Sumerianz Journal of Scientific Research, 2018, Vol. 1, No. 2, pp. 48-51
ISSN(e): 2617-6955, ISSN(p): 2617-765X
Website: https://www.sumerianz.com

Original Article Open Access

Dynamics of Activity of Aspartate Aminotransferase in Blood Plasma of Goats During Pregnancy

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Abstract

In the work presented, data on the activity of the enzyme aspartate aminotransferase in the blood plasma of domestic goats during pregnancy are given. Determination of the activity of the enzyme aspartate aminotransferase was performed spectrophotometrically on a Specol 1500 Analitik Jena (USA) spectrophotometer using the method of Bergmeyer H.U., Hoder M., Rej R. The optical density of the samples was measured at a wavelength of 540 nm. The activity of aminotransferases was also determined by the improved Raitman method proposed by Kolb VG, Kamyshnikov VS and Osadchaya L.M. AST enzyme activity in the blood plasma during the first third of pregnancy was 85,50 ± 5,25 U/L. In the second third of pregnancy AST activity averaged 95,20 ± 3,36 U/L. U/L. During the final third of pregnancy, decrease of AST activity in goat blood plasma was recorded, averaging 72,00 ± 1,98 U/L. Thus, a significant decrease in ACT activity was determined in the last third of the gestation period compared to the first and second third. The results obtained can serve for better understanding of the biochemical processes in pregnant goats, to assess their physiological status and diagnostic purposes.

Keywords: Aspartate Aminotransferase; Blood Plasma; Goats.

1. Introduction

According to FAOSTAT, the number of goats worldwide in 2014 was 1.011.251.833 animals. The main countries that raised goats were mainland China (185.675.000), India (133.000.000), Nigeria (72.466.698), Pakistan (66.615), and Bangladesh (55.900.000). In Brazil, in 2014, the Municipal Livestock Research reported the existence of 8.851.879 goats and the Northeast region had the highest number of these animals, with 91.6% of the national goat herd [1].

The literature contains the data on Blood metabolic profile of goat kids fed a diet supplemented with alfalfa protein-xanthophyll (PX) concentrate during rearing with their dams. The results and their analysis indicate that inclusion of 3% alfalfa protein-xanthophyll (PX) concentrate in the kids' diet positively affected the haematological and biochemical parameters of the blood. A higher level of erythrocytes, haemoglobin and haematocrit was noted, together with a decrease in the lymphocyte and monocyte count. The blood of goat kids receiving the PX concentrate-supplemented diet had significantly reduced content of total cholesterol and triglycerides, as well as low-density lipoproteins (LDL). The blood of the experimental kids showed a significantly higher level of total protein and urea. The alfalfa concentrate significantly diminished the activity of alanine and aspartate aminotransferases. Protein-xanthophyll (PX) concentrate of alfalfa can be used as a phytobiotic providing an excellent source of protein, vitamins and minerals essential for the proper function of the animal organism [2].

The results for the activity of alanine and aspartate aminotransferases are confirmedby the results of an experiment conducted on young fattening cattle. A compound feed supplemented with a 3% addition of alfalfa PX concentrate significantly reduced the activity of both the ALT and AST enzymes by about 28% [3].

Aspartate aminotransferase (AST) is a widely distributed enzyme, which is found in many tissues and organs, with high activity in the liver [4]. Increased AST activity in the serum is a sensitive marker of liver damage [5]. There are two main isoenzymes: mitochondrial and cytosolic, which prevails in the total concentration in the blood plasma because it has a longer half-life [6].

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 aminotransferase (ALT)/glutamic pyruvic transaminase (GPT), aspartate aminotransferase (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 [7].

According to some authors the enzyme is tied to the metabolism of glutathione, which has an important role in the entire antioxidative status of the organism [6].

Weigert, *et al.* [8] state that ALT activity in the blood plasma depends on age and muscle activity [8].

It is possible to raise productivity of cattle only on the basis of continuation of studying the capacities of reproductive system in high-productive cows in interconnection with indices of their physiology [9].

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.[10].

According to the research results of the blood plasma in mares during pregnancy and early lactation, there were no significant differences in the concentration of total proteins, albumin, and ALT and GGT enzyme activity. In the final third of pregnancy there was a statistically significant decrease of AST activity compared to the first period ($P<0.01$), and the second period of pregnancy ($P<0.001$). The lower activity of AST during pregnancy and early lactation can be attributed to this special breed. The obtained results constitute a contribution to a better understanding of biochemical processes in pregnant mares [11].

Blood samples were randomly collected from 80 does on two occasions: in March in their early lactation and in October in their early gravidity, and were analysed for the most common biochemical parameters (glucose, urea, bilirubin, total proteins, albumin, triglycerides, cholesterol, aspartate aminotransferase (AST), gamma-glutamyl transferase (GGT) and two parameters of metabolic profile (non-esterified fatty acids (NEFA), β-hydroxybutyrate (BHB). Significant differences were found between all of the parameters, except BHB and AST. The obtained results from multi-coloured goats may represent a contribution to a better understanding of metabolic processes during early lactation and early gravidity in indigenous Croatian goats [12].

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.

Based on the foregoing, the purpose of this study was to study the activity of the enzyme aspartate aminotransferase in blood plasma during pregnancy (at different periods of pregnancy) in domestic goats.

Since there is no systematic data on these important parameters of these animals, the results obtained can represent a contribution to a better understanding of biochemical processes in pregnant goats, as well as to assess their physiological status and for diagnostic purposes.

2. Materials and Methods

The experiments were carried out on ten domestic goats at the age from 2 to 5 years, the condition of which was controlled during pregnancy.

They were fed twice a day with hay and oats, depending on the period of pregnancy, and also vitamin and mineral supplements were added.

The goats were kept in stables, and sometimes in the spring and summer the animals remained outdoors under a canopy. Goats are rather unpretentious animals. However, you must carefully monitor their diet. Not only the health and appearance of goats, but also its productivity depends on the diet of goats. So, if there is a shortage of any substances, the amount of milk can drop drastically.

In the summer, the problem of feeding goats was solved quite easily. Animals received almost all the necessary food during grazing. They chewed grass, twigs, leaves and other greens. In addition, additional feeding was given to goats at home. Grains, vegetable waste, root crops and silage were added in their diet.

Blood was taken from the goats three times during pregnancy for analysis. The gestation period lasted 145-150 days.

In goats, blood was taken from the ear or tail in a volume of at least 5 ml in a tube with an anticoagulant of 0.5 M ethylenediaminetetraacetic acid (EDTA) in an amount of 200 µl. on one test tube. The place of blood collection was thoroughly disinfected with alcohol or 5% iodine solution. Tubes with blood were stored in the refrigerator at a temperature of + 4 ° C - +8 ° C. For blood analysis, 0.5 M EDTA was prepared (pH 8.0). 18.62 g of ethylenediaminetetraacetic acid (molecular weight 372.2) were placed in a 100 ml volume flask and dissolved in 80 ml of distilled water. With a solution of 30% sodium hydroxide, the pH of the solution was adjusted to pH 8.0. Then with distilled water, the volume of the solution was brought to the mark and the contents of the flask were mixed.

The blood samples were centrifuged at 1500 rpm for 10 minutes. After centrifugation, blood plasma was separated. Determination of the activity of the enzyme aspartate aminotransferase was performed spectrophotometrically on a Specol 1500 Analitik Jena (USA) spectrophotometer according to the method of Bergmeyer, *et al.* [13]. The optical density of the samples was measured at a wavelength of 540 nm [13].

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

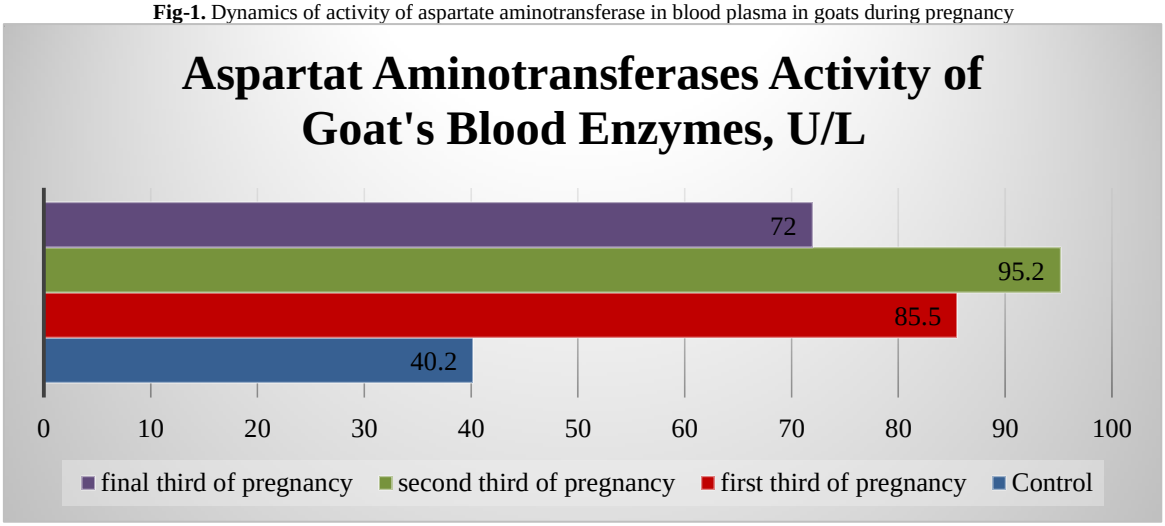
The determination of the activity of aminotransferases carried out by the improved Raitman method proposed by Kolb VG, Kamyshnikov VS and Osadchaya L.M. The principle of the method is that as a result of transamination occurring under the action of aspartate and alanine aminotransferases, oxaloacetic 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[4, 14] .

The obtained results were treated by statistical calculations of the mean value, standard deviations, standard errors of the mean value and variability coefficient. The significant difference among results was checked by Student's *t*-test, and statistical significance was taken to be indicated by $P<0.05$.

3. The Results of the Study and Discussion

AST enzyme activity in the blood plasma during the first third of pregnancy was 85,50 ± 5,25 U/L. In the second third of pregnancy AST activity averaged 95,20 ± 3,36 U/L. U/L. During the final third of pregnancy, decrease of AST activity in goat blood plasma was recorded, averaging 72,00 ± 1,98 U/L (Fig. 1).

Fig-1. Dynamics of activity of aspartate aminotransferase in blood plasma in goats during pregnancy



Quantitative data on the activity of the enzyme AST in the blood plasma of goats during pregnancy are presented in Table 1.

Table-1. Quantitative data on the activity of blood enzymes of goats taken from animals in various periods of pregnancy

Aspartat Aminotransferases Activity Of Goat's Blood Enzymes, U/L			
Control	first third of pregnancy	the second third of pregnancy	the final third of pregnancy
40.2±3.5	85,50 ± 5,25	95,20 ± 3,36	72,00 ± 1,98

It should be noted that the activity of aminotransaminase activity in the blood of goats reflects the gestation period of goats.

As studies of the value of aspartate transaminase activity in the blood of practically healthy animals have shown, the values range from 40.8 ± 1.2 to 41.8 ± 1.3 U/L.

Aspartate-transaminase activity in the blood of pregnant goats is maximally increased by 2.37 times in the second half of pregnancy, in comparison with the values of enzyme activity determined by us in the blood of not pregnant goats. The minimum increase (1.79 times) of the enzyme activity was noted in the third half of the goat's pregnancy.

From the results of experimental studies of the activity of AST enzymes in the plasma of pregnant goats, it is clear that AST activity increased significantly during pregnancy, and in the last third of the pregnancy it reached its lowest level.

Taking into account that the highest activity of AST in goats is 95.20 ± 3.36U / L then, the data obtained in this study show the chronology of the variability of AST in blood plasma in goats during pregnancy. It should be noted that the range of values of most serum enzymes in physiological conditions depends on age, breed, sex, pregnancy, feeding, living conditions and maintenance.

In view of the fact that information on the variability of enzyme activity in the blood of domestic animals is negligible, and since it is known that ACT activity varies depending on the breed, it can be stated with certainty that the experimental data obtained are below physiological limits. A significant decrease in ACT activity was determined in the last third of the gestation period compared to the first and second third of pregnancy.

Proceeding from the foregoing, it is necessary to state that the results obtained can serve for better understanding of the biochemical processes in pregnant goats, to assess their physiological status and diagnostic purposes.

4. Conclusions

Chronology of the variability of activity of the enzyme aspartate aminotransferase in blood plasma in goats during pregnancy has been revealed.

The activity of the AST enzyme in blood plasma during the first third of pregnancy was 85.50 ± 5.25 U/L.

In the second third of pregnancy, the ACT index averaged 95.20 ± 3.36 U/L.

During the last third of pregnancy, there was a decrease in AST activity in goat blood plasma, on average, up to 72.00 ± 1.98 U/L.

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