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RAKESH ORUGANTI
Editor In Chief

+91 9989292561

Huda Techo Enclave, HITech City Madhapur, Hyderabad, 500081

Info.ijiemr@gmail.com



**IMPACT OF ECHINOCOCCOSIS ON QUALITY OF SHEEP MEAT
IN THE SAMARKAND**

**Odil Achilov^{1*}, Saydullo Murodov², Pardakul Khakberdiyev³, Furkat
Ibragimov⁴, Samarjon Khalikov⁵, Nafisa Abduraxmanova⁶**

¹PhD student, Samarkand institute of veterinary medicine, Samarkand, Uzbekistan

^{2,3,4,5} Samarkand institute of veterinary medicine, Samarkand, Uzbekistan

⁶Master of Samarkand institute of veterinary medicine, Samarkand, Uzbekistan

*Corresponding autor: odiljon.achilov@mail.ru

ABSTRACT. The conducted studies of the meat of healthy and echinococcosis sheep's allow us to conclude that this disease has some influence on some parameters that determine the quality of meat. According to a study of 648 sheep slaughtered in slaughterhouses in the Samarkand region, the average incidence of echinococcosis was 12.8%. Echinococcosis leads to a decrease in the nutritional value of meat, which is expressed by low levels of protein and fat. This indicates that during invasion by echinococcosis in the studied tissues and organs, the pH indicator shifts towards an alkaline reaction due to the primary decay of the protein. The high moisture content in the meat of animals with echinococcosis is an unfavorable factor affecting the resistance of meat to long-term storage.

KEYWORDS. Echinococcosis, safety, quality, sheep, mutton, muscle, slaughterhouse.

INTRODUCTION

Nowadays, the progress in the sphere of animal husbandry plays an important role in establishing economy of Uzbekistan and improving the welfare of the people. The study helminthiasis's condition of the parenchymal organs of sheep in the Samarkand region, the development and implementation of improved modern measures to combat, prevention of death and forced slaughter of animals due to the most common diseases will increase the production of meat and meat products. Accordingly, the leadership of the republic pays great attention to the further development of sheep breeding in personal assistants, agricultural farming and farms.

The concept of healthy nutrition of the population and the state policy for creating the foundations of biological safety in our country involve the modification of the legislative framework and regulatory and methodological support of state supervision over the quality of animal products, the harmonization of which

with international standards is an urgent area of veterinary sanitary examination and food safety of Uzbekistan [1,2,23].

In this connection, it is necessary to constantly improve and test modern scientific achievements and carry out systematic control aimed at preventing substandard products from entering the sale, in case of animal helminthiasis, in order to eliminate harmful effects on human health [12,15].

The causative agent of echinococcosis - we all know that all stages of development of echinococcus granulosus take place in endogenous conditions and invertebrates do not participate in its development. In each area there are intermediate (farm animals, people), as well as main (dogs and some other carnivorous animals) hosts of the parasite. Thus, echinococcosis can spread to all regions of the country. Most importantly, the anthropogenic factor plays a key role in the infecting of dogs, which are the main host, with echinococcus, the effect of which increases year by year, as a result



echinococcosis is increasingly spreading among farm animals and people [6]. *Echinococcosis* - are chronic helminthiasis characterized by destructive lesions of the liver, lungs and other organs, allergization of the body and severe complications, often leading to disability and death. [18,19]. It is a new disease in many parts of the world, especially in the countries of the former Soviet Union, Eastern Europe and Asia [22,24]. In Uzbekistan, the prevalence of CE in sheep has increased from 45% to 62% between 1990 and 2002 (Aminjanov and Aminjanov, 2004) [7].

There are difficulties in early diagnosis, surgical interventions are carried out in advanced stages, and there are certain difficulties in carrying out comprehensive preventive measures that are associated with serious economic problems [4].

WHO and the International Bureau of Epizootic have included echinococcosis in the list of diseases subject to radical eradication [3,14]. In a number of countries (New Zealand, Argentina, Greece, Turkey, Spain, Italy, etc.), for which echinococcosis is a marginal pathology, its elimination has been raised to the rank of a state task, special national programs are being developed to control and prevent the disease. Thanks to such programs, in a number of countries previously unfavorable for echinococcosis (Iceland, Norway, Australia, and Tasmania), the disease has practically been eradicated [25]. Echinococcosis not only harms the health of animals and humans, but also causes economic damage, and therefore continues to be an important public problem [5,8,9,10,11].

Thus, given that animal husbandry is a traditional branch of agriculture, and meat products constitute a significant proportion of the population's diet, research and development of scientifically grounded criteria for assessing the quality and safety of sheep slaughter products in case of echinococcosis in Uzbekistan remains a problem, the relevance of which is beyond doubt, which determined the purpose of these studies.

The aim of the study was to determine the quality and safety of meat and meat

products from sheep infected with echinococcosis.

MATERIALS AND METHODS

Study area and animals

The study was conducted from January 2020 to December 2020 in the slaughterhouses in Samarkand. A total of 648 slaughtered sheep in age of 2 to 4 years were observed.

Post mortem examination

In the process of post-mortem veterinary and sanitary examination, echinococcal blisters of various sizes were found in the liver and lungs, the affected organs had a hard consistency and a bumpy surface.

Healthy and echinococcosis-infected sheep were carried out in accordance with the rules of veterinary-sanitary examination in determining the biochemical parameters of meat and meat products [21].

The organoleptic characteristics of meat and internal organs were studied in accordance with GOST (7269-79) and legislative standards (appearance and color, texture, smell of meat condition of fat and tendons) [16].

The purity, chemical and microscopic analysis of meat was carried out in accordance with the standard «GOST 23392-78» [17].

Data analysis

Basic data entry and handling were done using MS Excel (2010). The significance of differences among chemical values of each sample was determined by analysis of variance (ANOVA) and t-test. Prevalence of echinococcosis was calculated as the number of sheep found infected with echinococcosis expressed as the percentage of the total number of slaughtered. Differences were considered significant at $p < 0.05$ level.

RESULTS

Post mortem examination

In the process of post-mortem veterinary and sanitary examination, echinococcal blisters of various sizes were

found in the liver and lungs, the affected organs had a hard consistency and a bumpy surface. The condition of patients with echinococcosis and healthy animals was average.

At postmortem examination, a visual inspection was made of the condition of the carcasses, the head and regional lymph nodes. In carcasses of healthy animals, the muscles were well developed, thoracic and lumbar vertebrae, hips were allocated not sharply; the neck, scapula's, forward ribs and legs, the pelvic cavity and area of a groin had fat deposits in the form of small sites. In terms of organoleptic indicators, the meat of sick animals did not differ from that of healthy animals the carcasses of the animals had a dark red color, with a specific smell, dense consistency; the cut surface was moderately moist.

In carcasses of animals, infected by echinococcosis, there were less developed muscles, prominent spinous processes of vertebrae; a poor development of the fatty layer was noted.

During the study, from 648 sheep obtained from the slaughterhouse, 83 (12.8%) animals were positive for echinococcosis. Contamination by echinococcosis of sheep had rather stable character and slightly varied depending on a season of slaughter of sheep (Table 1).

Table 1. Dynamics of echinococcosis infection of sheep on seasons of year (2020)

Seasons	Number of sheep		Prevalence %
	Investigated	Infected	
Winter	195	24	12,4
Spring	173	25	14,5
Summer	115	13	11,3
Autumn	165	21	12,8
Total	648	83	12,8

In the autumn the contamination of sheep was, on the average, 12.8%. The infection prevalence was rather high during the spring period and reached 14.5%. In the summer and winter the prevalence was lower,

11.3% and 12.4%. The average level of contamination of sheep was 12.8%.

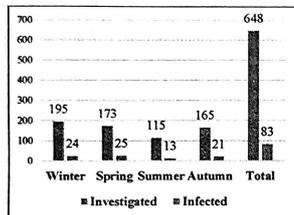


Figure 1. Dynamics of echinococcosis infection of sheep on seasons of year (2020)

Biochemical properties of muscle tissue in sheep.

As a result of the study, it was found that in sheep infected with echinococcosis, the moisture content in the muscle tissue is higher than in healthy animals and is 65.8±0.30 and 72.7±0.13 g/100g, respectively. This demonstrates an increase in muscle hydration. Protein concentration in healthy animals was 10% higher than in infected animals. The content of fat in muscles in sick sheep was significantly lower, and amounted to 40% of the value in healthy livestock. The energy value of mutton also depended on the presence of infestation in animals and was lower in sick sheep by approximately 27 calories per 100g of sample. Infection with echinococcosis also causes significant changes in mineral metabolism: the content of the investigated macro and microelements decreases (table 2).

It is known that infection with echinococcosis cysts reduces the level of protein in animal tissues. According to our research, the muscles of healthy sheep contain 19.46±0.03 g/100g of protein, while in infected animals this figure was lower and amounted to 18.43±0.18g/100g. The fat content in the muscles of the infected animals was also 38% less than that of healthy animals (Table 2, Figure 3).

Table 2. Nutritional value of mutton

Indicators	Meat of animals	
	Infected by echinococcosis	Healthy
Nutrition value (g/100 g)		
Proteins	18,43±0,18	19,46±0,3
Fats	9,27±0,26	15,3±0,04
Moisture content	65,8±0,30	72,7±0,13
Ashes	0,92±0,03	0,83±0,02
Caloric value cal/100 g		
	155	182
Vitamins (mg/100 g)		
Vitamin A	0,012±0,01	0,027±0,01
Vitamin E	0,6±0,03	0,8±0,20
Vitamin PP	4,352±0,03	4,626±0,02
Vitamin B ₁	0,7±0,01	0,83±0,02
Vitamin B ₂	0,133±0,01	0,192±0,01
Mineral elements (mg/100 g)		
Potassium (K)	318,0±0,3	329,0±0,4
Calcium (Ca)	8,9±0,02	9,2±0,1
Magnesium (Mg)	21,3±0,02	24,1±0,1
Sodium (Na)	97,8±0,1	98,9±0,7
Iron (Fe)	1,94±0,03	1,99±0,2
Zinc (Zn)	2,63±0,2	2,75±0,3

The research results show that in the meat of echinococcosis-infested sheep, the calcium concentration reached 8.9±0.21 mg/100g and was 4.3% less than in healthy animals; magnesium - 21.3±0.2 mg/100g and 11.6%; sodium - 97.8±0.1 mg/100g and 2%; potassium 318.0±0.3mg/100g and by 4.2%, respectively.

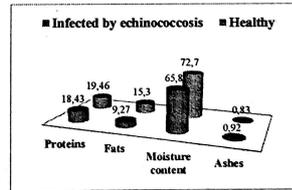


Figure 2. Nutritional value of mutton (g/100g)

The difference in the concentration of trace elements Fe and Zn in infected and uninfected animals was 2.7 and 3.9%, respectively.

According to the data obtained, with echinococcosis, there is also a change in the quantitative indicators of the vitamin composition of sheep slaughter products. For example, in the meat of animals infected with echinococcosis, the content of vitamin A was 0.012±0.01 mg/100g and was less by 57.7%, compared with clinically healthy sheep; vitamin E - 0.6±0.01 mg/100g and by 24.2%; vitamin B₁ - 0.7±0.01mg/100g and by 8.7%; vitamin B₂ - 0.133±0.01 mg/100g and by 31.4%; vitamin PP - 4.352±0.03 mg/100g and 3.2%, respectively (table 2, figures 3,4).

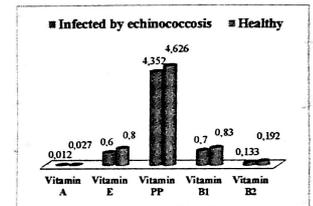


Figure 3. Nutritional value of mutton, vitamins (mg/100g)

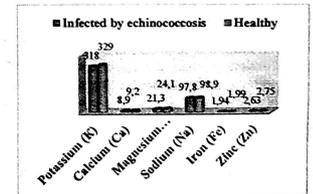


Figure 4. Nutritional value of mutton, mineral elements (mg/100g)

It should also be noted that the energy value of the contaminated meat was 15.2% lower than that of the muscle tissue of healthy sheep.

With echinococcosis of sheep, qualitative and quantitative changes in the structure of the amino acid composition of muscles were established. The total amino acid content of the infected animals was lower than that of healthy sheep. Moreover, the total amount of essential amino acids in the samples from the invasive material, as a whole, was lower by 4.4%, compared with healthy animals. Whereas the same indicator relative to nonessential amino acids was only 1.5% (table 3).

Table 3. Amino acid composition of mutton.

Indicators	Animal meat	
	infected with echinococcosis (n = 15)	healthy (n = 15)
1	2	3
Essential amino acids, mg/1g		
Arginine	11,5±0,03	12,15±0,42
Valine	10,21±0,01	10,98±0,58
Histidine	6,06±0,05	6,03±0,45
Isoleucine	9,04±0,01	9,27±0,33
Leucine	14,23±0,02	14,93±0,62
Lysine	15,57±0,01	16,56±0,41
Methionine	4,19±0,02	4,27±0,37
Threonine	7,96 ±0,02	8,32±0,51
Phenylalanine	7,31±0,02	7,63±0,54
Tryptophan	2,12±0,01	2,24±0,52
Sum of essential amino acids	87,99±0,01	92,38±0,22
Nonessential amino acids		
Alanine	11,28±0,00	11,27±0,41
Asparagine	17,92±0,13	18,41±0,16
Glycine	8,86±0,01	9,01±0,15
Glutamine	31,48±0,01	32,17±0,44
Proline	8,57±0,01	8,59±0,41
Oxiproline	3,45±0,01	3,46±0,39
Serine	8,64±0,01	8,72±0,42
Tyrosine	6,46±0,01	6,48±0,41
Cystine	2,46±0,01	2,49±0,25
Sum of nonessential amino acids	99,12±0,04	100,60±0,23
Sum of amino acids	187,11±0,05	192,98±0,24

Thus, with echinococcosis in the muscular tissue of sheep, the total amount of essential amino acids is 3 times lower than that of nonessential amino acids. The significance of these data determines that the first amino acids determine the nutritional value of mutton to a greater extent than the second.

In addition to quantitative changes in the amino acid content of the muscle tissue of the invaded animals, there is a change in the amino acid profile of the proteins of the studied tissue. Thus, with echinococcosis, the most noticeable decrease in the content of such essential amino acids as valine (by 6.7%), arginine (by 6.2%), lysine (by 5.7%), tryptophan and leucine (by 4.4%), as well as a number of other amino acids (Table 3, Figures 5,6) in comparison with their content in the protein of muscle tissue of healthy animals.

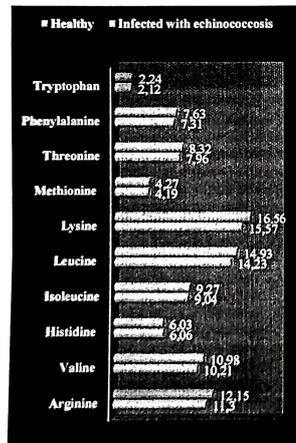


Figure 5. Amino acid composition of mutton, essential amino acids (mg/1g)

indicators of nutritional value, mineral elements and vitamins, and essential fatty acids decrease.

The present results reveal a significant change in the quality and quantity of the amino acids profile of proteins in the muscle tissue of sheep infected with echinococcosis. This is connected, in our opinion, with localization of echinococcosis cysts. As all samples of the studied muscles were selected from sheep with infected livers, for this reason there were disruptions in regulation of protein exchange in the presence of helminth larvae.

Studies of the chemical composition of meat and meat products of sheep infected with echinococcosis established that the maintenance of protein and fat decreases, and moisture increases in the Kazakhstan (Z.Valieva et al.) [27].

The results of the current study have shown that nutrient composition, fatty acid profile, levels of amino acids, vitamins and mineral elements in meat from healthy animals differ in results obtained from various regions of the world (Levies et al., 1995; Brzostowski et al., 2004) [20,13]. Williams (2007) indicated that nutritional composition of mutton depends on breed of sheep, feed, season and cut of meat [26].

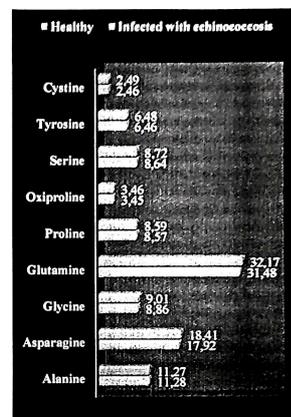


Figure 6. Amino acid composition of mutton, non-essential amino acids.

DISCUSSION

Our research demonstrated that the average contamination of *E. granulosus* of slaughtered sheep aged 2 to 4 sold through the market in the Samarkand region of Uzbekistan is 12.8%. The incidence of *E. granulosus* infection in adult sheep did not display large fluctuations on seasons of the year. In our opinion, this is explained by the constant character of the invasion by oncospheres during the lifetime of the sheep. Accordingly, the lowest prevalence of infection of sheep established during winter and summer seasons of year.

Thus, it has been established that with the invasion of echinococcosis in meat of sheep, organoleptic and biochemical properties significantly decrease, the pH value in the tissues of the invaded animals shifts towards an alkaline reaction, and quantitative

The biochemical analysis also showed that in the mutton from sheep infected by hydatidosis, in comparison with muscle tissue of healthy animals, the amount of protein, fat and calcium, calorific value significantly decrease. Besides, in the meat of animals infected with echinococcosis there is a substantial increase of humidity and amount of ashes.

The results of the conducted studies allow us to conclude that biochemical changes in the meat of invaded animals are the reason for a decrease in its biological and nutritional value.

CONCLUSION

Studies on the meat of healthy and echinococcosis-infected sheep have led to the conclusion that it affects some parameters that



determine meat quality. According to organoleptic tests, the meat of healthy animals is no different from the meat of animals infected with echinococcosis. The biochemical changes shown in the muscle tissue of infected sheep led to a decrease in the biological value of the meat.

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