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Investigation of Serum Leptin, Thyroid Hormones and Some Biochemical Parameters in Sarcoptic Sheeps: A Preliminary Study

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Abstract
The aim of this study was to determine the effects of the parasitic infestation on some hormonal and biochemical values in sheep infected with sarcoptic scabies. In this context, leptin and thyroid hormones which are important in metabolism and some biochemical changes were examined. The study material was selected from sheeps presented to Research and Application Hospital of Veterinary Faculty of Kırıkkale University and divided into two groups. The first group was consisted of sheeps infected with sarcoptic scabies and the second group was selected from healthy sheeps. The blood samples were collected from vena jugularis to serum tubes and they were centrifugated for the separation of the sera. The biochemical measurements were performed on these serum samples to investigate the levels of T3, T4, FT3, FT4 and leptin hormones as well as magnesium, albumin, total protein, uric acid, inorganic phosphate, triglyceride, calcium, creatine kinase and cholesterol. From these parameters, T4, calcium and cholesterol were increased and the FT3 values were decreased in the group of sarcoptic sheeps ($p<0.05$). Our data suggest that sarcoptic scabies may disturb the balance of thyroid hormone levels and lead to differences in the levels of biochemical parameters.

Keywords: Sheep, Mange, Thyroid Hormone, Leptin, Biochemical parameters.

INTRODUCTION

Sheep breeding is an important livelihood in the most of developing countries. Scabies is an important parasitic skin disease and one of the main problems of sheep raising. Especially in late autumn, winter and early spring scabies can be seen as outbreaks. These outbreaks can be divided into 4 different forms as sarcoptic, psoroptic, chorioptic and demodectic scabies (Gürgöze et al. 2003; Özer et al. 1998; Sekin et al. 1995; Ural et al. 2018). Because of the lack of predisposition of race, age and sex in sarcoptic scabies, each age group can be transmitted to animals and it can be seen in human medicine because of its zoonotic character (Bilal, 2008; Curtis, 2004). A rapid spread between animals is observed since the transmission can be easily by contact (Gürgöze et al. 2003; Umur and Irmak, 1993). This situation causes both economic and yield losses for the enterprise as well as decreasing the quality of leather and fleece.

Most of the studies on sarcoptic scabies have been designed for treatment and with such cases hormonal and biochemical parameter changes monitoring has been remained in a low level in animals. There are few studies to determine thyroid hormone levels (T3,T4,FT3 and FT4) responsible for energy consumption for both growth, development and thermoregulation (Ateşşahin et al. 2002; Dönertaş and Altıntaş, 2010). Also, in point of leptin, which is a type of antiobesity factor that provides functions such as regulation of gastrointestinal functions and sympathetic nervous system activation, regulation of energy intake and energy expenditure, which has been observed to be insufficient to report data of alterations on parasitic infections in farm animals (Aslan et al. 2004).

The aim of this study was to investigate the relationship between thyroid hormones, leptin and biochemical parameters such as magnesium, albumin, total protein, uric acid, inorganic phosphate, triglyceride, calcium, creatine kinase and cholesterol levels in sarcoptic scabies infected sheeps.

MATERIALS AND METHODS

In this study, Akkaraman sheeps (n=8) which were presented to Research and Application Hospital of Veterinary Faculty of Kırıkkale University and clinically positive after clinical and laboratory examinations for sarcoptic scabies were used. Five Akkaraman sheeps were selected as the control group which were determined to be healthy as the result of clinical examinations. Blood samples were collected from the infected and control animals in order to perform the related measurements in accordance with the aim of the present study. Red-cap serum tubes were used to collect blood samples from jugular vein for sampling. Blood samples were centrifuged at 3000 rpm for 10 minutes serum was removed to store at -80ºC until the related measurements were performed.

Commercial kits were used for the biochemical analysis of the obtained blood sera. ELISA kits were used for the measurement of T3, T4, FT3, FT4 (Diametra®, Italy) and leptin (Cusabio®, USA) hormones. Spectrophotometric kits were used to determine the magnesium, albumin, total protein (Spinreact ®, Spain), uric acid, inorganic phosphate, triglyceride, calcium, creatine kinase and cholesterol (Teco diagnostic ®,USA) levels. Each measurement was performed according to the protocol of the commercial kit using a spectrophotometer (Thermo Scientific MultiskanGO). Mann-Whitney U test was used to compare the differences between sarcoptic and control groups. The data were evaluated with SPSS (22.0 IBM, Chicago) statistical program and $p<0.05$ was considered as significant.

RESULTS

Eight sarcoptic sheeps showed clinical and laboratory evidences caused by sarcoptic scabies selected for the study. There was an itch that caused the animals to rub against the walls and fences due to localized itching on the head, neck and trunk. In addition to the thickening of the skin and hair loss (Figure 1), crusting foci due to flowing lymph fluid were clearly seen. Microscopic examination was performed by dropping %10 potassium hydroxide (KOH) on the skin scraping which was taken by bleeding. As a result of the 10x microscopic examination, the presence of the parasitic agent (Sarcoptes scabiei var. ovis) was determined and given in Figure 2. The levels of the biochemical parameters of the study groups were presented in Table 1.

Figure 1. Hair loss in the animals of sarcoptic group of the present study.

Figure 2. Microscopic image of sarcoptic scabies (10x).

Table 1. ELISA and spectrophotometric analyses in control and infested animals.

Parameter	Control	Infested	Level of significance
FT3 (pg/ml)	3.33 ± 0.34	3.04 ± 0.22	<0.05
FT4 (ng/dl)	1.02 ± 0.09	1.06 ± 0.14	
T4 (µg/dl)	8.52 ± 0.23	8.75 ± 0.19	<0.05
T3 (ng/dl)	189.23 ± 13.59	202.55 ± 17.41	
Leptin (ng/ml)	12.30 ± 0.67	11.75 ± 1.01	
Triglycerides (mg/dl)	206.46 ± 4.54	205.38 ± 2.73	
Uric acid (mg/dl)	5.04 ± 0.10	5.15 ± 0.27	
Calcium (mg/dl)	7.04 ± 0.28	8.21 ± 0.45	<0.05
Albumin (g/dl)	4.41 ± 2.75	2.82 ± 0.65	
Cholesterol (mg/dl)	79.21 ± 4.51	105.41 ± 18.32	<0.05
Inorganic phosphate (mg/dl)	7.26 ± 0.63	7.25 ± 1.09	
Magnesium (mg/dl)	1.90 ± 0.09	2.00 ± 0.20	
Total protein (g/dl)	6.62 ± 1.91	7.89 ± 1.40	
Creatine kinase (IU/L)	435. ± 317.78	253.38 ± 286.76	
FT3 (pg/ml)	3.33 ± 0.34	3.04 ± 0.22	<0.05
FT4 (ng/dl)	1.02 ± 0.09	1.06 ± 0.14	

Data were expressed as mean±standard deviation.

DISCUSSION

Thyroid hormones are responsible for controlling concentrations and functionality of numerous enzymes. In this way, the use of fat, carbohydrates, proteins, vitamins, and minerals, as well as secretion of the other hormones affect the tissue response. These movements are mediated by the binding of thyroid hormone and thyroid hormone nuclear receptors, which in turn activate gene transcription and cause various forms of enzyme syntheses (Feldman and Nelson, 2003).

In the literature review, it was found that the studies aimed at investigating hormonal and biochemical changes in sarcoptic farm animals were extremely rare, and no data were found on thyroid hormone levels in sarcoptic sheep. With the same point of view, studies reporting thyroid hormone levels are rare in generally parasitic diseases of the animals. Reincke et al. (1993) found that in patients with trypanosomiasis, similar to our study design, FT3 and FT4 levels were decreased in the infested group compared to the control group. Similar findings were obtained with FT3 in our study. These researchers stated that FT3 and FT4 levels returned to normal levels after treatment, suggesting that the severity of parasitic manifestation decreased and the thyroid endocrine functions responded positively to such treatments. The researchers also concluded that the disease may cause a transient impairment of thyroid function, which, however, can be reversed with a specific therapy protocol. Low concentrations of FT3 and FT4 may lead to primary hypothyroidism in parasitic diseases. The authors also suggested that such an impaired condition or function may result from high plasma cytokine concentrations associated with parasitic diseases or parasitic thyroiditis. In parallel with this concept, the decrease in FT3 levels and the increase in T4 levels found in the present study might have occurred a result of alterations in cytokine levels due to parasitic manifestation.

Leptin, a 16-kDa protein secreted from white adipocytes, plays roles in regulating food intake, energy expenditure and whole body energy balance in rodents and humans. Leptin expression and secretion are highly correlated with the body fat mass and adipocyte size. Cortisol and insulin are potent stimulators of leptin expression, which is also attenuated by β-adrenergic agonists, cAMP and thiazolidinediones. Other hormones and growth factors have been proposed to play roles in regulation of leptin expression and its secretion. In serum, leptin specifically binds to proteins that regulates its half-life and biological activity (Houseknecht et al. 1998).

To the best of our knowledge, leptin hormone levels have not been reported in sarcoptic scabies in farm animals. However, a study conducted on dogs argued that the nutritional impairment in scabies may cause a decrease in leptin production by adipocytes (Kaltsogianni et al. 2017). The decrease in leptin levels in the patients with parasitic manifestation was also supported by other studies conducted in humans (Al-Hadraawyl et al. 2019; Fievez et al. 2019). In our study, although not statistically significant, there was a decrease in leptin levels in the sarcoptic group compared to the control group.

In the present study, it was observed that calcium and cholesterol values showed statistically significant increases in the infested group ($p < 0.05$), and there were no statistically significant changes in other parameters. Similar to our results, the study by Arlian et al. (1995) also reported that there were no statistically significant alterations in the biochemical parameters of sarcoptic dogs. Also in another study conducted on sarcoptic goats, De and Dey (2010) reported that albumin and total protein values were not altered significantly between the infested and control groups. However, Gökçe and Kızıltepe (2013) reported that albumin and total protein values have been decreased significantly in sheep infested with psoroptic scabies. The authors stated that the decrease in albumin value could be a result of anorexia seen as a clinical symptom of psoroptic scabies or it may be related to leakage of serum proteins as a result of impaired skin and/or epidermis layer (Gökçe and Kızıltepe, 2013; O'Brien et al. 1995). In our study although statistically insignificant, albumin values were lower and total protein values were higher in the infested sheep.

In conclusion, thyroid hormones, calcium and cholesterol levels showed significant alterations in the naturally infested sarcoptic sheep. The present study provided information on biochemical parameters, especially thyroid hormones and leptin, in sarcoptic sheep as there is a lack of data in the literature. The data revealed by the present study suggest that sarcoptic scabies may impair the balance of thyroid hormone levels. Further studies would be beneficial to unveil relationship between thyroid hormones and cytokines in sarcoptic cases.

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