Alteration of paraoxonase, ceruloplasmin and immunoglobulin G levels in hair goats at different ages

ABSTRACT

In this study, the alteration of paraoxonase, ceruloplasmin and immunoglobulin G levels in hair goats at different ages were investigated. 88 hair goats were included in the study. Goats were divided into five groups as 0-6 months old, 7-12 months old, 1.5-2 years old, 2.5-6 years old and 7≤ years old. Paraoxonase activity and ceruloplasmin levels were measured by spectrophotometer and immunoglobulin G was measured with ELISA kit. Although there was no statistically significant difference between the groups in paraoxonase activity, it increased until 6 years of age, but decreased with aging. A statistically significant difference was found between the groups in ceruloplasmin levels. While it provided a decrease in values up to the age of 2 and in old age, a little increase was observed in the fourth group. A statistically significant difference was found between the groups in immunoglobulin G levels, and it was observed that immunoglobulin G levels increased from newborns to adulthood, decreased with age, but increased again with aging. As a result, aging actually means an increase in reactive oxygen species, the emergence of diseases, and the loss of function of tissues and cells. Based on this, it can be said that as animals get older, the body will become open to microorganisms and the emergence of diseases will increase. These results suggest that immunoglobulin G increase with age to protect the body. Paraoxonase and ceruloplasmin levels also showed significant change with age. However, more extensive studies are needed to reveal the cause more precisely.

Keywords: Age, antioxidant, hair goats

INTRODUCTION

Goats are animals that can evaluate pasture areas and shrubs that other animals cannot. The most preferred species in the Mediterranean region is the goat because it is the most suitable animal for climate, vegetation and land structure. It is also economic to breeding, but as it harms trees and shrubs, its production and management is kept under control (Babalık and Fakir, 2007; Şirin, 2019).

Goats were domesticated around 6000 BC. It has its origins from Capra fisca (Middle European), Capra falconeri (Asia) and Capra aegagrus (Anatolia) wild goats. Goats are classified as dairy breeds, beef breeds, fiber type and combined productive breeds and fur and leather breeds. Hair Goats are one of the most grown breeds in Turkey. Except Hair Goats, Angora, Kilis, Honamlı, Norduz, Damascus, Malta and Turkish Saanen breeds are grown in Turkey too. Turkish Saanen, Malta, Damascus, Norduz and Kilis Goats are classified in dairy breeds, Angora Goats are in fiber type breeds and Hair Goats are classified in combined productive breeds (Günlü and Alaşahan, 2010; Keskin et al., 2012).

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Research Article

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In Turkey, 97% of goat assets belong to Hair Goats. It is cultivated in the Mediterranean, Aegean and Southeastern Anatolia Regions. Its bristles are generally black in color. Although their yields are generally low, they are very resistant to harsh care and feeding conditions and diseases. It is preferred because it is a breed that can easily adapt to all conditions (Keskin et al., 2012).

Paraoxonase 1 has an important role in protecting against oxidation and provides protection against lipid peroxidation. It has been demonstrated that high density lipoprotein (HDL) is associated with paraoxonase 1 and thus has antioxidative effects. Paraoxonase 1 decreases during the acute phase response and in diseases. Increase of acute phase proteins and C reactive proteins in circulation is seen with aging. Inflammatory development increases due to aging. Therefore, Paraoxonase 1 activity is thought to decrease with aging (Aviram et al., 1998). It was found that Paraoxonase 1 levels were decreased in middle-aged and elderly patients (Seres et al., 2004). Paraoxonase activity varies between animal species. It is higher in rabbits and rats than in cows, pigs and horses (Carr et al. 2015).

Ceruloplasmin is a blue colored glycoprotein containing 8 copper / molecule. It is synthesized in liver and has antioxidant properties. Ceruloplasmin is an acute phase and a transport protein. In addition to its transport function, it has many catalytic functions, from conversion of bivalent iron to trivalent iron, to the oxidation of polyamines, catecholamines and polyphenols. And because of containing copper, Ceruloplasmin is an important and highly sensitive marker for diseases associated with copper (Aliasgharpour, 2015; Merle et al., 2009).

Immunoglobulin G (IgG) is the highest level of immunoglobulin class in the blood and is produced and secreted by plasma cells in the spleen, lymph nodes, and bone marrow. Its most important function is to neutralize microorganisms and toxins. They can also take part in allergic and autoimmune reactions (Diker, 2005; Kavur et al., 2021). In colostrum, 65-90% of the immunoglobulins consist of IgG. In a study by Osaka et al. (2014), the effect of postpartum colostrum intake on serum immunoglobulin G changes in calves was shown. In the study, the effect of colostrum given immediately after birth and colostrum given after a few hours on the immunoglobulin G ratio was examined. The results showed that the earlier the colostrum is fed to the calves, the higher the serum immunoglobulin G values will be. According to these results it's important for newborns to fed them with colostrum as soon as possible.

In this study, the alteration of paraoxonase, ceruloplasmin and immunoglobulin G levels in hair goats at different ages were investigated.

MATERIAL and METHOD

Animal Groups

88 hair goats were divided into 5 groups. Group 1, 0-6 months old hair goats, group 2, 7-12 months old hair goats, group 3, 1,5-2 year old hair goats, group 4, 2,5-6 year old hair goats and group 5, 7≤ year old hair goats. Blood samples were collected from the jugular vein and taken in no additive tubes. After collecting, blood samples were centrifuged at 3000 xg for 10 minutes. Serum samples were stored at -86°C until analysis.

The study was carried out in accordance with animal welfare and ethical rules. Our study was carried out with the permission of the ethics committee, dated June 21, 2021, 08 meeting number and decision number 01.

Paraoxonase Test Procedure

In the paraoxon activity measurement, 50 mM glycine containing 1mM and 4 mM paraoxone; optical densities at 412 nm of p-nitrophenol formed as a result of enzymatic hydrolysis of

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paraoxonase using pH 10.5 buffer were measured and paraoxonase activities were investigated (Armstrong, 2008).

Ceruloplasmin Test Procedure

Serum ceruloplasmin measurements were investigated by reading the absorbance of the colored product formed by serum samples of P-phenylene diamine dichloride (PPD) prepared in acetate buffer at pH 5.2 and 37℃, at 550 nm in the spectrophotometer (Ceron and Martinez-Subiela, 2004).

Immunoglobulin G Test Procedure

It was measured with bovine immunoglobulin G ELISA (Monoscreen® Belgium) kits. The kits were ready to use. It was read at 450 nm and after obtaining the standard curve, the values of the samples (ng/ml) were found.

Statistycal Analysis

SPSS statistical program was used for analysis. One way ANOVA test was utilized and $p<0,05$ was regarded as statistically significant. Results were submitted as Mean±Standart Error.

RESULTS

No statistically significant difference was found in the result of the paraoxonase measurement (Table 1). While the paraoxonase levels were at the lowest levels in the first and second groups, it suddenly peaked in the third group and then started to decrease again as the age progressed (Fig. 1.).

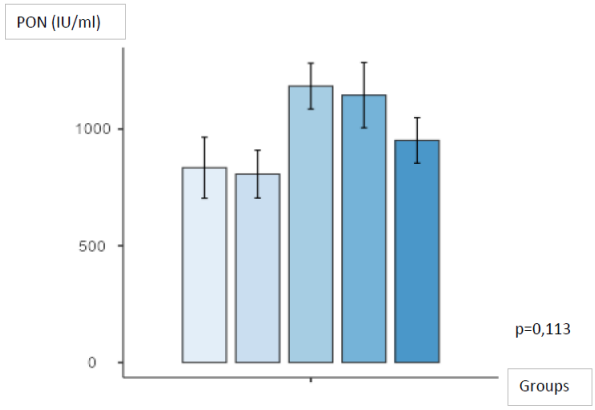


Figure 1. Serum PON activity in hair goats with different ages.

In ceruloplasmin there is a statistically significant difference between the first and second group. Groups from 2 to 5 there was found a statistically difference too (Table 1.). According to these results it can be said that there is a decrease with age progression (Fig. 2.)

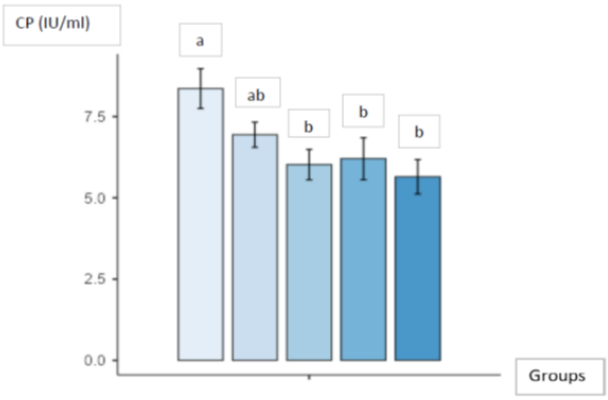


Figure 2. Serum CP levels in hair goats with different ages.

There was also a statistically significant difference between the groups in immunoglobulin G (Table 1). Second group made a sudden peak then decrease and after that it increases. Exluding the second group there is a regular increase with age (Fig. 3.).

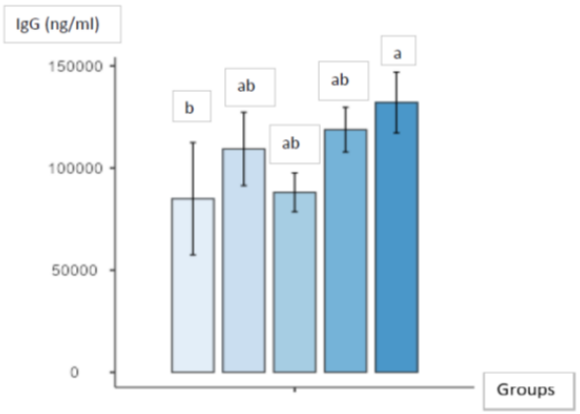


Figure 3. Serum IgG levels in hair goats with different ages.

Table 1. Serum PON, CP and IgG levels of hair goats in different age group

	Group	N	Mean±SE	p
PON (IU/ml)	0-6 months	14	834.38±130.649	0,113
	7-12 month	14	807.06±102.284	
	1.5-2 year	20	1190.63±93.412	
	2.5-6 year	20	1112.02±133.903	
	7≤ year	20	934.85±93.301	
CP (IU/ml)	0-6 months	13	8.36±0.613 [a]	0,017
	7-12 month	14	6.94±0.388 [ab]	
	1.5-2 year	20	5.78±0.505 [b]	
	2.5-6 year	20	5.78±0.505 [b]	
	7 ≤ year	19	5.78±0.505 [b]	
IgG (ng/ml)	0-6 months	14	84984±27504[b]	0,004
	7-12 month	14	109344±17932[ab]	
	1.5-2 year	19	88086±9488[ab]	
	2.5-6 year	19	118799±10941[ab]	
	7≤ year	18	132088±14871[a]	

DISCUSSION

Aging is the accumulation of destructive, progressive and universal changes that begin at birth and are responsible for increasing the risk of diseases that will cause death eventually (Halliwell and Gutteridge, 1990). It is thought that it is the aging process of the mitochondria of the cell that determines the life span. As a result of the reactions initiated by the mitochondria, free radicals are formed and mitochondria damage occurs. The rate of this damage forms the stages of aging (Harman, 1998). Electrons are attached to oxygen by mitochondrial transfer, but during this time the superoxide is accidentally separated, causing the formation of reactive oxygen species (Stadtman, 2002). Since mitochondrial DNA is more sensitive than nuclear DNA, DNA damage occurs and reactive oxygen species neutralization is reduced (Şekeroğlu, 2009).

It is known that paraoxonase is an antioxidant enzyme due to its protective effect against lipid peroxidation products (Costa et al., 2005). Paraoxonase activity may increase or decrease depending on the type of disease. In a study conducted with diabetes, it was found that paraoxonase activity increased, while paraoxonase activity decreased in cardiovasculer diseases (Martinelli et al., 2009; Savu et al., 2014). Inflammatory development increases due to aging. Therefore, paraoxonase activity is thought to decrease with aging (Aviram et al., 1998). In a study conducted by Seres et al. (2004), the change in HDL-associated paraoxonase activity by age was examined and it was found that paraoxonase levels were significantly decreased in middle aged and elderly patients compared to young people. In this study, higher paraoxonase levels are noteworthy in the young group compared to both the elderly and offspring groups. The decrease in paraoxonase levels with aging is already an expected result and has been confirmed by the studies shown. The decrease in the offspring groups can be attributed to the fact that the postnatal immune system has not yet developed as much as the young ones.

Ceruloplasmin is a positive acute phase protein and is directly related to copper metabolism. ceruloplasmin synthesis decreases in copper deficiency, while its synthesis increases in important diseases such as inflammation, infection, diabetes, cancer and

cardiovascular diseases (Tapiero et al., 2003). Aging is a biological event that causes an increase in oxidative stress and the onset of diseases, so ceruloplasmin levels are expected to increase as age increases. In this study, we see different results, in order to better understand the cause, blood copper levels in addition to ceruloplasmin should also be examined because ceruloplasmin activity decreases in copper deficiency, as copper deficiency reduces the stability of ceruloplasmin. This decrease impairs the mobilization of iron to transferrin and iron begins to accumulate in the tissues (Hellmann and Gitlin, 2002; Prohaska and Gybina, 2005). This accumulation leads to oxidative stress (Arnaud et al., 1988).

The nutrition of newborns is of great importance because the protection of colostrum is understood in line with important information such as the quality, quantity and bacterial content of the colostrum that newborns are fed (Gelsinger et al., 2015; Stott et al., 1983). It has been observed that the higher concentrations of immunoglobulin G mass the calves are fed, the longer they maintain high serum immunoglobulin G concentrations (Lopez et al., 2020). In a study by Aydoğdu et al. (2018), it was found that immunoglobulin G levels were quite different between heifers and cows. Heifers have lower imunoglobulin G levels compared to cows, due to the fact that heifers are less exposed to pathogens in the farm with age. In our study, the results showed parallelism with the studies of Aydoğdu et al. (2018) however, the reason for the sharp increase in the second group was interpreted as the stress caused by separation from the mother and feeding with concentrated food.

CONCLUSION

According to the results obtained, it can be said that there are quite significant differences. As a conclusion, no literature has been found on paraoxonase levels in healthy offsprings. This research provides a reference for paraoxonase values of healthy offsprings. Studies show that ceruloplasmin increases in diseases. As animals become prone to diseases with aging, an increase in ceruloplasmin values is expected. However, considering the relationship between ceruloplasmin and copper, copper values should also be examined in order to understand the decrease in this study more clearly. Immunoglobulin G, on the other hand, generally increased with age. Utilizing all these results, paraoxonase, ceruloplasmine and immunolgobulin G showed significant changes with age.

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Conflict of interest: The author declared no conflict of interest.

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