



Lamb Meat and Offal in the Early Postnatal Period

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Abstract

Many countries impose restrictions on slaughtering animals before 14 days of age, while many others do not. This study aims to determine whether there is a significant difference in chemical composition and nutritional value between lambs slaughtered at different days after birth. The study was conducted at the "Elite" experimental farm in the Kyrgyz Republic. The research involved the formation of eight groups of animals, each consisting of five individuals, categorized based on their date of birth. The chemical analysis of the meat and associated by-products was performed on lambs slaughtered immediately after birth and at intervals of 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13, and 14-15 days to determine moisture, protein, fat, ash, and extractive content. Only a minor variation in moisture, protein, and fat levels was observed in the meat and by-products of lambs aged 1-6 days, otherwise there was no difference noted.

Keywords: Chemical composition of meat, offal, lambs, young animals, harmlessness of meat

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1. Introduction

In some countries, there are situations in which it is necessary to slaughter animals (in cases of liquidation of economically bankrupt farms and farms, in the fight against certain infectious diseases, after environmental disasters and natural disasters). However, in some countries, it is not allowed to slaughter lambs for meat before 14 days of age. The practice of not slaughtering lambs for meat before they reach a certain age, often around 14 days, is mainly due to concerns related to animal welfare, meat quality, and food safety. Slaughtering very young lambs can result in lower-quality meat with immature flavor and texture. It may also raise ethical concerns about the treatment of young animals during slaughter. Allowing lambs to grow for a short period before slaughter helps improve meat quality, ensure humane treatment, reduce food safety risks, and meet consumer preferences. Regulations and standards regarding lamb slaughter age vary by country and are influenced by cultural and regional factors. Therefore, when slaughtering healthy animals younger than 14 days, carcasses and offal are sent to feed animals or disposed of [1-3]. At the same time, in some countries there is no such age limit for the slaughter of animals for meat. For example, in African and South-Eastern Asian countries, on the contrary, meat of newborn animals

under the age of 13-14 days is recommended for food purposes [4-7]. This tradition values the tenderness and unique flavor of very young animal meat, which is considered a delicacy. Additionally, it can be resource-efficient, has a shorter production cycle, and is believed to have specific nutritional benefits. However, preferences for this practice can vary within and between regions, and cultural factors strongly influence its acceptance. In connection with the disagreements that arose, we conducted a comparative analysis of the meat of ram carcasses from birth to 15 days of age. Therefore, if the safety of meat of animals slaughtered before the age of 14 days is proved, this would be a large reserve in the balance of nutrition of the population and providing it with proteins [8]. Lamb meat is known for its high-quality protein, essential amino acids, vitamins (such as B12), and minerals (like iron and zinc) [9]. If the meat from younger lambs is proven safe, it could provide a valuable source of these nutrients [10-11]. Younger animals typically require less feed and resources to reach slaughter weight compared to older animals [12-13]. If lambs can be raised to a nutritious and safe size in a shorter period, it could lead to more efficient use of agricultural resources [14].

The purpose of the study was to analyze how the chemical composition of lamb meat and offal changes during the early stages of life and whether these differences have practical implications in terms of meat quality or nutritional value.

2. Material and methods

The work was carried out in the experimental farm "Elite" of the Kyrgyz Republic. To determine the quality and suitability of lamb meat from birth to 15 days of age, eight groups of animals were formed, depending on the day of birth, five heads in each group. In the chemical study of meat, moisture, protein, fat, ash, and extractives were determined in the meat and by-products of lambs killed immediately after birth and at the age of 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13 and 14-15 days.

Table 1 shows that the moisture in the meat of 1-2-day-old lambs is 77.94-78.96%, in the meat of 3-8-day-old - 78.44-79.18%, the meat of 9-12-day-old - 78.49-78.54%, in the muscle tissue of 13-day-old lambs - 78.54%, and control 14-15-day-old animals - 78.08%. Thus, the meat of 1-4-day-old lambs contained moisture 0.86-1.1% more than the meat of 14-15-day-old lambs. The meat of 5-6-day-old lambs contained moisture 0.76% more moisture than the meat of control animals. The meat of 7-13-day-old lambs contained only 0.36-0.46% more moisture than the meat of 14-15-day-old animals.

The protein content in the meat of newborn lambs was 18.41-18.56%, in 3-8-day-old - 18.24-18.88%, in the muscle tissue of 9-13-day-old animals - 18.56-18.89%, and in the meat of control 14-15-day-old lambs - 18.88%. The protein content of the muscle tissue samples is not subject to significant fluctuations compared to the change in fat content.

3. Results and Discussion

The amount of fat in the meat of 1-4-day-old lambs was 1.53-1.93%, in the muscle tissue of 5-8-day-old lambs fat was 2.42-2.86%, and in the meat of 9-13-day-old lambs - 3.32-3.77%. In the muscle tissue of control lambs, fat was 3.81%. According to the state standard of Russia, the fat content for lamb is allowed to be 3.74-15.3, which is slightly higher than its content in the meat of 1-13-day-old lambs. There was no pronounced difference in the ash content in the meat of all newborn lambs. If in the first 7-8 days the ash level was 1.10-1.12%, then in subsequent slaughter periods, including control 14-15-day-old lambs, the ash was 1.12-1.13%. The chemical composition of by-products: liver, heart, lungs, kidneys, tongue, spleen - presented in Table 2. From the data of this table, it can be seen that the moisture in the liver of lambs of 1-6 days of age is 78.50-78.78%. In the liver of 7-13-day-old lambs - 77.21-78.04%, and in the liver of control 14-15-day-old animals - 77.21%. In terms of protein content in the liver parenchyma, only 1-4-day-old lambs differ slightly (17.92-18.16%). In the liver tissue of 5-13-day-old lambs, the protein content was 18.06-18.52%, and in control lambs - 18.60%. In terms of fat content, the liver of lambs of 9-13 days of age (2.64-2.88%) is close to that of control lambs (3.40%), and in lambs in the first 7-8 days after birth, the fat in the liver tissue did not exceed 1.92-2.38%.

The ash in the liver of all experimental and control lambs was almost at the same level and amounted to 1.33-1.39%. The moisture content in the heart muscle was 0.55-

1.50% higher only in lambs 1-6 days of age. In the heart muscle of H-13-day-old lambs, it was about the same (77.98-77.66%) as in lambs of 14-15 days of age (77.62%). In terms of protein content in the heart muscle, a slight difference was noted in lambs in the first 1-6 days after lambing (17.43-17.83). In the heart of lambs for 7-13 days, as well as in the heart muscle of control animals, the protein content was 18.17-18.73%.

There was also no difference in the content of fat and ash in the heart muscle of experimental and control lambs. The amount of fat in the heart muscle of lambs was 4.36-4.56%, and ash - 1.09-1.11%. The chemical composition of the lung parenchyma also changed slightly with increasing age. The moisture content of 1-10-day-old lambs exceeded that of control animals by 0.28-1.38%. And the difference in the moisture content in the lung tissue of 11-13- and 14-15-day-old lambs was practically not observed (79.96-79.62% and 77.44%). The protein content in the lung tissue of 1-6-day-old lambs was 16.19-16.57%, and in the lungs of 7-10-day-old lambs - 16.70-16.81%. The lung tissue of 11-13- and 14-15-day-old animals had no pronounced differences in protein (17.07-17.26 and 17.40%). The fat and ash content in the lung tissue of all experimental and control lambs was approximately the same and was 2.13-2.30% and 0.81-0.86%, respectively. The chemical composition of the kidney parenchyma in terms of moisture, protein, fat, and ash in lambs for 1-13 days practically did not differ from the indicators of kidney tissues of 14-15-day-old animals.

The absence of a pronounced difference in the content of moisture, protein, fat and ash was also noted in the study of tongue tissues. At the same time, the indicators of 9-13-day-old lambs were almost the same as those of control 14-15-day-old animals. Chemical studies of the spleen have also shown the proximity of the content of moisture, protein, fat, and ash in all experimental and control lambs. In most of the animals studied, the spleen contained moisture 79.14-79.44%, protein 16.98-17.10%, fat 2.82-3.00%, ash 1.72-1.83%. The obtained results indicate that the chemical composition of muscle tissue and parenchyma of internal organs of 7-13-day-old lambs is close to that of 14-15-day-old lambs, with only slight differences in moisture, protein, and fat content in younger lambs (1-6 days old), which corresponds with other studies reviewed. A study aimed at comparing the chemical composition and fatty acid content of the muscle tissues of lambs and adult sheep was conducted by Junkuszew and coauthors [15]. Their study suggests that there may be noticeable differences in the chemical composition of meat at different stages of a sheep's development. Another study by Payne et al. [16] evaluated consumer eating quality scores from various cuts of new season (average age = 240 days) and old season lambs (average age = 328 days). It found little difference in eating quality between the two age classes for most cuts. Other relevant studies include those focusing on consumer assessments of sheep meat, the impact of breeding values on meat quality, and sensory scores in lamb meat [17, 18]. These studies often explore the influence of age, breed, and rearing conditions on meat quality characteristics [19, 20].

These articles contribute to the understanding of how lamb age can affect meat quality, with some studies suggesting minimal impact while others highlight specific differences.

Table 1. The chemical composition of lamb meat in the early postnatal period

Age of lambs, days	Content, %			
	moisture	protein	fat	ash
At birth	79.96±0.78	17.41±0.77	1.53±0.19	1.10±0.05
1-2	79.94±0.83	17.56±0.65	1.68±0.17	1.08±0.06
3-4	79.18±0.66	18.24±0.43	1.93±0.21	1.12±0.03
5-6	78.84±0.72	18.62±0.69	2.42±0.14	1.12±0.01
7-8	78.44±0.77	18.88±0.56	2.86±0.17	1.12±0.01
9-10	78.49±0.88	18.89±0.41	3.32±0.15	1.13±0.02
11-12	78.54±0.68	18.72±0.71	3.42±0.16	1.12±0.04
13	78.54±0.86	18.56±0.59	3.77±0.19	1.13±0.06
14-15 (control)	78.08±0.79	18.88±0.61	3.81±0.21	1.13±0.05

Table 2. The chemical composition of lamb by-products in the early postnatal period

Age of lambs, days	Moisture, %	Protein, %	Fat, %	Ash, %
	liver			
At birth	78.77±0.76	17.98±0.53	1.92±0.15	1.33±0.02
1-2	78.78±0.68	17.92±0.55	1.98±0.11	1.32±0.02
3-4	78.39 ±0.82	18.16±0.48	2.11±0.17	1.34±0.03
5-6	78.50 ±0.66	18.06±0.55	2.16±0.15	1.34±0.02
7-8	78.04 ±0.55	18.22±0.53	2.38±0.13	1.35±0.02
9-10	77.98±0. 66	18.21±0.61	2.64±0.17	1.37±0.03
11-12	77.93±0.86	18.24±0.48	2.86±0.15	1.37±0.03
13	77.21±0.72	18.52±0.55	2.88±0.16	1.39±0.02
14-15 (control)	77.21±0.88	18.60±0.61	3.40±0.13	1.39±0.03
spleen				
At birth	79.44±0.88	16.98±0.43	2.86±0.18	1.72±0.02
1-2	79.38±0.82	17.04±0.38	2.82±0.22	1.76±0.03
3-4	79.29±0.76	17.01±0.46	2.94±0.46	1.76±0.03
5-6	79.21±0.82	16.99±0.38	2.98±0.18	1.82±0.03
7-8	79.21±0.78	17.10±0.42	2.88±0.14	1.81±0.02
9-10	79.27±0.76	16.98±0.51	2.96±0.22	1.79±0.02
11-12	79.14±0.64	17.10±0.46	2.96±0.16	1.81±0.02
13	79.17±0.76	16.86±0.52	3.00±0.20	1.83±0.03
14-15 (control)	79.15±0.84	17.06±0.54	3.00±0.22	1.79±0.03
tongue				
At birth	78.99±0.52	17.66±0.48	2.46±0.19	0.87±0.02
1-2	78.82±0.76	17.82±0.42	2.49±0.11	0.87±0.03
3-4	78.54±0.88	17.96±0.34	2.62±0.17	0.88±0.02
5-6	78.58±0.66	17.86±0.48	2.68±0.15	0.88±0.02
7-8	78.72±0.74	17.63±0.48	2.76±0.19	0.89±0.03
9-10	77.98±0.68	18.60±0.46	2.54±0.17	0.88±0.02
11-12	77.92±0.84	18.32±0.38	2.88±0.11	0.89±0.02
13	77.94±0.66	18.20±0.42	2.96±0.15	0.90±0.03
14-15 (control)	77.96±0.74	18.34±0.54	2.79±0.19	0.91±0.02
heart				
At birth	79.12±0.88	17.43±0.48	4.36±0.11	1.09±0.02
1-2	79.09±0.66	17.48±0.33	4.32±0.17	1.10±0.03
3-4	78.92±0.76	17.60±0.36	4.38±0.14	1.10±0.02
5-6	78.68±0.72	17.83±0.42	4.38±0.17	1.11±0.02
7-8	78.17±0.68	18.17±0.27	4.56±0.13	1.10±0.03
9-10	78.07±0.84	18.24±0.38	4.58±0.14	1.11±0.03
11-12	77.98±0.76	18.36±0.42	4.56±0.17	1.10±0.02
13	77.66±0.84	18.73±0.36	4.52±0.13	1.09±0.02
14-15 (control)	77.62±0.88	18.72±0.42	4.56±0.17	1.10±0.03
lungs				

At birth	80.82±0.72	16.19±0.46	2.18±0.13	0.81±0.03
1-2	80.76±0.76	16.34±0.42	2.16±0.11	0.81±0.02
3-4	80.68±0.84	16.33±0.48	2.17±0.09	0.82±0.02
5-6	80.48±0.88	16.57±0.39	2.13±0.11	0.82±0.03
7-8	80.24±0.76	16.70±0.39	2.22±0.10	0.84±0.02
9-10	80.12±0.78	16.81±0.44	2.26±0.13	0.82±0.02
11-12	79.96±0.82	17.07±0.52	2.30±0.10	0.83±0.03
13	79.62±0.68	17.26±0.48	2.28±0.11	0.84±0.03
14-15 (control)	79.44±0.88	17.40±0.52	2.30±0.13	0.86±0.03

Although issues of taste and consumer perception are controversial, the economic and environmental benefits of shorter growing periods should be emphasized [21-23]. Shorter rearing periods may reduce the environmental footprint associated with lamb production. This includes lower emissions of greenhouse gases, reduced water usage, and less land needed for grazing or feed production. Farmers might benefit economically from faster production cycles, allowing for quicker turnover and potentially higher yields from their flocks. Increasing the availability of safe and nutritious meat could be crucial for food security, especially in regions where access to diverse protein sources is limited. However, it's important to note that these benefits hinge on the proven safety and ethical considerations of slaughtering lambs at such a young age. Animal welfare concerns, along with the physiological development and health status of the lambs, would need to be carefully considered and addressed.

4. Conclusions

Thus, analyzing the chemical composition of muscle tissue and parenchyma of internal organs, it can be concluded that a slight difference in the content of moisture, protein and fat was noted only in the slaughter products of individual lambs of 1-6 days of age. And the chemical parameters of meat and offal of 7-13-day-old lambs were close to those of control 14-15-day-old animals.

Obtained results require to conduct further studies to confirm these findings across different breeds and rearing conditions. This would help to establish a more generalized understanding of the nutritional value of lamb meat at different ages.

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