



ASSESSMENT OF OXIDATIVE STRESS DURING PERIPARTUM PERIOD IN CROSSBRED MALABARI GOATS*

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Abstract

A study was conducted to assess the oxidative stress status of cross bred Malabari goats during peripartum period. Serum levels of malondialdehyde (MDA), a degradation product of lipid peroxidation, reduced glutathione (GSH), serum ascorbic acid and oxidative stress factor (OSF) were used to assess the oxidative stress status of animals in advanced pregnancy, day of kidding and one week after kidding. Changes in haematology (PCV and Hb) associated with pregnancy and kidding were also analyzed. The results of the study showed that MDA and OSF were significantly ($P \leq 0.01$) increased in animals on day of kidding and one week after kidding when compared to non pregnant animals. Serum ascorbic acid concentration of animals was reduced on day of kidding and one week after kidding. Lowest ascorbic acid concentration was noticed at one week after kidding. However, serum GSH level was not significantly affected either by pregnancy or by kidding. Haemoglobin level of pregnant animals was significantly higher ($P \leq 0.05$) when compared to that of non- pregnant animals.

Key words:- Oxidative stress, peripartum period, goats.

Oxidative stress (OS) is a condition caused by excess production of free radicals and or depletion of antioxidant reserve within the body. During normal metabolic reactions, reactive oxygen species (ROS) like superoxide anion radicals, hydrogen peroxide and hydroxyl radical are formed continuously in living cells which cause oxidative damage to

J. Rejitha¹ and K. Karthiayini²

Department of Veterinary Physiology,
College of Veterinary and Animal Sciences,
Mannuthy-680651, Thrissur, Kerala.

the cells. However, under physiological conditions, there is a balance between endogenous oxidants and various antioxidant defenses in the body. Normally, body has sufficient antioxidant reserves to manage the production of free radicals (Miller *et al.*, 1993; Castillo *et al.*, 2005), but the ROS production may increase in pathological and other stress conditions (Roth, 1997) so that the endogenous antioxidant reserves may not be sufficient to remove the ROS leading to OS. During peripartum period, increased metabolic activity and negative energy balance might also lead the animal to a state of OS. Body is capable to resist OS, but depletion of antioxidant reserve, sudden hormonal changes and physiological adaptation to increased metabolic need for lactogenesis and galactopoiesis might be the reasons for OS during peripartum period. Hence the present study was undertaken.

Materials and Methods

The experiment was conducted using eight pregnant and eight non pregnant Malabari crossbred does, aged one to six years maintained at the University Goat and Sheep Farm, College of Veterinary and Animal Sciences, Mannuthy. The blood samples were collected from pregnant animals at 128 to 138th day of pregnancy, within 12 h of kidding and one week after kidding. Blood samples were collected from animals by jugular venipuncture using sterile scalp vein. Samples were collected with and without anticoagulant (Sodium EDTA @ 1.5mg/ml of blood; Heparin 20 IU/ml of blood). Whole blood and separated serum from each animal were used for

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1. MVSc Scholar

2. Associate Professor, CVAS, Pookode, Wayanad

haematological parameters and analysis of antioxidant status. Haemoglobin (Hb) concentration and volume packed red cell (VPRC) were estimated as per the standard technique described by Schalm (1986). Level of lipid peroxides in serum was determined by estimating malondialdehyde (MDA) level (Yagi, 1984). Reduced glutathione level in blood was determined by the method of Moron *et al.* (1979). Ascorbic acid level was determined by method of Sonnenwirth and Jarett (1980). Oxidative stress factor was calculated using the formula of Bisla *et al.* (2003).

$$\text{OSF} = \frac{\text{MDA} \left(\frac{\text{nM}}{\text{ml}} \text{ of blood} \right) \times \text{GSH} \left(\frac{\text{mg}}{\text{dl}} \text{ of blood} \right)}{\text{PCV} (\%)}$$

Statistical Analysis

Independent 't'- test was used to compare the pregnant and non pregnant animals. Paired 't' test was used to compare between the different peripartum periods (Late pregnancy, day of kidding and one week after kidding) by using computerized software program SPSS Ver. 17.0.

Results and Discussion

The Hb concentration, VPRC value and oxidative stress status of pregnant animals during peripartum period and non pregnant animals are given in Table 1, Table 2, Table 3 and Table 4. The Hb concentration of pregnant animals was higher than that of non pregnant animals. There was no significant variation in the VPRC value of pregnant and non pregnant animals. These hematological parameters were also similar in animals in advanced stage of pregnancy, 12 h of kidding and one week after kidding. On day of kidding the level of lipid peroxidation was significantly high when compared to that of animals in advanced stage

of pregnancy. However, it reduced one week after kidding. The serum GSH level was similar in both pregnant and non pregnant group of does. The GSH level of animals during the peripartum period was also similar. This might be due to the increased production of GSH within the body according to the need especially during the physiological states like pregnancy and parturition. Georgeson *et al.* (2002) reported that when pregnant animal was exposed to some OS, antioxidant activities increased in placenta which limited the effect of free oxygen radicals in the embryonic tissue. There was no significant variation in the value of serum ascorbic acid between pregnant and non pregnant animals. But on day of kidding and one week after kidding the serum ascorbic acid concentration of does were less when compared to non pregnant animals. The concentration of ascorbic acid was lowest (0.68 ± 0.07 mg/dl) in animals at one week after kidding which was significantly lower than the value observed in animals of advanced stage of pregnancy. These observations showed that there might be increased production of antioxidants within the body during the period of pregnancy to meet the increased demands of the body. However, it was observed that the level of production of antioxidants is quite insufficient to meet the demand during the day of kidding and immediate post partum period which indicate the need to supplement it to alleviate the OS during these periods.

The study revealed that during peripartum period the animals were under OS indicated by high levels of MDA, a product of lipid peroxidation and reduced serum levels of antioxidants like GSH and ascorbic acid. This OS might disturb the body homeostasis leading to reduced performance of the dam and kid.

Table 1. Oxidative stress status and haematological status of non pregnant Vs pregnant animals (Mean \pm SE, n=8).

Parameters	Non pregnant animals	Pregnant animals/ 128-138 d pregnancy
MDA (nM/ml)	3.33 \pm 0.40	4.29 \pm 0.48
GSH (mg/dl)	8.30 \pm 1.07	9.53 \pm 1.21
Ascorbic acid (mg/dl)	1.13 \pm 0.08	0.91 \pm 0.08
OSF	1.07 \pm 0.13	1.57 \pm 0.24
VPRC ($\times 10^{-2}$ L/L)	26.17 \pm 0.87	25.75 \pm 0.80
Hb concentration ($\times 10$ g/L)	9.17 \pm 0.11	9.25* \pm 0.28

* - $P < 0.05$; difference significant at 5% level** - $P < 0.01$; difference significant at 1% level

Table 2. Oxidative stress status and haematological status of non pregnant Vs animals on day of kidding (Mean±SE, n=8).

Parameters	Non pregnant animals	On day of kidding
MDA (nM/ml)	3.33 ± 0.40	12.63**±3.08
GSH (mg/dl)	8.30±1.07	8.01±1.10
Ascorbic acid (mg/dl)	1.13±0.08	0.89±0.05
OSF	1.07±0.13	3.79**±0.87
VPRC (x 10 ⁻² L/L)	26.17±0.87	24.56 ±1.25
Hb concentration (x10g/L)	9.17±0.11	9.22*±0.38

* - P<0.05; difference significant at 5% level ** - P<0.01; difference significant at 1% level

Table 3. Oxidative stress status and haematological status of non pregnant Vs animals at one week after kidding (Mean±SE, n=8).

Parameters	Non pregnant animals	One week after kidding
MDA (nM/ml)	3.33 ± 0.40	6.04**±1.37
GSH (mg/dl)	8.30±1.07	7.02±0.92
Ascorbic acid (mg/dl)	1.13±0.08	0.68±0.07
OSF	1.07±0.13	2.60**±0.73
VPRC (x 10 ⁻² L/L)	26.17±0.87	23.67±1.51
Hb concentration (x10g/L)	9.17±0.11	9.22**±0.66

Table 4. Oxidative stress status and haematological status of animals on advanced pregnancy, on day of kidding and at one week after kidding (Mean±SE, n=8).

Parameters	Pregnant animals/128-138 d pregnancy	On day of kidding	One week after kidding
MDA (nM/ml)	4.29 ^a ±0.48	12.63 ^b ±3.08	6.04 ^{ab} ±1.37
GSH (mg/dl)	9.53 ^a ±1.21	8.01 ^a ±1.10	7.02 ^a ±0.92
Ascorbic acid (mg/dl)	0.91 ^b ±0.08	0.89 ^b ±0.05	0.68 ^a ±0.07
OSF	1.57 ^a ±0.24	3.79 ^b ±0.87	2.60 ^b ±0.73
VPRC (x 10 ⁻² L/L)	25.75 ^a ±0.80	24.56 ^a ±1.25	23.67 ^a ±1.51
Hb concentration (x10g/L)	9.25 ^a ±0.28	9.22 ^a ±0.38	9.22 ^a ±0.66

^{a, b} Means within a row with no common superscripts are significantly different at 5% level

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