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RESEARCH ARTICLE

Change in the Enzymatic Activity of Aspartate Aminotransferase in the Blood of Goats Related to the State of Animal Health

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Abstract

This article presents experimental studies of the detection of Aspartate AminoTransferase (AST) activity of blood enzymes of goats infested by nematodes in the Khizi-Khachmaz zone of Azerbaijan in different seasons of the year.

An increase in the permeability of cell membranes, as a result of which enzymes entering the blood, provoke a sharp increase in their enzymatic activity, which is an indicator of the pathological process in the animals has been experimentally revealed in pathological processes.

The determination of aspartate aminotransferase (AST) activity of the blood enzymes of goats of the Khizi-Khachmaz zone of Azerbaijan was carried out spectrophotometrically according to the method of Bergmeyer H.U., Hoder M., Rej R. (1986), spectrophotometer Specol 1500 (Analitik Jena), at a wavelength of 540 nm.

The maximum peak intensity of aspartate aminotransferase activity of blood enzymes of goats infested with nematodes was revealed. The maximum value of aspartate aminotransferase activity was noted in spring and summer, and minimal in autumn and winter, reaching values of: 94.5 ± 3.5, 68.3 ± 3.4, 46.2 ± 2.1 and 44.1 ± 2.4 U / L, respectively.

Aspartate-aminotransaminase enzyme activity in goat blood reaches the maximum value in the spring season (94.5 ± 3.5 U / L), and minimal in the autumn season (42.1 ± 1.1 U / L).

Keywords: Aspartate-Aminotransaminase; Goats; Blood; Trematodes; Enzyme Activity

Introduction

Parasite numbers rise with time when conditions are suitable and internal parasite burdens impact on the health and well-being of the animal when their numbers grow beyond what the animal can tolerate. Nematodes are pathogenic parasites, causing disease in the host. Usually they live in the digestive system ofthe host. Haemonchus contortus attaches to the wall of the abomasum in sheep and goats, feeding on the host's blood, causing aneamia. Other nematodes usurp the nutrients eaten by the host, causing weight loss [1].

Authors studied serum enzymes in 163 apparently healthy goats from three indigenous goat breeds of Ethiopia. The effect of breed, age, sex and season on Alanine Amino Transferase (ALT)/Glutamic Pyruvic Transaminase (GPT), Aspartate Amino Transferase (AST)/Glutamic Oxalacetic Transaminases (GOT), Alkaline Phosphatase (ALP) and Acid Phosphatase (AcP) levels was assessed. The mean serum enzymes levels of the indigenous Arsi-Bale, Central Highland and Long- eared Somali goat breeds ranged from 14.0-20.2 iu L(-1) for ALT/GPT, from 43.2-49.3 iu L(-1) for AST/GOT, from 83.7-98.8 iu L(-1) for ALP, and from 2.99-4.23 iu L(-1) for AcP, were within the normal range for goats elsewhere. Breed had significant influence on AST/GOT values. Sex had significant effect on ALT/GPT for Arsi-Bale goats with higher values in males than females.

The serum enzyme levels of these indigenous goat breeds can be used as normal reference values for Ethiopian goat breeds adapted to similar agro-ecology and production system [2].

The purpose of the study was to determine the relationships between age of the goat and faecal egg counts, liver enzymes, and minerals in the wet and dry seasons in male and female Nguni goats of South Africa. Fifty-six female and forty male Nguni goats

were used for the study. Faecal and blood samples were collected once in the dry (August) and wet (January) season. Faecal Egg Counts (FEC) was determined by the modified McMaster technique while trematodes were determined by the sedimentation method. Blood was analyzed for phosphorus, calcium, magnesium, Alkaline Phosphatase (ALP), Alanine Transaminase (ALT), Creatine Kinase (CK), Aspartate Amino Transferase (AST), and Gamma-Glutamyl Transferase (GGT) levels.

Alkaline phosphatase activity, alanine transaminase, and gamma- glutamyltransferase levels in the blood serum were analyzed spectrophotometrically according to the method by Bürger, *et al.* Ultraviolet methods were used for determinations of Creatine Kinase (CK) and Aspartate Amino Transferase (AST). Aspartate aminotransferase in Wet season below (97.6 (40), within 2.4 (1); in Dry season below 98.2 (54), within 1.82 91) [3-5].

One of the important factors determining the degree of spread and the intensity of infestations is the season and the climatic conditions of the farms. It is noted that the increase in the physiological activity of parasites occurs in spring, summer and in a lesser degree in the autumn [6].

At trematodes with varying degrees, the decrease in the quality and nutritional value of meat, especially protein, is recorded, which is accompanied by a decrease in calorie content by 6.7-21.9% [7].

The changes occurring in helminthiases in organs and tissues serve as an indicator of metabolic disorders, the presence of dystrophic processes, allergic and immunomorphological reactions, i.e., they are the response of the organism to the pathogenic action of the helminth.

Parasites can have a double effect on the host's body. On the one hand, they stimulate the immune response, as a result of which a number of phenomena of the cellular and humoral response are observed, and on the other hand, they inhibit the functional and proliferative activity of lymphoid tissue cells, which leads to the development of secondary immune deficiencies. This contributes to a sharp change in the nature of the relationship in the host-parasite system and helps the survival of the host in the host organism [8-10].

Anthelmintic activity in vitro was investigated using the inhibition of Egg Hatching Assay (EHA), while cytotoxicity on Vero cells was evaluated using the MTT test. In vivo, thirty goats that were naturally infected with GINs were divided into three groups: group I, treated with a daily dose of AE C. ambrosioides (700mg/kg) for eight days; group II (positive control), treated with a single dose of levamisole phosphate (6.3mg/kg); and Group III, untreated (negative control). Treatment efficacy was assessed on the basis of egg counts (FEC), faecal cultures and post-mortem worm burden counts. In the EHA, the EC50 and EC90 corresponded to 1.6 and 1.9mg/mL, respectively. The AE promoted a slight reduction in cell viability in the cytotoxicity test. The AE reduced ($p < 0.05$) the number of infective larvae of the genera Haemonchus and Oesophagostomum. The anthelmintic treatment of goats with AE C. ambrosioides resulted in moderate efficacy against infective larvae, but revealed neither ovicidal nor toxic activity towards adult nematodes. No toxic effects of this plant-derived treatment were observed in the animals [11].

Biochemical studies of blood in heifers, carried out by the authors confirm the genotypic relationship between its enzyme indices and the productivity of animals, which makes it possible to successfully use these data for the early prediction of their productivity. The authors conducted a long-term experiment on cattle in order to test the prospects of using enzymatic tests for the level of alanine-aspartate aminotransferase in the blood serum during the selection of livestock for milk and meat production. As a result, it was found that the selection of parents for the specified blood test can significantly affect the character of the productivity of their offspring [12,13].

The carried out experimental studies revealed the presence of goat proteolytic activity in the homogenates of the liver studied.

The maximum peak intensity of proteolytic activity of trematodes isolated from goat liver was detected. The maximum value of the enzyme activity was reached in spring in March equal to 170μg of tyrosine per gram of wet weight of the helminth, and minimal in the summer season in June reaching 70μg of tyrosine per gram of wet weight of the helminth [14].

As a result of the experimental work, maximum peaks in the intensity of proteolytic activity of nematodes isolated from liver of sheep and cows were detected. The maximum enzyme activity was reached in March, which corresponded to 180 and 140μg of tyrosine per gram of wet weight of the helminth, and the minimum was reached in June reaching a value of 55 and 75μg of tyrosine per gram of green weight of the helminth isolated from the liver of sheep and cows, respectively [15].

Many leading scientists of the world suggest the possibility of a correlation between the productivity of animals and the activity of enzymatic systems. However, the available experimental data on this problem, unfortunately, are now disjointed, fragmentary and often contradictory.

Analysis of literature data shows that the composition of the blood and the nature of the processes in the animal organism are interdependent. Therefore, any changes that occur in the tissues of the body are reflected in the blood of the animal proceeding from the foregoing, the purpose of these studies was to study the dynamics of aspartate-transaminase activity of goat Khizi-Khachmaz zone goats in different seasons of the year.

Material and Methods

The subject of the study was goats (infected and uninfected) from the regions of Azerbaijan (Khizi and Khachmaz) for the period from December 2017 to May 2018 inclusive.

The material for the study was the blood of goats (75) slaughtered in winter (December, January, February), spring (March, April, May) and summer periods of the year (June, July, August).

Blood samples were also collected from goats by puncture with the addition of heparin as an anticoagulant.

The determination of the activity of aminotransferases carried out by the method of Bergmeyer H.U., Hoder M., Rej R. (1986) and also by the improved Raitman method proposed by Kolb VG, Kamyshnikov VS and Osadchaya L.M. The principle of the method is that as a result of transamination occurring under the action of aspartate and alanine aminotransferases, oxaloacetic and pyruvic acids are formed. After addition of 2,4-dinitrophenylhydrazine, pyruvic acid hydrazone is formed, which in alkaline environment gives a red-brown color, the intensity of which is proportional to the amount of pyruvic acid formed.

1 ml of blood was placed in a graded glass test tube, a 9-fold volume of 0.25M sucrose was added, thoroughly mixed and the tube was placed in an ice vessel. The resulting mixture was then centrifuged for 10 minutes at 1000 rpm. The supernatant was diluted with sucrose in a ratio of 1:50. Then 0.5ml of the substrate solution was added to the tube, 0.1ml of blood homogenate was added and the tube was placed in a thermostat at 37 °C for 1 hour. 0.5ml of dinitrophenylhydrazine was added to the supernatant. The samples were left for 20 minutes at room temperature. Then, 5ml of 0.4N NAOH was added and left at room temperature for 10 minutes to develop color. The optical density was measured with a spectrophotometer at a wavelength of 540nm. The control sample contained all the ingredients of the test sample, with the exception of blood homogenate. Instead of blood homogenate, 0.1ml of distilled water was added [16,17].

Measurements of the optical density of the samples were carried out on a Specol 1500 spectrophotometer (Analitik Jena) at a wavelength of 540nm.

Results and Discussion

Quantitative data on the determination of aspartate aminotransaminase activity of blood enzymes of infected and uninfected goats taken from slaughtered animals in the winter, autumn, spring and summer seasons are given in Table 1.

Aspartate-transaminase activity of goat's blood enzymes, U/ L							
Months							
Winter season		**Autumn season**		**Spring season**		**Summer season**	
December	42.8 ± 2.3	September	46.2 ± 2.1	March	94.5 ± 3.5	June	68.3 ± 3.4
January	43.4 ± 1.6	October	44.2 ± 1.3	April	72.4 ± 2.1	July	59.5 ± 2.2
February	44.1 ± 2.4	November	42.1 ± 1.1	May	70.6 ± 1.8	August	48.5 ± 2.5

Table 1: Quantitative data on the aspartate-transaminase enzymatic activity of goat blood taken from animals in different seasons of the year

It should be noted that the activity of Aspartate-Amino Transaminase activity (AST) in the blood of goats reflects the functional state of the liver. The activity of serum enzymes increases as a result of destructive processes in the liver and a disorder of protein metabolism. One of the most characteristic signs, reflecting the disturbance of the integrity of the liver tissue, is a change in the content of aminotransferases in the blood serum of parasitized animals.

As the studies showed, the value of aspartate aminotransaminase activity in blood of invasive animals is higher than in healthy blood, and range from 20.8 ±1.2 to 31.8 ± 1.3 U / L for practically healthy animals and from 42.1 ± 2.3 to 94.5 ± 3.5 U / L for invasive parasites of goats, respectively.

Figure 1 shows the data on the determination of aspartate-aminotrans- aminase activity in the blood of goats, in different seasons of the year, related to the state of animal health.

As can be seen from Figure 1, aspartate-aminotransaminase activity in goat blood is maximally increased by 3.59 times, in comparison with the values of enzyme activity determined by us in the blood of invasive goats during the spring period of time, i.e., in March. The minimum increase (1.63 times) of the enzyme activity, was noted in December. In winter, in February, an increase in activity of the enzyme was observed 1.68 times.

Thus, comparing the average values of aspartate-aminotransaminase activity of goat blood enzymes taken from invasive and non-invasive animals in different seasons of the year, it should be noted that their difference is significant ($P > 0.96$). In conclusion, it should be noted that the aspartate-aminotransaminase enzymatic activity of goat blood reaches its maximum value in the spring season and is characterized by the highest values in March (94.5 ± 3.5 U/L) and the lowest in November (42.1 ± 1.1 U/L).

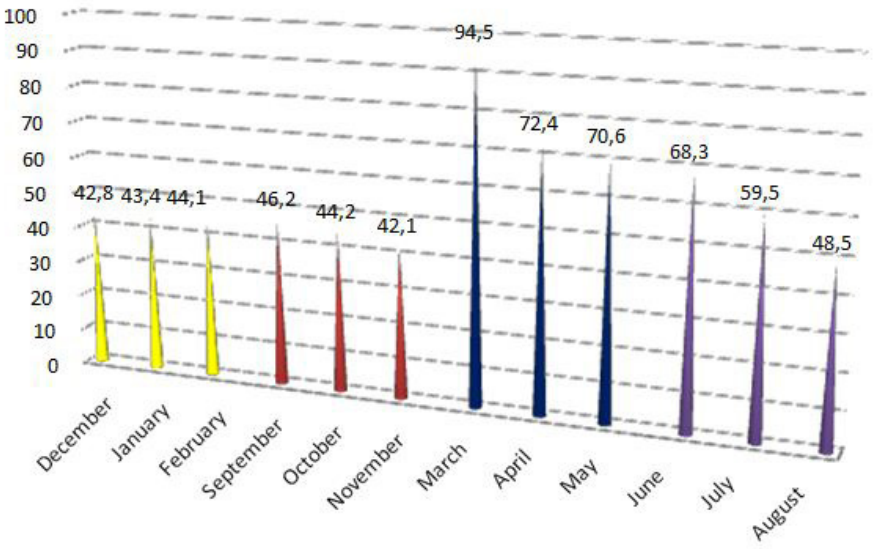

Figure 1: Data of aspartate-aminotransaminase activity in the blood of goats, in different seasons of the year, related to the state of animal health

From the results of experimental studies it follows that the transaminase activity of blood enzymes of goats is significantly influenced both by the season of the year and by the general physiological state of the animals.

Conclusions

The conducted experimental studies revealed the presence of goat aspartate- aminotransaminase activity of enzymes in the test blood samples.

Aspartate-transaminase enzyme activity in goat blood reaches a maximum value in the spring season (94.5 ± 3.5 U/L), and minimal in the autumn season (42.1 ± 1.1 U/L).

The change in aspartate-aminotransaminase activity in the blood of invasive goats was revealed. The maximum increase was noted in the spring (3.59 times). In the summer, autumn and winter periods, the increase in the enzymatic activity in 2.60, 1.76, 1.68 times, respectively, compared with the blood of almost healthy animals was revealed.

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