The relationship between total thiol and pregnancy in hair goats

Research Article

ABSTRACT

Hormonal application have been applied to increase fertility in Hair Goats, but the relationship between reproduction and stress/oxidant values has not been investigated. In this study, the relationship between increase fertility and total thiol values were investigated in Hair Goats. 100 females and 20 male Hair Goats were used in this study. September, 100 females selected and marked, and blood samples were taken from all goats into anticoagulant tubes from vena jugularis 15 days before male introduction to the herd. Blood samples were collected both October and May in all goats. Total thiol values in female were found to be significant in October compared to May. It was determined that there was a difference ($p \leq 0.05$) in the total thiol value in terms of sex and birth type. The total thiol value of twin-bearing hair goats was statistically different from the non-bearing hair goats while the total thiol value in single-bearing hair goats was similar to those that gave birth to twins and those that did not. Goats with low total thiol value had a twin birth and goats with high total thiol value were have no birth. Total thiol value was found to be important for multiple births ($p \leq 0.05$). This study is the first study in the literature to show the relationship between total thiol value and offspring yield in hair goats. As a result, it was concluded that the total thiol value during the breeding season in was related to birth rate and offspring yield in hair goats.

Keywords: Hair goat, total thiol, pregnancy.

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INTRODUCTION

Much research have been carried out in order to increase production in animal husbandry and especially the studies on the breeding of genotype have been emphasized. In some cases, animals do not display their genetic capacity due to insufficient care, nutrition, environmental influences, and oxidative stress. Domestic breed goats, which are procured from enterprises with very good yield performance, cannot show their previous yield performance in the new enterprise. Similar phenomenon is also observed in dairy cattle and management, nutrition and stress factors were thought to be effective. Therefore, the effect of antioxidant substances on the fertility of hair goats should be investigated (Akyüz et al. 2020, Aslankoç et al. 2019, Chianeh et al. 2014, Çamkerten et al. 2019).

During the digestion of foods, some harmful free radicals (ROT) (hydroxyl radicale, superoxide anion, lipid peroxide, nitric oxide, hydrogen peroxide, etc.) are formed (Beaupre and Weiss 2021, Çetinkaya 2020). Damage to the body (especially to proteins, lipids and many biological molecules, especially proteins, lipids and nucleic acids) is called oxidative stress (OSI) (Coşkun et al. 2016, Esra et al. 2012), various enzymes or non-enzymes substances that prevent tissue damage by binding are called antioxidants (TAS) (Güntürk 2021, Çetinkaya 2020, Başkol and Köse 2004).

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In reducing oxidative stress, i.e. repairing damage to tissue, the organic matter that allows antioxidants to bind to damaged tissue is called Thiol (Öktem et al. 2021, Chianeh and Prabhu 2014). Thiol is an organic compound containing a sulfidril (-SH) group that is important in preventing oxidative stress in cells (Beaupre and Weiss 2021, Sen and Packer 20005). The amount of cells damaged by free radicals and the total amount of Thiol are directly proportional (Haydar et al. 2020). The first target of free radicals is thiol groups. With free radicals, the thiol groups in the environment are oxidized and transformed into reversible disulfide bonds. This conversion is the earliest sign of radical-mediated protein oxidation (Öktem et al. 2021, Haydar et al. 2020). Accordingly, the decrease in the amount of Total Thiol in the blood is associated with the damage to the tissues, and the increase in the value of antioxidants for tissue repair and the decrease in the value of thiol are formed. Oxidative stress is defined as the imbalance between oxidants and antioxidants at the cell value (Beaupre and Weiss 2021, Haydar et al. 2020). Antioxidant enzymes are capable of neutralizing harmful free radicals and preventing oxidative stress (tissue damage). Thiol groups provide this operation (Beaupre and Weiss 2021, Büyükoğlu 2018). Thiol groups also have critical roles in antioxidant defense, apoptosis, immune response, inflammation and intracellular signaling mechanisms. Oxidative products such as reactive oxygen species formed in the organism are reduced by transferring their excess electrons to compounds containing thiol (Beaupre and Weiss 2021, Gümüşyayla et al. 2016), while thiol groups are oxidized. The oxidation of thiol groups causes the formation of disulfide bonds. However, this is a reversible reaction, and the disulfide bonds formed can be reduced back to thiol groups. Some of the antioxidants that reduce/eliminate OSI by Thiol are ascorbic acid (Vit. C), α-tocopherol (Vit E) and Ceruloplasmin (Dimri et al. 2010). In addition, zinc, copper, iron and selenium are essential components of certain substances such as hormones and enzymes and endogenous antioxidants (Aslankoç et al. 2019). It has been reported that oxidative stress creates pathological conditions for the cell and impairs the comfort of farm animals, thus affecting production (Lykkesfeldt and Svendsen 2007). Çamkerten et al. (2019) found that the disulfide balance in infested sheep is affected by the pendulum scabies factor and they suggest that antioxidant molecules that will provide this balance should be used in the treatment. Total Disulfide Hemostasis has been shown to suggest that imbalance triggers disease through oxidative stress and tissue inflammation (Üstüner 2018). Haçarız and Baykal (2014) state that antioxidant substances (in order to ensure the regeneration of the damage caused) are more active in the infested liver tissue with Fasciola Hepatica to stimulate the immune system. Thiol groups interact with antioxidants and are neutralized. Total concentrations of thiol and natural thiol, a less toxic product called disulfide, have been shown to decrease (Erel and Neşelioğlu 2014).

MATERIAL and METHOD

Animal Material

The material of the study consisted of 100 heads of females with a live weight (LW) of 45-50 kg and 20 heads of male goats 60-70 kg LW aged 2-4 years in a family business located in Aksaray province. In September, the animals in the enterprise were fed with an average of 100 g of wheat hay and 80-100 g of barley in addition to pasture, while in May, they were fed entirely based on pasture. The water needs of the animals were ad libitum. In October, 15 days before the male introduction, of all goats included in the stady blood samples were taken. Blood was taken from the same animals again before the start of lactation in May. Blood samples were taken from anticoagulant tubes from vena jugularis. The samples were

transported to the laboratory in accordance with the cold chain rule. The tubes containing blood samples were centrifuged at +4°C, 3000 RPM for 10 minutes and the sera were removed. Each resulting serum was transferred to two Eppendorf tubes and stored at -20°C until further analysis. Total thiol values were determined by the colorimetric method revealed by Erel and Neşelioğlu.

Statistical Analysis

Descriptive statistics for continuous variables are given as Mean, Standard Deviation, Minimum and Maximum values, while for Categorical variables it is expressed as number and percentage. One-way analysis of variance was performed to compare group averages in terms of continuous variables. Following the analysis of variance, Duncan multiple comparison test was used to identify different groups. Pearson correlation coefficients were calculated to determine the relationship between these variables. In determining the relationship between groups and categorical variables, Chi-square test was performed. The statistical significance value was taken as 5% in the calculations and SPSS (ver.21) statistical package program was used for the calculations.

RESULTS

Lipid Profile Findings

Total thiol values varied depending on sex and season (low in both sexes compared to May in October) (Table 1) and the importance of the effect of these values on fertility were determined by correlation (Table 3). It was determined that there was a statistical difference ($p \leq 0.05$) in total thiol value in terms of sex and birth Type (Table 2). It was found that the total thiol value of twin-bearing hair goats was similar to single-bearing hair goats but statistically different from infertile hair goats (Table 2). It was found that single-bearing and infertile goats were statistically similar (Table 2). Twin births were higher in hair goats with low total thiol value and no birth was found in hair goats with high total thiol value (Table 2). Total thiol value was found to be important for multiple births ($p \leq 0.05$, $r \geq 0.05$) (Table 2, Table 3). Total thiol values in single-bearing hair goats were similar to those of twin-bearing and non-twin-bearing hair goats (Table 2). From the data obtained in this study, it was seen that there was a correlation between Total thiol and antioxidants (r=0.549) (Table 3).

Table 1. Descriptive statistics and comparison results by season and gender

	Gender	Oktober			May		
		Mean	SD	SEM	Mean	SD	SEM
TotalThiol (µmolL)	M	◊ 298,15 #	66,72	14,92	◊622,95	136,08	30,43
	F	451,84 #	73,11	7,31	518,35	125,49	12,55

Statistically different from May.◊ Statistically different from females

Table 2. Descriptive statistical values and number of animals for total thiol value in October (October Addition) for sterile, single and twin births.

		Mean	SD	Min.	Max.	P
Total Thiol (µmol/L)	Single (n=73)	AB 462,42	62,688	352	568	0,003
	Twin (n=23)	B 414,65	95,197	332	553	
	Infertile (n=4)	A 472,50	41,485	414	502	
	Total	481,00	126,441	101	784	

A, B,C↓: The category that takes different uppercase letters in the same column is statistically significant

Table 3. Correlations between Total Tiol value and TAS, TOS, OSI in October

	Total Thiol (µmol/L)	TAS (mmol/L)	TOS (µmol/L)	OSI
Total Thiol (µmol/L)	1			
TAS (mmol/L)	0,549**	1		
TOS (µmol/L)	0,167**	0,094	1	
OSI	0,047	0,124	0,973**	1

** p< 0.01 *: p<0.05

DISCUSSION

Small ruminants are the animals that make the best use of the land that is not suitable for agriculture and create employment and economy with products such as meat, milk leaf/mohair. Although it is difficult to manage compared to sheep, hair goats make better use of rugged and unproductive pastures. Although the birth rate is high in hair goats, twinning rate is quite low (Boztepe et al. 2014, Erduran 2010). Since hair goats are grazed in pastures with poor vegetation and low grass yield which cause oxidative stress due to the lack of balanced feeding, and therefore it is stated that the fertility is low (Boztepe et al. 2014, Gökdal 20 20). As a matter of fact, in the study presented, it is seen that the birth rate is high in hair goats with low Total Thiol values, which provide neutralization of oxidative stress factors (environment for antioxidants to function) during the breeding season (October) (Table 2).

In the literature review, there were no studies on the subject. Studies aimed at increasing the yield of offspring in goats have been mostly associated with hormone values and studies have been carried out in this direction. This study, which identified a situation that it is possible to increase fertility by reducing oxidative stress, revealed that there is a relationship between Total Thiol value and fertility (Table 3). Ghavipanje et al. (2021), who have studied a similar subject, state that there is not enough data on the evaluation of yield in dairy goats related to TAS. There has been no study revealing the relationship between Total Thiol value and offspring yield in hair goats or any animals. For this reason, it is believed that this study is the first research to evaluate the total thiol value and the fertility of hair goats. Because OSI, which occurs because of diseases and unbalanced feeding in animals, is expressed by many scientists to have a significant effect on comfort, fertility and ovarian functions (Çoşkun et al. 2016, Klir et al. 2019).

In a study conducted at Ankara Numune Training and Research Hospital, the rate of Thiol was found to be significantly higher in Hyper Blood Pressure (HT) patients than in healthy patients. Because cell damage (apopotosis) is higher in sick individuals, to eliminate cell damage binding thiols bind via sulfidril bonds (–SH) to prepare antioxidants to prevent this damage. In other words, thiols will be used, and cell damage will be tried to be eliminated. In healthy ones, if there is existing damage using Thiols, it is reduced by using it in regeneration (Ates et al. 2016). In the current study, antioxidants function by using Thiols (by decreasing the value of Total Thiol), oxidative stress was reduced, and twin (majority) births occurred (Table 2).

It isreported that there are non-significant decreases and increases in total thiol values in calves that have been discharged by applying sedative, local anesthetic, and anti-inflammatory drugs in the dehorning surgery until the 120th minute after application (Erdoğan et al. 2019). In the present study, it is found that there are differences in total Thiol values between the seasons (October/May) and it is like Erdoğan et al. (2019).

Total thiol values are expected to be low in individuals with low Oxidative stress since the

enzyme that allows antioxidant substances to bind to the oxidant substances (Gumusyayla et al. 2016). Since a reference value has not yet been established with the value of Total Thiol in hair goats, it is seen that the total thiol ratio is quite high compared to other species (human, cattle) in the presented study. The total Thiol values obtained in this study are also thought to constitute a reference value. The twin birth rate (23%) increased in hair goats whose total thiol value was below the average Thiol value (451.84 µmol/L, Table 1) (Table 2). Most births were quite high in the enterprise where the study was conducted.

Total thiol values were found to be significantly lower in people with chronic renal failure (CKD) compared to healthy people. In the presented study, the low total thiol rate in hair goats with multiple births compared to infertile (sick) hair goats coincides with the reports of Coşkun et al. (2016). Üstüner (218) states that there is a significant difference in total thiol values in patients with vitiligo compared to healthy people. In the presented study, it is similar to the high value of total thiol in infertile hair goats (health problems). It is stated that the total thiol value decreases with recovery as the total thiol value is high at the beginning of the infection in infants with pneumonia (Öktem et al. 2021). Başgöz et al. (2021) reported that 66 newborns with sepsis had high total thiol values before treatment. Due to severe infection or oxidative stress, the total thiol value is highest in those who do not give birth and lowest in those who give birth to twins, coincides with some reports (Öktem et al. 2021, Başgöz et al. 2021).

In the case of oxidative stress due to infection, thiol values have been reported to decrease (Esen et al. 2015). It has been demonstrated by many scientists that oxidative stress adversely affects fertility. It was determined that there was a significant correlation between oxidative stress and total thiol values (Table 3) ($r \geq 0.5$). In this case, it will be possible that since there is a correlation with total thiol and oxidative stress, there is also an important correlation between total thiol and fertility (Table 3).

CONCLUSION

This study is the first study in the literature to show the relationship between total thiol value and offspring yield in hair goats. We report that there is a need to investigate the effect of oxidative stress and the measure to alleviate its effect on fertility in hair goats and other farm animals.

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Ethical approval:

The study was carried out by the approval of Selcuk University Faculty of Veterinary Medicine, Experimental Animals Production and Research Center Ethics Committee (09.12.2020 and 2020/116).

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