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## Research Article

# The Influence of Pregnancy and Lactation on Plasma Antioxidant Status in Aardi Goats

## Summary

The aim of this study is to assess the effects of pregnancy and lactation on selected antioxidant profile in Aardi, goats. Blood samples were taken from sixteen goats approached 3-4 months of pregnancy, and a month before parturition, blood samples were taken, and weekly until parturition, and then every week until four weeks postpartum. The total antioxidant concentrations increased during the 4th to the 2nd week before parturition, and started to decline until partition, and continued the decline until the second week after parturition, then increased again. Serum Thiobarbituric Reactive Substances (TBARS) concentrations follow similar pattern to Total Antioxidant Concentration (TAC). Immediately after parturition, there was an increase in TBARS, and then by the end of 1st week started to decrease until the 4th week postpartum. Low serum Super Oxide Dismutase (SOD) four weeks postpartum, might be related to the lower activity of reactive oxygen metabolites, as indicated by the increased antioxidant capacity. Superoxide dismutase increased on the 2nd week postpartum up to the 4th week postpartum. In conclusion, this data about local goats will be beneficial for understanding the basic adaptive physiological biomarker.

## Introduction

Antioxidants are chemicals inhibiting the oxidations of other chemicals and regulating the metabolic activity of ruminant. Pregnancy and lactation poses a challenge to goat industry, and also resulted in the generation of free radicals, causing damage to cell [1]. Better nutrition during late gestation may be improved in arid and semiarid regions around the globe [2]. According to Radin et al. (2015) [3], goats of higher parity display higher levels of metabolism intensity and consequently, varying levels of oxidative stress during the peripartum period. Basic physiological and biochemical profile for local Saudi goats are lacking. Studies on local breeds of goat in Saudi Arabia is lacking, in particular that of adaptational physiological to their harsh environment. Pregnancy and lactation poses a challenge to goat industry. The main aim of this study was to assess the effects of pregnancy and lactation on selected antioxidant biomarkers in local Saudi goats, Aardi.

## Materials and Methods

Three Pens at the Department of Animal Production Research Station were prepared for receiving 16 female Aardi goats, in addition to 2 males Aardi. The 16 females were nulliparous and about 1.5 years of age. Animals were provided with feed (Alfa

Alfa, and concentrate) according to NRC calculations, with water ad libitum. During the first month of the acclimatization period, males were tested for semen quality; semen was collected from the 2 males using electro ejaculator, and semen was examined under microscope for sperm motility, activity, and quality. Female Aardi goats were watch for heat (estrus) signs and by the end of the month, all females were ready for the experiment to start. Females were synchronized using a program called Ovsynch that includes using GnRH injection, followed by PGF<sub>2α</sub> 7 days after. Two days later, a second GnRH injection is given to the female Aardi goats, and introduced to the males. Female Aardi goats exhibited signs of heat by bellowing and accepting the approach of males. Dates of the first signs of estrus and mating were recorded in order to estimate the time of parturition.

Blood samples were collected into vacutainer tubes at the time of the second PGF<sub>2α</sub> injection in order to verify that serum Progesterone hormone concentration is low and serum Estrogen hormone concentration is high, which goes well with females that are in estrus. Blood samples were collected and centrifuged at 4°C for 30 min. at 3000 rpm and stored at -20°C until analysis. All samples were analyzed for the parameters indicated using ELISA kits bought from Cayman Pharma (USA).

Blood samples were taken from pregnant goats during the last month of pregnancy on a weekly basis. In addition, Blood samples were taken at the time of parturition, and for one month after that on a weekly basis. Total Antioxidant Capacity, TBARS, and SOD activities were measured in the plasma. Changes in the concentrations of TAS, MDA, and SOD were analyzed by means of ANOVA repeated-measures procedure. Data were expressed as the mean  $\pm$  SE for all parameters. Fisher's least significant difference (LSD) was used at a level of  $P < 0.05$ . All data were analyzed using SAS program (SAS Inst. Inc., Cary, NC).

## Results and Discussion

Pregnancy and lactation are considered very demanding and stressful physiological stages in ruminants. Pregnancy is associated with oxidative stress in water buffaloes [4] and sheep and goats [5]. The main aim of this study was to assess the degree of oxidative stress in pregnant and lactating Aardi goats, local Saudi breeds, for the first time. Research on oxidative stress in the field of animal science is emerging as a new field of research.

Goats of higher parity displays varying levels of oxidative stress during the peri-partum period [3]. Stress imposed by pregnancy and lactation affected the reproductive performance in postpartum anestrus animals which might be inherently more susceptible to these stressors than those who were normal cyclic as all the animals were maintained under similar feeding and management practices [6].

Total antioxidant concentrations increased during the 4<sup>th</sup> to the 2<sup>nd</sup> week before parturition, and started to decline until partition, and continued the decline until the second week after parturition, then increased again (Figure 1). Previous studies outlined that the reproductive cycle (pregnancy and lactation) play role in antioxidant-oxidant balance in animal's body. For example, dairy cows seemed to have more oxidative stress and low antioxidant defense during early lactation or just after parturition than advanced pregnant cows [7]. Oxidative stress and lipid peroxidation are involved in the development and complications of pregnancy toxemia [8].

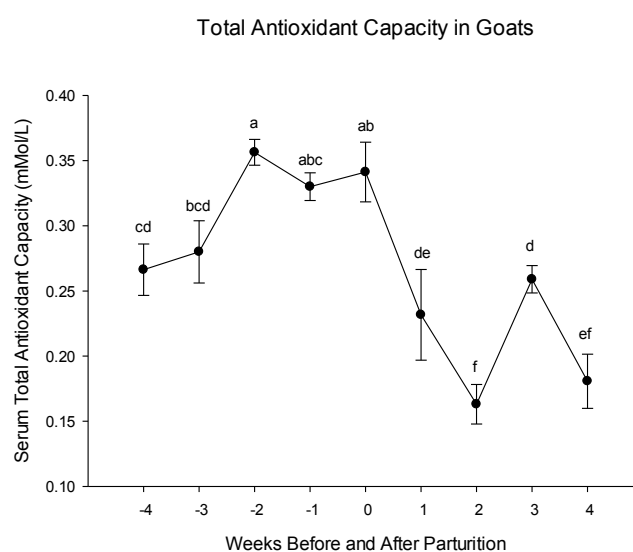
Comparing first and second lactation, TAC and the parameters of lipid and protein peroxidation in blood showed increasing tendency in second as first lactation. The content of anti-oxidative vitamins and SH groups in colostrum/milk showed increasing tendency in second as first lactation, while TAC and content of end products of lipid peroxidation showed opposite trend [9].

Porcine levels of vitamin C and glutathione decrease during the peri-parturient period, which may lead to a decreased antioxidant defense system and an imbalance in redox homeostasis [10]. Decreased CAT activities after the 1st month of pregnancy were observed in ewes [11].

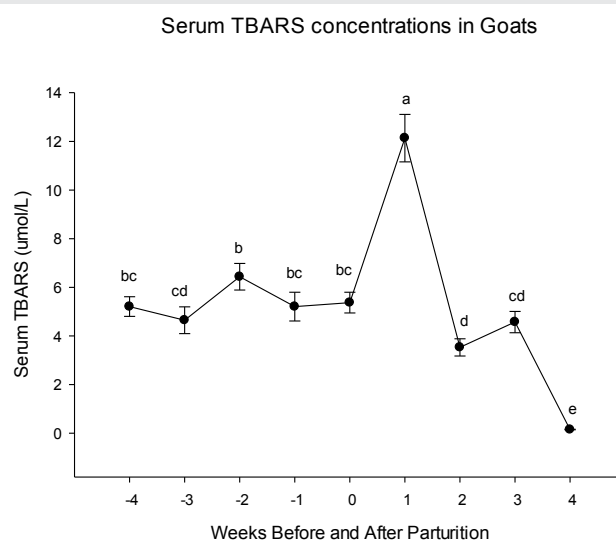
Figure 2 shows serum TBARS concentrations in goats. Serum

TBARS concentrations follow similar pattern when compared to TAC. Immediately after parturition, there was an increase in TBARS, and then by the end of 1<sup>st</sup> week, TBARS concentrations started to decrease until the 4<sup>th</sup> week postpartum. Goats experienced moderate oxidative stress during the peripartum period [12]. Rapid modification of diet composition affects metabolic and oxidative homeostasis in lactating sheep [13]. The combination of MDA and TAS can provide complementary information about the metabolic status of the cow [14].

The antioxidant defense might be impaired in the periparturient period and it returns to an antioxidant balance in the second month of lactation [15]. Lipid peroxidation increased around parturition [16]. Restoration of the antioxidant balance during pregnancy in the Western diet-fed dam is associated with decreased adiposity in offspring [17].



**Figure 1:** Serum Total Antioxidant Capacity in goats during pregnancy, parturition and after parturition. Values are expressed as means  $\pm$  SE. Values with different scripts are statistically ( $p < 0.05$ ) different.

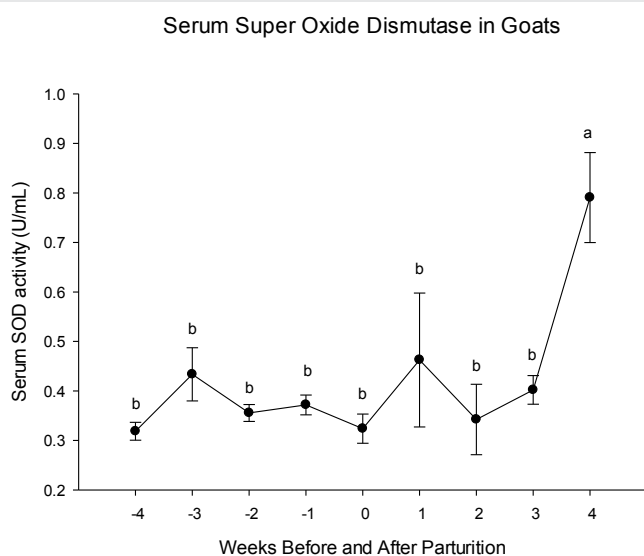


**Figure 2:** Serum TBARS in goats during pregnancy, parturition and after parturition. Values are expressed as means  $\pm$  SE. Values with different scripts are statistically ( $p < 0.05$ ) different.

When there is an increase in oxidative stress, it should be balanced by increased in endogenous antioxidant production. It is indicated that increased lipid peroxidation and TAC around parturition in bovine suggests increased oxidative stresses [16] that might explain the decrease in TAC after parturition, which reflects the stress of weather and milk production.

Superoxide dismutase is well known for its activity as the first defense against free radicals (Halliwell and Chricco, 1993; Tuzun et al., 2002). Low serum SOD four weeks postpartum (Figure 3), might be related to the lower activity of reactive oxygen metabolites, as indicated by the increased antioxidant capacity. Superoxide dismutase concentrations is an indicator of oxidative stress started to increase on the 2<sup>nd</sup> week postpartum, and increased significantly up to the 4<sup>th</sup> week postpartum. These results disagree with previous one [18] that SOD increased until 2 weeks postpartum before started to decrease. These results might explain that goats may have experienced some degree of oxidative stress and lipid peroxidation [12] during postpartum period. At the same time, our study showed that oxygen free radical scavenger, SOD increased in Aardi goats during postpartum period, which is different from other studies, which might reflect species differences or responses during different year seasons. Lipid peroxidation decreased and antioxidant defense system mechanism in late lactation period in goats served as more positive than early lactation period [19,3].

This study showed that Aardi goats are well adapted to local environment and its antioxidants during pregnancy are high since animals are under oxidative stresses during pregnancy. Postpartum animals are under less stresses, which were reflected by lower TAC and TBARS. The basic data about oxidative stresses on Aardi goats will be beneficial for understanding the basic responses of a valuable local breed of goats. Our results gave us very close details on the animals during such important period.



**Figure 3:** Serum Superoxide dismutase activity in goats during pregnancy, parturition and after parturition. Values are expressed as means + SE. Values with different scripts are statistically ( $p < 0.05$ ) different.

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