General	2.69	2.67	2.63	2.65	2.68
	Residual	0.42	0.41	0.33	0.31	0.37
	Protein	2.33	2.24	2.29	2.32	2.30
Longest back	General	2.70	2.72	2.74	2.56	2.63
	Residual	0.42	0.32	0.31	0.26	0.32
	protein	2.36	2.40	2.42	2.30	2.31

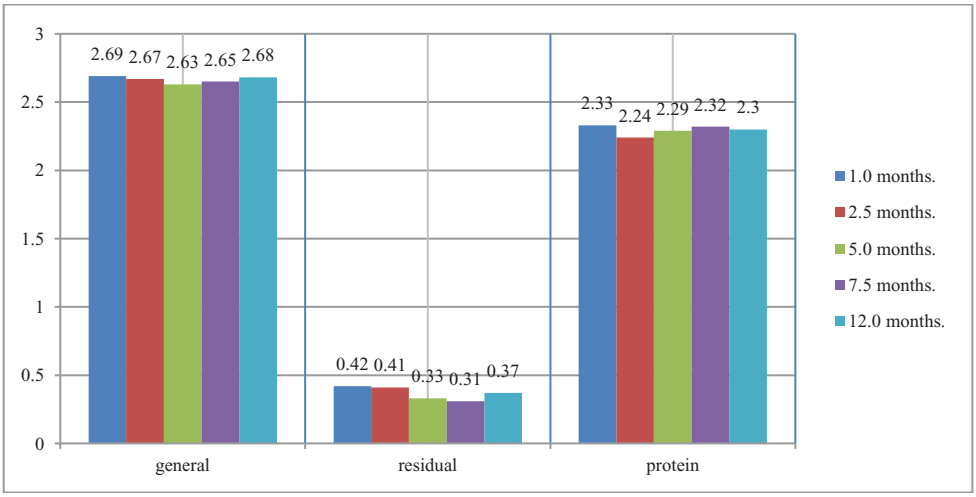

Fig. 1. Content of total nitrogen and its fractions in meat from Hissar sheep (in grams).

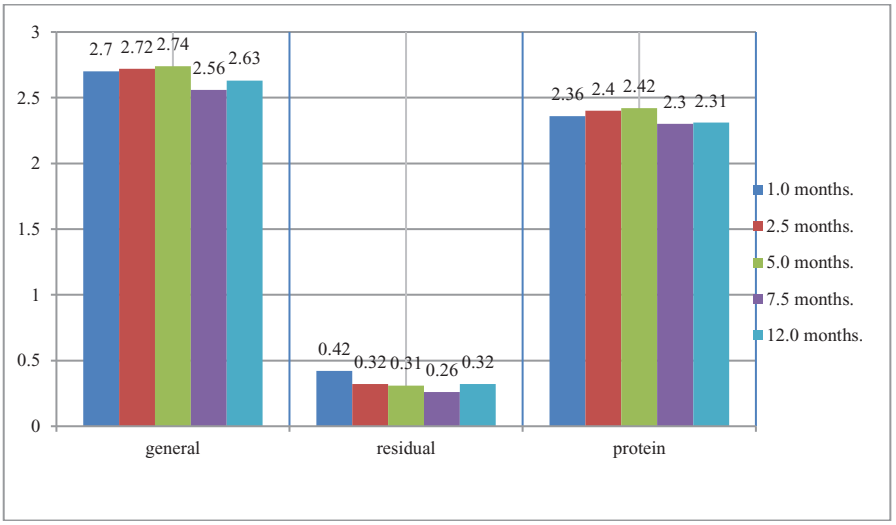

Fig. 2. Total nitrogen content in the long back muscles of Hissar sheep (in grams).

Table 2. Content of total nitrogen and its fractions in meat and muscles of the longest back in Hissar-Kyrgyz sheep (in grams).

Indicators	Nitrogen	Age in months				
		1.0	2.5	5.0	7.5	12.0
Average meat sample	General	2.80	2.67	2.65	2.84	2.67
	Residual	0.32	0.40	0.33	0.34	0.36
	Protein	2.51	2.26	2.32	2.50	2.31
Longest back	General	2.82	2.64	2.70	2.56	2.65
	Residual	0.39	0.35	0.29	0.25	0.32
	protein	2.44	2.25	2.39	2.32	2.33

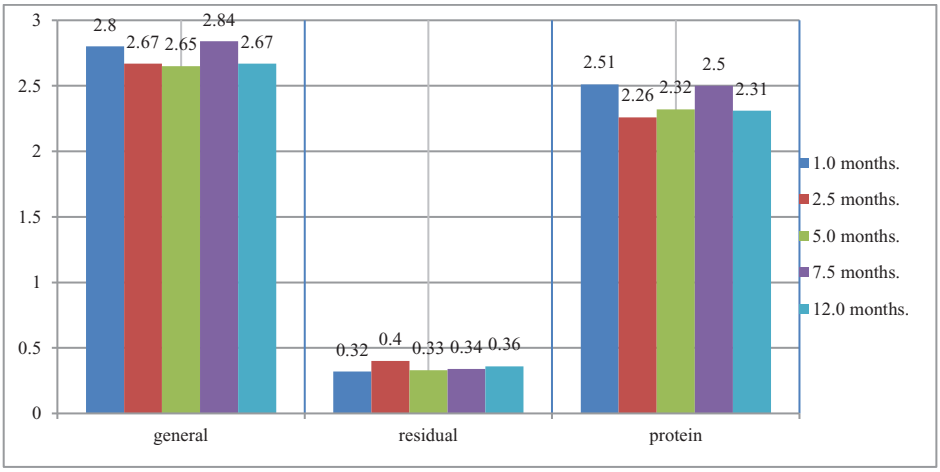

Fig. 3. Content of total nitrogen and its fractions in meat from Hissar-Kyrgyz sheep (in grams).

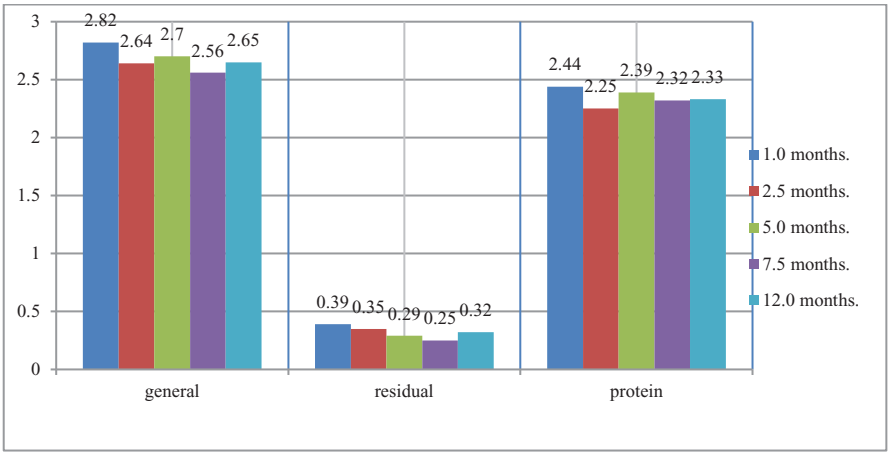

Fig. 4. Total nitrogen content in the muscles of the longest back in Hissar-Kyrgyz sheep (in grams).

From the data of Tables 1 and 2 it is obvious that the same tendency is observed, i.e. concentration of total, protein and residual nitrogen decreases with age. So in the average meat sample the concentration of protein nitrogen was the highest in monthly lambs of Kurdy sheep (2.33-2.51), by two months of age its concentration decreases by 3.87 g in Hissar and 9.97 g in Hissar-Kyrgyz sheep. Later on, some recovery of protein nitrogen concentration is observed, but it approaches its initial level only by 7.5 months of age, and its concentration was within 2.32 - 2.50 g in Kurdish sheep. Further accumulation of protein nitrogen concentration in the average sample has a wave-like character.

Some increase in residual nitrogen in the first months of life in the average meat sample was noted, which apparently creates more favourable conditions for the liver for protein synthesis by.increasing the fund of protein-free substances. The most dramatic change in the level of residual nitrogen is observed in the average meat sample in Hissar-Kyrgyz sheep at 2.5 months of age, and in Hissar sheep at one month of age.

In the longest muscle of the back there is an increase in the content of protein nitrogen, from 2.36 to 2.42 g in one month to 5 months of age in Hissar sheep, and in Hissar-Kyrgyz sheep on the contrary decreases from 2.44 to 2.39 g at the same age.

Assessing the obtained data as a whole, we can conclude that there are a number of qualitatively different age periods in the ontogenesis of turkey sheep. To the first period of them can be referred the period from the day of birth to one month of age, in which the adaptation of animals to new habitat conditions takes place. It is characterised by a high level of metabolic processes and is the most demanding to living conditions. In the second period (2-3 months of age) biosynthetic processes are activated, the activity of nucleic enzymes in the main organs increases, acids and proteins are accumulated. During this period, animals respond to improved feeding with good gains. From 5 months of age, a turning point period begins, associated with the final transition to vegetable nutrition.

Shifts in enzyme activity, content of basic metabolites and macro energy phosphates are replaced by relative stabilisation of metabolic processes with final establishment of basic physiological functions characteristic of adult animals.

4 Conclusions

Thus, it can be concluded that changes in the composition of growth and carcasses of animals in general are subordinated to the general biological laws of postembryonic development and are associated with the formation of meat productivity of animals.

These regularities should be taken into account when using turkey sheep for meat and lard production, as the character of growth separately with tissue and organs where closely related to metabolism in ontogenesis and the ability to biosynthesis of proteins and esters.

As animals age, there is a gradual decrease in moisture and an increase in fat in the meat and in some muscles and curd fat. The caloric content changes accordingly.

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