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Variations in Oxidative Stress Indicators of West African Dwarf Goats

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Abstract

This study was conducted to assess sexual dimorphism in serum oxidative status of West African dwarf goats. Twenty each of bucks and does 12 months old were randomly selected from a herd purchase from a farm in Owode, Oyo in Oyo State. The average body weight of the goats was 13.08 ± 3.26 and 11.15 ± 1.51 kg does and bucks, respectively. Fastened blood samples were collected from the goats and assayed for lipid peroxidation, total antioxidant activity, catalase and superoxide dismutase using standard procedures. Data obtained were subjected to T-test. The result indicated that lipid peroxidation, total antioxidant activity and superoxide dismutase were statistically similar in both sexes. Serum catalase was significantly ($p < 0.05$) higher in buck than in doe. This showed that both sexes have similar serum oxidative indices and bucks have better serum catalase activity than does.

Keywords: Antioxidant activity, free radicals, WAD goat, oxidative stress, sexual dimorphism

Introduction

Examining blood for their constituents is used to monitor and evaluate health and nutritional status of animals (Gupta *et al.*, 2007). Inevitability of exposure of goat to extreme weather conditions, makes oxidative stress associated with extreme environmental conditions an appropriate field of study to explore adaptive physiological measures of the body system (Maan and Kataria, 2012). Nutrition, age, sex, genetics (breed and crossbreeding), infections, reproductive status (pregnancy and oestrus), housing, starvation, environmental factors, stress and transportation are known to influence blood biochemical parameters (Balikci *et al.*, 2007) and as such assessment of oxidative markers will go a long way to ascertain the health status of the animals because blood serves as a pathological reflector of the status of exposed animals to toxicant and other conditions (Olafadehan *et al.*, 2010). Oxidative stress is a major threat to homeostasis and therefore to the integrity of aerobic organisms arising from chemical species possessing one or more unpaired electrons in their outer orbital called free radicals (Halliwell and Gutteridge, 1997). External factors such as trauma, infections, radiations, toxins etc. can lead to increased free radicals and other reactive oxygen species ROS and may lead to oxidative stress (Halliwell *et al.*, 1992). Antioxidant enzymes act to scavenge free radicals by converting them to less harmful molecules (Sies, 1993). Among the most known enzymatic antioxidants are superoxide dismutase (SOD), glutathione reductase (GR), glutathione peroxidase (GPx) and catalase (CAT). There is little documentation on oxidative stress markers in Nigeria goat population and need to develop reference range in Nigerian indigenous West African dwarf goat.

Thus, study was carried out to evaluate the effects of sexual dimorphism in oxidative status of West African dwarf male and female goat.

Materials and Methods

West African dwarf goats consisting of 20 each of does and bucks with an average weight of 13.08 ± 3.26 and 11.15 ± 1.51 kg of does and bucks respectively, were selected from a farm in Ibadan, Oyo State, Nigeria. The goats were quarantined and acclimatized for 4 weeks. The does were dry and all animals were of good conformation. The animals were managed in a semi intensive system, offered concentrate in the morning and allowed free choice grazing in the afternoon. The concentrate had 13.00% crude protein, 11.00% crude fibre and 3150 kcal/kg of digestible energy. Fresh water was provided regularly. Blood sample were collected through jugular vein from all animals and serum obtained using standard procedures. Serum was assayed for peroxidation, antioxidant activity, catalase and superoxide dismutase using standard procedures as reported by Jimoh *et al.* (2017).

Data obtained in this study were subjected to student's T-test using statistical analysis software.

Results and Discussion

The result of oxidative status of West African dwarf goats as influenced by sex difference is shown in Table 1. It showed that all oxidative indicators were not affected by sex differences, except catalase activity. Serum catalase in bucks was significantly ($p < 0.05$) higher than serum catalase in does. Though, bucks had apparently higher total antioxidant activity than does, serum lipid peroxidation was apparently lower in buck. This indicates that the significantly higher serum catalase was

responsible for the numerical high total antioxidant activity and low lipid peroxidation value of buck signifying that the bucks are less susceptible to lipid peroxidation. Lipid peroxidation is one of the best indicators of the level of reactive oxygen species (ROS) that induced systemic biological damage (Popova and Popove, 2002). The antioxidant system has a cellular protective action against oxidative stress of cell, organs and tissue damage that result from infections (Dedeet *et al.*, 2002). Since infection causes change in lipid peroxidation parameters (Kaya *et al.*, 2007, Cam *et al.*, 2008), It also plays a role in the protection of the phagocytic leukocytes against their own products and oxygen radicals. The apparently higher antioxidant activity in bucks could be attributed to its higher catalase activity which indicates higher scavenging of hydrogen peroxides. Also, this could be attributed to report that catalase protects the cell from the damage due to the secondary generation of highly reactive hydroxyl group from superoxide ion to H₂O₂ (Gannie *et al.*, 2013). SOD catalyses the dismutation of superoxide anion radical to peroxide (H₂O₂) and molecular oxygen (O₂). Catalase, an iron-containing heme protein converts hydrogen peroxide to water and oxygen (Kurasaki *et al.*, 1986). They are known to neutralize excess reactive oxygen species and prevent it from damaging cell structure.

Table 1: Oxidative stress indicators of West African dwarf goat

Parameters	Doe	Buck	SEM	Significance
Total antioxidant activity (mmol/litre)	97.75	127.35	18.22	NS
Catalase (nmoles of H ₂ O ₂ consumed/min/mg protein)	73.32	199.77	61.12	*
Superoxide dismutase (U/min/mg protein)	1.25	0.65	0.39	NS
Lipid peroxidation (x10 ⁻³ MDA/mg protein)	3.76	3.53	0.55	NS

NS: Not significant; * Significant

Conclusion

This study revealed that the West African dwarf does are more susceptible to lipid peroxidation as seen in their lower catalase level and antioxidant capacity. Boosting of antioxidant activity of does should be encouraged by adopting antioxidant supplementation in diets.

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