

Effect of Pregnancy on Oxidative Status of Sheep

Musa Suleman Ibrahim*, Briskila Oliver Ombugadu and Yusuf Ibrahim Hussaini

Department of Animal Science, Nigeria

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***Corresponding author:** Musa Suleman Ibrahim, Department of Animal Science, Keffi, Shabu- Lafia Campus, Nigeria

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Abstract

The objective of the study was to determine the effects of pregnancy on oxidative status of sheep. Specific goal of the study was to determine the impact of pregnancy on serum concentration of antioxidant enzymes and the level of lipid peroxidation. Two groups of sheep (10) consisting of pregnant and non-pregnant ewes were used for the study. The pregnant ewes were at third trimester of pregnancy which was confirmed by abdominal palpation and serum progesterone level above 2.2ng/ml. Serum levels of catalase, superoxide dismutase, glutathione peroxidase enzymes and malondealdehyde were determined. The results indicated similar ($p>0.05$) mean values of serum concentration of catalase, superoxide dismutase and glutathione peroxidase. The serum level of malondealdehyde was significantly higher in pregnant ewes compared to non-pregnant animals. It can be concluded that the third trimester of pregnancy is associated with higher serum levels of malondealdehyde.

Keywords: Ewes; Pregnancy; Oxidative stress; Antioxidant enzymes; Antioxidant status

Introduction

Reactive oxygen species play a critical role in many physiological processes but are detrimental to body cells at high concentration [1]. Pregnancy is associated with proinflammatory state due to increased activity of monocytes and macrophages resulting in high concentration of oxidative stress biomarkers [2]. Adverse effects of oxidative stress on reproductive performance of sows have been documented, decrease litter size and birth weight were associated with oxidative stress [3]. Oxidation of proteins can modify their structure thereby causing adverse effects on functions of the protein. Oxidized proteins can also generate antigens that stimulate immune response [4]. Increase oxidative stress has been associated with prolonged concentrate feeding in dairy cows, this is attributed to increase rumen endotoxins associated with high concentrate and low neutral detergent fibre content which may stimulate Para inflammatory reactions and reactive oxygen species [5]. Lipid mobilization associated with low energy balance has also been associated with an increase in reactive oxygen species [6].

Reactive oxygen species play a critical role in reproductive processes such as ovulation, fertilization and early embryo development. However, oxidative stress is associated with embryo losses, and it is involved in the pathogenesis of follicular cyst and repeat breeder syndrome in dairy cows [7]. Insufficient antioxidant activity can lead to poor pregnancy outcome including fetal growth restrictions. The metabolic changes associated with pregnancy may result in impaired oxidative status leading to adverse effects on pregnancy establishment and maintenance. The objective of this study, therefore, was to determine the effects of pregnancy on serum concentration of superoxide dismutase, catalase and glutathione peroxidase enzymes. The impact of pregnancy on lipid peroxidation was also evaluated as indicated by serum level of malondealdehyde.

Materials and Methods

The objective of the study was to determine the effect of pregnancy on oxidative status of sheep. Two groups of sheep ($n=10$) consisting of pregnant and non-pregnant ewes were used for the study. The pregnant ewes were at the third trimester of pregnancy which was

confirmed by abdominal palpation and serum progesterone level above 1.2ng/ml. Blood samples were collected through the jugular vein for determination antioxidant enzymes concentration.

Determination of serum antioxidant enzymes

Serum level of superoxide dismutase was determined by calorimetric method based on the ability of the enzyme to inhibit phenazine methosulphate mediated reduction of nitro blue as described by Weydert [8]. Catalase activity was measured using a combination of optimized enzymatic conditions and spectrophotometric assay of hydrogen peroxide as described by Laszo et al. [9]. Glutathione peroxidase activity was measured using hydrogen peroxide as a substrate as described by Liu [10]. Serum malondialdehyde was determined in terms of thiobarbituric acid reactive substances using spectrophotometer as reported by Surapon [11].

Statistical analysis

Data obtained was subjected to student t test using Statistical Tool for Agricultural Research (STAR). Means separation was done

using least significant difference where significant differences exist.

Results and Discussion

The effects of pregnancy on oxidative status of sheep are shown on Table 1. The results indicated similar mean values of catalase, superoxide dismutase and glutathione peroxidase enzymes in both groups. The serum level of malondialdehyde is however, higher ($p>0.05$) in pregnant ewes compared to non-pregnant ewes. The concentration of malondialdehyde is an established indicator of cellular injury as well as a biomarker of oxidative stress in cells and tissues [12]. Pregnancy is associated with the increase of generation of reactive oxygen species which is linked to oocyte maturation, luteolysis and embryo implantation. Oxidative stress adversely affects placental functions which may lead to poor pregnancy outcome [13]. This may be attributed to changing metabolic demands associated with pregnancy. Oxidative stress results from disruption of balance between antioxidant system and reactive oxygen species. Decrease plasma antioxidant have been observed in early phase of pregnancy, while total antioxidant capacity improves in the second and third stage of pregnancy [14].

Table 1: Effects of pregnancy on serum level of antioxidant enzymes (mean).

Parameters	Pregnant Sheep	Non-Pregnant Sheep	Los
Superoxide dismutase (iu/l)	16.40 ^a	15.03 ^a	NS
Catalase (iu/l)	40.36 ^a	40.43 ^a	NS
Glutathione peroxidase (iu/l)	29.43 ^a	29.83 ^a	NS
Malondialdehyde (mmol/l)	1.76 ^b	1.06 ^a	*

Note: Means within same row bearing different superscript are significantly different ($P<0.05$), Ns = Not significant, * = Significant ($P<0.05$), Los = Level of Significance.

The findings of this study showed that pregnancy is associated with potential impairment of oxidative status. Increased serum malondialdehyde indicating higher level of lipid peroxidation was recorded in this study. Supplementation with antioxidants is recommended in pregnant ewes.

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