MEDWELL PUBLISHING
Journal of Animal and Veterinary Advances 8 (3): 530-533, 2009
ISSN: 1680-5593

Changes in Some Macro Minerals and Biochemical Parameters in Female Healthy Siirt Hair Goats Before and after Parturation

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Abstract: The aim of this study, was to evaluate the changes of electrolytes (Na, K), minerals (Ca, Mg, P, Fe) and some parameters related to mineral metabolism (iron binding capacity, Transferrin, Ferritin, Folate, Vitamin B_{12}), just before and after parturition, in healthy Siirt hair goats. For this aim, 10, healthy, 2-4 years old, female Siirt hair goats, were used as material. The blood samples were collected 1 week before and after parturition. The levels of Na, K, Ca, Mg, of blood serum did not change with gestation. P, Fe, IBC, transferrin, ferritin, vitamin B_{12} and folate concentrations increased after parturition ($p<0.05$). It was found out, in this study that iron especially and protein levels related to iron had significant differences before and after parturition in a short time.

Key words: Biochemical parameters, goats, parturition, macro minerals, siirt hairy goats

INTRODUCTION

The Siirt hairy goat is one of the best-known hairy goats bred in Turkey. Pregnancy and lactation are physiological stages considered to induce metabolic stress. There is a great variation in the hematological parameters during the different physiological stages between goat breeds (Azab and Maksoud, 1999). Metabolism of mineral substances plays a significant role in the regulation of physiological functions of the puerperal period. Their concentrations in the blood circulation represent homeostatic mechanisms that are in a close relationship with the neurohumoral regulation (Krajnicakova *et al*., 2003). On the other hand, minerals are important as essential nutrients in the diet of animals. Physiological status might modify animal's requirement to these elements (Ahmed *et al*., 2000).

All animals require minerals (Ca, Mg, P, Na, K, Fe) for growth, reproduction, lactation and performance, which often affect the specific requirement, serve as structural or catalytic components of enzymes and regulate many physiologic systems especially pregnancy and lactation (Ahmed *et al*., 2000; Krajnicakova *et al*., 2003; Liesegang *et al*., 2007; Mbassa and Poulsen, 1991).

Some biochemical blood parameters (Fe binding capacity, transferrin, ferritin, folate and vitamin B_{12}) are directly related to mineral metabolism (Berg *et al*., 2006; Mason, 2008; Hoffman *et al*., 2005; Murray *et al*., 2003). We could not find literature about affecting the levels of these parameters before and after parturition in Siirt hairy goats.

The purpose was to determine the influence of late pregnancy and early lactation on electrolytes levels (Na, K), minerals (Ca, Mg, P, Fe) and some parameters of related mineral metabolism (Fe binding capacity, transferrin, ferritin, folate, vitamin B_{12}) in the blood serum in the Siirt hair goats.

MATERIALS AND METHODS

Animals: Twenty healthy Siirt hair goats, 2-4 years old, weighing between 25-30 kg, in research farm of Yuzuncu Yil University comprised animal materials. Oestrus synchronized with prostaglandin F^2a (Dalmazin, Vetas, Turkey) in breeding season. All animals were kept on rangeland during days and kept in burns at nights.

Blood sampling and analysis: Pregnancies were determined via ultrasonography (honda, HS-1500) in 20 goats 142 days post mating and blood was collected from the jugular vein. Goats were maintained until delivery. Ten goats kidded 7th day after the 1st bleeding were included in the study. Thus, these 10 goats were bled once again and the other 10 goats were excluded from study.

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Blood samples were centrifugated (3000 rpm, 10 min) and sera obtained. Biochemical parameters (Na, K, Ca, Mg, P, Fe, Iron Binding Capacity, Transferin, Ferritin, Folate and Vitamin B_{12}) were examined in the samples using a biochemical autoanalyzer and established procedures (MODULAR PP, Roche/Hitachi, Japan).

Statistical analysis: The results were expressed as Means±S.D. Paired-samples t-test was used for statistical analysis, setting $p<0.05$ to establish statistically significant differences.

RESULTS AND DISCUSSION

P and Fe concentrations increased significantly ($p<0.05$) after parturition. The concentrations of other minerals and electrolytes were not affected from parturition. Iron binding capacity, transferrin, ferritin, folate and Vitamin B_{12} levels of gestation were higher after parturition ($p<0.05$). Other parameters were affected from parturition. The obtained results were summarized at Table 1 and 2.

There were significant differences in biochemical parameters parallel to changing physiology of the animals before and after parturition. There also, were significant differences especially, at the level of biochemical parameters in a short time. Mineral substances join the structures of important enzymes and proteins and play important roles in these cases. The biochemical parameters alter during pregnancy and lactation in goats (Krajnicakova *et al*., 2003; Mbassa and Poulsen, 1991). Some researchers obtained different results about Ca levels during pregnancy and lactation. Some of authors found that Ca levels decreased (Ahmed *et al*., 2000; Liesegang *et al*., 2007; Mbassa and Poulsen, 1991). On the other hand, Kadzere *et al*. (1997), reported that Ca concentrations in plasma increased as gestation progressed and decreased after kidding. The cause of decreases may be related to the flux of Ca to the fetus or into the milk resulting in a significant decrease in serum calcium in goats and sheep at parturition and the enhanced bone remodeling in early lactation (Liesegang *et al*., 2007). In our study, we could not observe statistical differences between before and after parturition at Ca levels. That is, the calcium concentrations were not influenced by parturition in Siirt goats. Similarly, Iriadam (2007) reported that no significant differences recorded at pregnancy and parturition, regarding plasma Ca concentrations in Kilis does.

Phosphorous (P) is a component of phospholipids, which are important in lipid transport and skeleton and dent formation (Krajnicakova *et al*., 2003). Although, some researchers reported that no significant differences were observed at the phosphorous levels at the different stages of growth, reproduction, pregnancy and lactation (Kaushik and Bugalia, 1999; Krajnicakova *et al*., 2003), other researchers informed that phosphorous levels during late gestation and postpartum significantly increased in ewes and goats (Ahmed *et al*., 2000; Mbassa and Poulsen, 1991; Ozyurtlu *et al*., 2007). In our present study, P concentrations increased after parturition.

Table 1: The concentrations of electrolytes (Na, K) and minerals (Ca, Mg, P, Fe) in the blood serum of goats before and after parturition

Parameters	Before parturition	After parturition
Calcium (mg dL^{-1})	9.79±0.12	9.79±0.19
Phosphorus (mg dL^{-1})	4.79±0.49	7.04±0.38*
Sodium (mg dL^{-1})	149.90±0.86	152.80±1.29
Potassium (mg dL^{-1})	5.37±0.09	5.98±0.33
Magnessium (mg dL^{-1})	2.99±0.30	2.65±0.17
Iron (μg dL^{-1})	100.74±4.60	126.03±10.03*

Table 2: The concentrations of some parameters of related to mineral metabolism in the blood serum of goats before and after parturition

Parameters	Before parturition	After parturition
Iron binding capacity (μg dL^{-1})	171.31±5.9900	174.34±8.61*
Transferrin (mg mL^{-1})	0.012±0.002	0.028±0.012
Ferritin (ng mL^{-1})	1.50±0.0100	1.61±0.11
Folate (ng mL^{-1})	1.96±0.1100	2.63±0.26*
Vitamin B_{12} (pg mL^{-1})	489.80±31.610	692.80±48.44*

Sodium (Na) and potassium (K) play a vital role in maintaining osmotic pressure and acid-base balance as electrolytes. There were significant differences between open and pregnancy periods for serum K concentration in sheep ($p<0.05$) (Kulcu and Yur, 2003). Both ions were found to fluctuate only slightly during pregnancy and lactation (Mbassa and Poulsen, 1991). There are some studies reporting the decrease of Na and K concentrations mostly in parturition and lactation (Ahmed *et al*., 2000; Azab and Maksoud, 1999). But by the end of the evaluated period, their values did not significantly change (Krajnicakova *et al*., 2003). In this study, Na and K levels did not change after parturition. The reason for this situation could be the shorter period of time for this study.

Magnesium (Mg) is required for normal skeletal development and one of the most common enzyme activators. There were significant differences between pregnancy and the lactation period for serum Mg concentration in sheep ($p<0.05$) (Kulcu and Yur, 2003). It was reported that the levels of Mg increased sometimes (Ahmed *et al*., 2000; Kadzere *et al*., 1997) and decreased in other times in relation to different periods of pregnancy and lactation (Mbassa and Poulsen, 1991). Plasma Mg concentration increased at 3 weeks prepartum followed by a non-significant decrease. This decrease became significant ($p<0.05$) at the day of parturition (Azab and Maksoud, 1999). Mg levels decreased very little after parturition in this study, but this decrease was not considered to be statistically significant.

Iron level in blood is a reliable diagnostic indicator of various disease cases and physiological stages. Decreased levels of blood iron may result from increased demand on iron storage during normal pregnancy (Barrett *et al*., 1994). Gurdogan *et al.* (2006) reported that in pregnant sheep, significant decreases in serum Fe groups, respectively at 60, 100 and 150 days of pregnancy and Fe concentrations increased steadily at 45 days of parturition compared to the pregnancy periods. In our study, Fe levels increased statistically after parturition. These results show that Fe levels decrease at the last period of pregnancy, increase after parturition, statistically.

Total Iron Binding Capacity (TIBC) is a blood test that shows if there is too much or too little iron in the blood. About 30% of the iron in the body is stored as a substance called ferritin in the liver, bone marrow and spleen The iron binding sites in the serum are almost entirely dependent on circulating transferrin, this is really an indirect measurement of the amount of transferrin in the blood (Guyatt *et al*., 1990; Hoffman *et al*., 2005; Murray *et al*., 2003). In this study, TIBC, transferrin and ferritin levels of gestation were higher than ($p<0.05$) after parturition. It is significant that the increase in these parameters functioning in Fe metabolism is parallel to the increase in Fe levels after parturition.

Folic acid (folate) is a type of B vitamin. Folic acid works along with vitamin B_{12} and vitamin C to help the body break down, uses and creates new proteins, which are necessary for red blood cell formation and growth (Mason, 2008). A study indicated that folate concentrations were altered neither season of the year nor the reproductive status of sheep (Yokus *et al*., 2006). But, in our study folate levels were affected from parturition. Folate levels of gestation were higher than ($p<0.05$) after parturition. It is thought that this result indicates that folate is closely related to its function in blood production, Fe metabolism in this function and changes at the levels of other proteins joining this metabolism.

Vitamin B_{12}, helps in the formation of red blood cells and in the maintenance of the central nervous system (Mason, 2008; Murray *et al*., 2003). It was observed that the level of vitamin B_{12} increased after parturition compared to the last period of parturition.

CONCLUSION

It was observed that P, Fe and Fe related proteins functioning in blood production and the levels of folate and vitamin B_{12} decreased at the last stage of pregnancy, but increased significantly just after parturition. These results could be useful for following of healthy pregnancy and parturition in Siirt hairy goats.

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