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Research Article

Serum Thiol Disulphide Levels Among Sheep with Sarcoptic Mange

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Abstract

Sarcoptic mange, a notable parasitic disease, causes dermatological alterations among ruminants. Thiol-disulphite hemostasis is a novel oxidative stress parameter. The aim of this study was to evaluate dynamic thiol/disulfide homeostasis in sheep with sarcoptic mange. Total of thirty-six sheep (n=15 female, n=21 male) with sarcoptic mange (Group I), and twelve healthy sheep (Group II) were used in the study. A novel method was used to determine the thiol disulphide parameters. Native thiol, total thiol and Disulphide values were statistically lower in Group I. Disulphide/native thiol, Disulphide/total thiol, and Native thiol/total thiol proportions had no statistical differences in groups. Sarcoptic mange was probably affected by the thiol Disulphide hemostasis in infected sheep. Thus, the data obtained in this study might form base for further studies to include antioxidant molecules in the treatment protocols.

Keywords: *Oxidative stress, Sarcoptic mange, Sheep and Thiol disulphide*

Sarkoptik Uyuzlu Koyunlarda Serum Tiyol Disülfit Seviyeleri

Öz

Önemli paraziter bir hastalık olan sarkoptik uyuz ruminantlarda dermatolojik lezyonlara neden olmaktadır. Tiyol-disülfit dengesi yeni bir stress oksidatif parametresidir. Bu çalışmanın amacı sarkoptik uyuzlu koyunlarda dinamik tiyol/disülfit dengesinin değerlendirilmesidir. Bu amaçla sarkoptik uyuzla (grup I) enfekte 36 koyun (n=15 dişi, n=21 erkek) ve 12 sağlıklı koyun (grup II) çalışmaya dahil edilmiştir. Tiyol disülfitin belirlenmesinde yeni bir metot kullanılmıştır. Natif tiyol, total tiyol ve disülfit parametreleri grup I'de istatistiksel olarak düşük seyrederken disülfit/natif tiyol, disülfit/total tiyol ve natif tiyol/total tiyol oranları arasında gruplarda farklılık elde edilmemiştir. Sarkoptik uyuzun enfekte koyunlarda disülfit dengesini etkilediği düşünülmekte olup bu dengeyi sağlayacak antioksidan moleküllerin terapotik seçeneklere eklenmesi gerektiği öngörülmektedir.

Anahtar sözcükler: *Oksidatif stres, Sarkoptik uyuz, Koyun ve Tiyol disülfit*

INTRODUCTION

Sarcoptic mange, a well-known/significant parasitic disease, causes animal discomfort and dermatological alterations among ruminants. Due to parasite and host interactions [epidermal layer, *stratum corneum* and responsible agent as, *Sarcoptes scabiei* var *canis*] itching, alopecia and primary/secondary lesions exist [1]. Small ruminant animals are well known to adapt to unpleasant harsh conditions. Indeed, overcrowding, nutritional deficiencies and effects of various diseases can result in economic losses [2]. Among sheep diseases, mites are one of the most beneficial reasons of economic loss related to dermal system due to morphlogical changes [3]. Mite invasions are contagious skin diseases resulted with reduce in meat quality due to skin damage by hyperkeratosis, pruritus [4].

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Oxidative stress term describes the balance relation in oxidants and antioxidants, when the balance shift in oxidants. Thus, increased formation of free radicals and lipid peroxidation develops the oxidative stress. Oxidative stress might be estimated with malondialdehyde, sialic acid, total oxidant capacity and total antioxidant capacity [5].

Thiol, a well-known antioxidant, participate within the eradication of reactive oxygen molecules by enzymatic/non-enzymatic pathways [6,7]. Low molecular weight thiols, (i.e. homocysteine, cysteine, glutathione, and albumin), all involve within the plasma thiol pool. Thiols employ in oxidative response within oxidant molecules, establishing disulfide bonds. Regarding arrangement of enzymatic reactions, detoxification, apoptosis, regulation of signaling pathways, dynamic thiol/disulfide homeostasis is essential. Taking into account altered thiol/disulfide concentrations are associated with many inflammatoric conditions [8-14], determination of thiol/disulfide homeostasis were composed of classic Ellman method using 5,5¢-dithiobis-(2-nitrobenzoic) (DTNB) acid [15], high-performance liquid chromatography, fluorescence capillary electrophoresis, bioluminescent systems [16-19] and relatively novel method as described by Erel and Neselioglu [20]. In the present study the aim was to analyze dynamic thiol/disulfide homeostasis in sheep with sarcoptic mange.

MATERIAL and METHODS

Thirty-six sheep from both sexes (n=15 female, n=21 male) were admitted to Adnan Menderes University, Faculty of Veterinary, Department of Internal Medicine with a alopecia, crusting and scaling history. The diseased population enrolled in the present study at the age of 1 to 6 years of age, of both sexes (n=15 female, n=21 male). The vast majority of the sheep breed were composed of Sakiz. At clinical examination lesions typically showing sarcoptic mange appearance were severely excoriated [i.e. scratching, itching and biting/self-damage]. The lesions were located on the nose, ear and mouth edge. Other twelve sheep were involved as healthy control. Deep skin scrapings were collected from lesions (ear and face) for diagnosis of sarcoptic mange. For determining the mite examination 10% NaOH were used on slide to microscopy.

Afterwards, sheep were allocated in to two groups. Group I involved 26 sheep with sarcoptic mange and Group II healthy control animals (n=12) without obvious clinical signs. Blood samples were collected from jugular vein in to the tubes (Vacutte, USA) containing with clot activator. All samples were centrifugated at 3000 rpm for 10 min and sera were kept on -80°C until analyses. Thiol Disulphide parameters were analyzed with a commercial ELISA kit (Real Assay Diagnostics, Turkey) as described before [20].

Statistical Analyses

Native thiol, total thiol, disulphide, Disulphide/native thiol %, Disulphide/total thiol % and Native thiol/total thiol % levels in groups were tabulated as mean and standard deviation. Groups were compared with non-parametric Mann-Whitney U test since data did not showed normal distribution. All analyses were performed with SPSS 21.0 (IBM, Chicago) program and $P<0.05$ were considered significant.

RESULTS

Oxidative stress parameters native thiol, total thiol, and disulphide values were statistically lower in Group I. The calculated parameters Disulphide/native thiol, Disulphide/total thiol, and Native thiol/total thiol ratios had no statistical differences in Group I and II shown in *Table 1*, *Fig 1*.

DISCUSSION

During consultation sheep infested with sarcoptic mite showed significant exfoliative dermatitis, scaling and crusting along with intense pruritus, self-trauma and wool loss. Complete lesions observed in nonwoolly skin of the body determined on to the face, as described previously [21-23]. Primary/secondary skin lesions [24] comprising alopecia, mild crusting [lips, nostrils to those of extending to other parts of the head, face and ears] and significant erythema. The vast majority of the sheep presented self-trauma due to pruritus, alopecia namely wool loss, brown scabs on to the skin [22].

It has been well recognized that the oxidation of reactive oxygen radicals relatively causes disulfide bonds existing. Disulfide bonds might return to thiol groups, through a pathway involving thiol/disulfide homeostasis

Table 1. *Thiol/disulphide hemostasis parameters of healthy and sheep with sarcoptic mange*

Parameters	Group I	Group II	*P value*
Native thiol	188.64±99.21	276.03±46.81	0.002
Total thiol	198.93±97.92	324.89±32.79	0.000
Disulphide (SS)	18.95±7.44	33.67±5.86	0.000
Disulphide/native thiol %	25.59±33.97	12.78±4.43	0.429
Disulphide/total thiol %	14.15±10.64	10.49±2.38	0.982
Native thiol/total thiol %	85.05±26.76	84.69±11.16	0.228

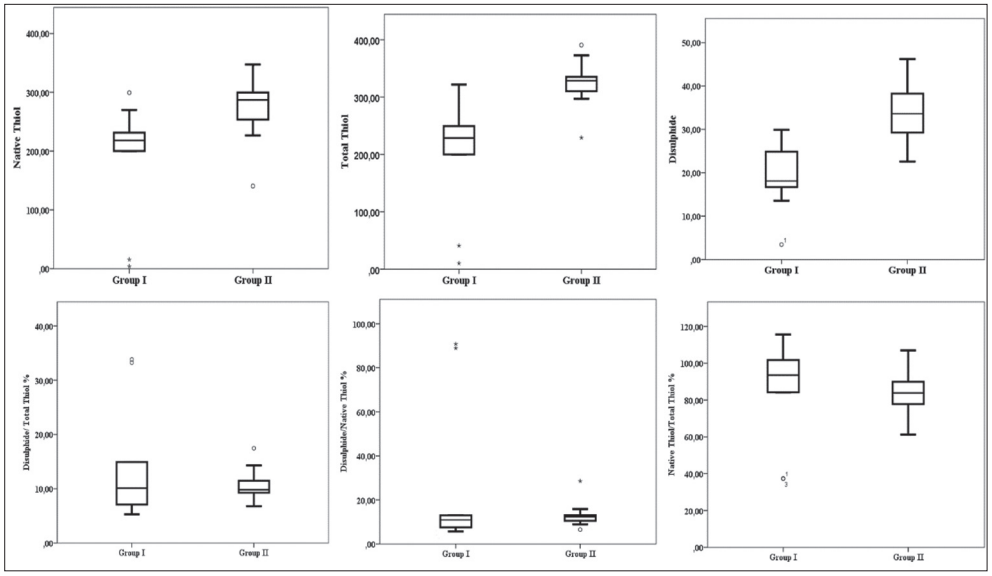

Fig 1. The box plot display of thiols/disulphide parameters of healthy and sheep with sarcoptic mange

maintenance [25,26]. Altered thiol/disulfide balance has been related to several diseases [8-14]. In the present study, thiol, as an important component of the plasma antioxidant system, was significantly lower in sheep with sarcoptic mange.

The results of the present study might be comparable to prior investigations [27]. In a previous research oxidant/antioxidant balance to those dogs with sarcoptic mange, composed of 30 cross-breed male dogs [n=15 with sarcoptic mange compared with n=15 healthy controls], lipid hydroperoxide level, total oxidant status and oxidative stress index in diseased dogs were statistically elevated (P<0.01, P<0.01 and P<0.05, respectively) when compared to healthy ones [27]. Taking into account sulphydril levels in mange mite infected cases statistically decreased levels (P<0.05) were striking. There was no statistical difference detected to those of total antioxidant capacity among groups. The researcher briefly concluded a probable relationship between oxidant/antioxidant imbalance and sarcoptic mange infestation in dogs [27].

A relatively novel research evaluating oxidative stress [by detecting malondialdehyde (MDA), total antioxidant capacity (TAC) and total oxidant status (TOS)] markers in 40 sheep naturally infected with *Psoroptes ovis indicated that* serum MDA and TOS increased significantly (P<0.01), whereas serum TAC decreased significantly (P<0.01) in diseased animals. Available evidence suggested a probable interaction between oxidant/antioxidant imbalance and *Psoroptes ovis* infection in sheep. The authors concluded that MDA, TAC and TOS might be interpreted for detecting the oxidative stress in naturally occurring *Psoroptes ovis* infection among sheep [28].

Another research designated for detecting the status of antioxidant alterations in 59 pigs naturally infected with sarcoptic mange, three groups were involved as follows; healthy control, subclinical sarcoptic mange and clinical sarcoptic mange. Lipid peroxides (LPO), reduced glutathione (GSH), superoxide dismutase (SOD) and glutathione peroxidase (GPx) were measured. Regarding the latter study GSH, SOD, GPx concentrations in blood were significantly declined in the clinical and subclinical sarcoptic mange groups, in contrast to the healthy controls, whereas LPO content of diseased pigs was significantly higher. From the present study, it may be concluded that sarcoptic mange was related to remarkable alterations in the oxidative stress markers, which promptly necessitates correction of the antioxidant status of the infested pigs [29]. In another research thiol-disulphide hemostasis was examined on calves undergoing dehorning process with different analgesia protocols. This study stated the reduction on native thiol and total thiol levels in all analgesia groups without any significance and researches pointed out the pain management protocols might be influence the oxidative balance by thiols [30].

Thiol measurement is a growing era in basic and applied molecular life sciences. By measurement of thiol/disulfide homeostasis, it may be possible to understand and highlight the negative effects of oxidative stress in an attempt to make interpretation for disease activation. The results of this study might suggest that further researches directed to include antioxidant molecules in the treatment protocols of such cases may be of help.

REFERENCES

1. Corke M, Matthews J: Diagnosing and treating skin diseases in goats: An update. *In Practice*, 40 (4): 149-156, 2018. DOI: 10.1136/inp.k1595

2. Nixon EJ, Vineer HR, Wall R: Treatment strategies for sheep scab: An economic model of farmer behaviour. *Prev Vet Med*, 137, 43-51, 2017. DOI: 10.1016/j.prevetmed.2016.12.015

3. Woldemeskel M: Dermatophilosis: A threat to livestock production in Ethiopia. *Dtsch Tierarztl Wochenschr,* 107 (4): 144-146, 2000.

4. Asmare K, Abebe R, Sheferaw D, Krontveit RI, Barbara W: Mange mite infestation in small ruminants in Ethiopia: Systematic review and meta-analysis. *Vet Parasitol*, 218, 73-81, 2016. DOI: 10.1016/j.vetpar.2016.01.017

5. Uzlu E, Karapehlivan M, Erdoğan HM, Kızıltepe Ş, Erkılıç EE, Deveci HA, Gökçe E, Kaya İ, Çitil M: Serum and saliva sialic acid and oxidative stress parameters changes in bulls with foot and mouth disease. *Kafkas Univ Vet Fak Derg*, 22 (3): 321-325, 2016. DOI: 10.9775/kvfd.2015.13114

6. Espinosa-Diez C, Miguel V, Mennerich D, Kietzmann T, Sánchez-Pérez P, Cadenas S, Lamas S: Antioxidant responses and cellular adjustments to oxidative stress. *Redox Biol*, 6, 183-197, 2015. DOI: 10.1016/j.redox.2015.07.008

7. Young IS, Woodside JV: Antioxidants in health and disease. *J Clin Pathol,* 54 (3): 176-186, 2001. DOI: 10.1136/jcp.54.3.176

8. Biswas S, Chida AS, Rahman I: Redox modifications of protein-thiols: Emerging roles in cell signaling. *Biochem Pharmacol,* 71 (5): 551-564, 2006. DOI: 10.1016/j.bcp.2005.10.044

9. Circu ML, Aw TY: Reactive oxygen species, cellular redox systems, and apoptosis. *Free Radic Biol Med,* 48 (6): 749-762, 2010. DOI: 10.1016/j.freeradbiomed.2009.12.022

10. Matteucci E, Giampietro O: Thiol signalling network with an eye to diabetes. *Molecules,* 15 (12): 8890-8903, 2010. DOI: 10.3390/molecules15128890

11. Tetik S, Ahmad S, Alturfan AA, Fresko I, Disbudak M, Sahin Y, Aksoy H, Yardımcı KT: Determination of oxidant stress in plasma of rheumatoid arthritis and primary osteoarthritis patients. *Indian J Biochem Biophys,* 47 (6): 353-358, 2010.

12. Go YM, Jones DP: Cysteine/cystine redox signaling in cardiovascular disease. *Free Radic Biol Med,* 50 (4): 495-509, 2011. DOI: 10.1016/j.freeradbiomed.2010.11.029

13. Kuo LM, Kuo CY, Lin CY, Hung MF, Shen JJ, Hwang TL: Intracellular glutathione depletion by oridonin leads to apoptosis in hepatic stellate cells. *Molecules,* 19 (3): 3327-3344, 2014. DOI: 10.3390/molecules19033327

14. Prabhu A, Sarcar B, Kahali S, Yuan Z, Johnson JJ, Adam KP, Kensicki E, Chinnaiyan P: Cysteine catabolism: A novel metabolic pathway contributing to glioblastoma growth. *Cancer Res,* 74 (3): 787-796, 2014. DOI: 10.1158/0008-5472.CAN-13-1423

15. Winther JR, Thorpe C: Quantification of thiols and disulfides. *Biochim Biophys Acta,* 1840 (2): 838-846, 2014. DOI: 10.1016/j.bbagen.2013.03.031

16. Mourad T, Min KL, Steghens JP: Measurement of oxidized glutathione by enzymatic recycling coupled to bioluminescent detection. *Anal Biochem,* 283 (2): 146-152, 2000. DOI: 10.1006/abio.2000.4659

17. Carru C, Deiana L, Sotgia S, Pes GM, Zinellu A: Plasma thiols redox status by laser-induced fluorescence capillary electrophoresis. *Electrophoresis,* 25 (6): 882-889, 2004. DOI: 10.1002/elps.200305768

18. Chen W, Zhao Y, Seefeldt T, Guan X: Determination of thiols and disulfides via HPLC quantification of 5-thio-2-nitrobenzoic acid. *J Pharm Biomed Anal,* 48 (5): 1375-1380, 2008. DOI: 10.1016/j.jpba.2008.08.033

19. Glowacki R, Bald E: Fully automated method for simultaneous determination of total cysteine, cysteinylglycine, glutathione and homocysteine in plasma by HPLC with UV absorbance detection. *J Chromatogr B Analyt Technol Biomed Life Sci,* 877 (28): 3400–3404, 2009. DOI: 10.1016/j.jchromb.2009.06.012

20. Erel O, Neselioglu S: A novel and automated assay for thiol/disulphide homeostasis. *Clin Biochem,* 47 (18): 326-332, 2014. DOI: 10.1016/j.clinbiochem.2014.09.026

21. Agegnehu A, Bogale B, Tesfaye S, Dagnachew S: Status of mange infestation in indigenous sheep and goats and their control practices in Wag-Himra zone, Ethiopia. *J Vet Med Anim Health*, 10 (5): 128-134, 2018. DOI: 10.5897/JVMAH2017.0649

22. Iqbal A, Baba MA, Shah M, Mushtaq I, Sakina A, Wani S: Treatment of mange infection in a weaner flock of sheep with ivermectin at sheep breeding farm Hardishiva of Kashmir valley. *J Parasit Dis,* 39 (2): 171-173, 2015. DOI: 10.1007/s12639-013-0305-6

23. Seid K, Amare S, Tolossa YH: Mange mites of sheep and goats in selected sites of Eastern Amhara region, Ethiopia. *J Parasit Dis*, 40 (1): 132-137, 2016. DOI: 10.1007/s12639-014-0463-1

24. Ural K, Tunca R, Alıç Ural D, Çamkerten İ, Erdoğan H, Ayan A, Gültekin M, Haydardedeoğlu AE, Aysul N, Erdoğan S: Interpretation of serum 25-Hydroxy vitamin D3 concentrations in sheep with naturally occuring sarcoptic mange. *J Adv VetBio Sci Tech,* 3 (1): 35-40, 2018. DOI: 10.31797/vetbio.413018

25. Hudson DA, Gannon SA, Thorpe C: Oxidative protein folding: From thiol–disulfide exchange reactions to the redox poise of the endoplasmic reticulum. *Free Radic Biol Med*, 80, 171-182, 2015. DOI: 10.1016/j.freeradbiomed.2014.07.037

26. Kundi H, Ates I, Kiziltunc E, Cetin M, Cicekcioglu H, Neselioglu S, Erel O, Ornek E: A novel oxidative stress marker in acute myocardial infarction; thiol/disulphide homeostasis. *Am J Emerg Med*, 33 (11): 1567-1571, 2015. DOI: 10.1016/j.ajem.2015.06.016

27. Camkerten I, Sahin T, Borazan G, Gokcen A, Erel O, Das A: Evaluation of blood oxidant/antioxidant balance in dogs with sarcoptic mange. *Vet Parasitol,* 161 (1-2): 106-109, 2009. DOI: 10.1016/j.vetpar.2008.12.019

28. Aktas MS, Kandemir FM, Kirbas A, Hanedan B, Aydin MA: Evaluation of oxidative stress in sheep infected with Psoroptes ovis using total antioxidant capacity, total oxidant status, and malondialdehyde level. *J Vet Res,* 61 (2): 197-201, 2017. DOI: 10.1515/jvetres-2017-0025

29. Dimri U, Bandyopadhyay S, Singh SK, Ranjan R, Mukherjee R, Yatoo MI, Patra PH, De UK, Dar AA: Assay of alterations in oxidative stress markers in pigs naturally infested with *Sarcoptes scabiei* var. *suis*. *Vet Parasitol,* 205 (1-2): 295-299, 2014. DOI: 10.1016/j.vetpar.2014.06.015

30. Erdoğan H, Camkerten I, Çamkerten G, Ural K, Erdoğan S, Günal İ, Erel Ö: The Effect of hot-iron disbudding on thiol-disulphide homeostasis in calves. *Kafkas Univ Vet Fak Derg*, 25 (3): 335-339, 2019. DOI: 10.9775/kvfd.2018.20950