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FACTORS AFFECTING SOME SERUM BIOCHEMICAL PROFILE OF WEST AFRICAN DWARF (WAD) GOATS IN UMUAHIA, SOUTH EASTERN NIGERIA

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Abstract

The effects of age and gender on the serum biochemical profile of 160 West African Dwarf (WAD) goats consisting of 80 adults (40 Does and 40 Bucks) and 80 young ones (40 Does-kids and 40 Bucks-kids) were studied. The goats were randomly selected from the flocks of goats in breeding farms located at Umuahia North LGA, Umuahia South LGA and Ikwuano LGA of Abia State and divided into four groups of forty (40) animals each according to their ages and sexes as follows: Groups I, II, III and IV representing the Doe-kid, Buck-kid, Doe and Buck respectively. This study lasted for 90 days. The mean serum globulin concentration was significantly ($P<0.05$) lower in Doe-kid (1.27±0.21g/dl) compared to Doe (3.93±0.11g/dl) and Buck (3.43±0.31g/dl) but showed no significant variation ($P>0.05$) when compared to Buck-kid (2.58±0.37g/dl). The mean serum urea concentration was significantly ($P<0.05$) higher in Buck (28.39±3.73mg/dl) compared to Doe-kid (15.69±2.32mg/dl) but showed no significant difference ($P>0.05$) when compared to Buck-kid (21.79+0.96mg/dl) and Doe (24.25±4.73mg/dl). The mean total protein was significantly ($P<0.05$) lower in Buck-kid (5.25±0.31g/dl) compared to Doe-kid (6.47±0.35g/dl), Doe (6.63±0.16g/dl) and Buck (6.33±0.26g/dl). There were no significant variations ($P>0.05$) in the mean serum concentrations of Albumin, Cholesterol, Creatinine and Alanine aminotransferase (ALT) for all the groups. This present findings suggest that the serum concentrations of creatinine, urea, total protein, albumin, ALT, cholesterol and globulin of WAD goat similarly fed, could alter depending on gender and age which have to be taken into consideration for precise interpretation of serum chemistry in this species. In conclusion, this study has reported some serum biochemical values which could serve as baseline information for comparison in conditions of nutrient deficiency, physiological and health status of West African Dwarf goats in South-Eastern Nigeria.

Keywords: Serum Biochemistry, Age, Sex, WAD goat

Introduction

To meet the high demand for meat as a source of animal protein in the future, much of the increase in meat production would have to come from short-cycle animals which will require a little management practice to rear. Examples are the domestic goat, sheep and other mini-livestock such as the grasscutter. The West African Dwarf (WAD) goat is the dominant breed of all ruminants and makes up 38% of the three (3) million goats found in the West African humid zone (Gall, 1996). Goat production plays a major role both as income to farmers and as an important source of meat which come first before sheep and cattle meat in this country (Akraim *et al.*, 2008). West African Dwarf goats are capable of breeding at six (6) months (Devendra and McLeory, 1982). Multiple births are very common with twining being normal and Triplets frequent. These goats are typically kept as Livestock by families who use or sell the milk and meat (Wilson, 1991).

Blood is an important and reliable medium for assessing the health status of an individual animal (Ramprabhu *et al*., 2010). Variations in blood parameters of animals are due to several factors such as altitude, feeding level, age, sex, breed, season, temperature and physiological status of animals (Mbassa and Poulsen, 2003). The biochemical values are very important for evaluation of normal physiological status of animal and in helping for evaluation of the management practice, nutrition and diagnosis of health condition (Opara *et al.,* 2010). The significance of determining the biochemical indices of domestic animals has been well documented (Oduye and Adadevoh, 1976; Odunye and Otesile, 1977; Obi and Anosa, 1980) and changes in these parameters have been studied in cattle (Ghergariu *et al.,* 1984), sheep (Kaushish and Arora, 1977; Vihan and Rai, 1987) and Red Sokoto goats (Tambuwal *et al.,* 2002). Serum biochemical profiles provide reliable information on the health status of animals (Kral and Suchy, 2000, Cetin *et al.,* 2009). They also reflect the responsiveness of an animal to its internal and external environments (Esonu *et al.*, 2001). Changes in the plasma globulins reflect the severity of a disease in birds and thus serve as a prognosis (Oladele *et al.*, 2005).

There are numerous factors that influence the biochemical parameters of farm animals some of which are genetic and non-genetic factors (Xie *et al.,* 2013), Physiological (Alodan and Mashaly, 1999), environmental condition (Vecerek *et al.,* 2002), Fasting (Lamosova *et al.,* 2004) and Age (Forlan *et al.,* 1999). Administration of drugs (Khan *et al.,* 1994), Antiaflatoxin treatment (Oguz *et al.,* 2000) and continuous supplementation of vitamin (Trans *et al.,* 2002) affect the blood profile of healthy animals.

Serum biochemical profiles can be influenced by many factors for instance; Creatinine levels may be low due to loss of muscle mass as seen in the aged, when the intake or absorption of calories from food is severely reduced. Also prolonged starvation or illness that reduces nutrient absorption can lead to significant loss of muscle mass. A low creatinine diet can also impact low creatinine level and so a vegetarian diet is a common cause of low creatinine level (Mabruka, 2014).

Gravid animals also tend to have low creatinine level while abnormally high creatinine may indicate kidney damage or chronic kidney disease. Serum biochemical assessment are relevant tools in evaluating the physiological status and thus provide information for proper diagnosis of diseases, making diagnosis and evaluating the efficacy of instituted therapy and toxicity of drugs and chemical substances (Stockham and Scott, 2008). Serum biochemical assessment helps to predict pathological processes in the vital internal organs of the body such as liver, muscle, heart, pancrease and kidney (Stockham and Scott, 2008). It also helps to establish the presence or absence of a disease of an organ and determine the nature and extent of a disease process (Static, progressive or regressive). There is dearth of literature on the plasma biochemical profile of WAD goat kept in this eco-zone hence the objective of this study was to determine the effects of age and gender on some serum biochemical profile of WAD goats reared extensively in Umuahia, South Eastern, Nigeria and its environs.

Materials and Methods:

Experimental Location: The WAD goats used in this study were obtained from different locations in Umuahia, Abia State (Umuahia North, Umuahia South and Ikwuano LGAs), South Eastern Nigeria. Abia state is located on the latitude 4-6^{0}N, Longitude 7.8ºE and altitude of 244 – 305m above sea level. Mean annual rainfall is 187.7mm.

Age of the animals used in this study:

One hundred and sixty (160) apparently healthy WAD goats aged between 4 and 6 months old for Doe-kids and Buck-kids and 1 year old for Bucks and Does respectively were used for this study. The ages of the animals were determined using farm records

Data Collection:

Blood samples were collected from the external Jugular vein after proper restraint and local disinfection with methylated spirit from 160 apparently healthy WAD goats of different ages and sexes consisting of 80 adults (40 Bucks, 40 Does) and 80 young ones (40 Buck-kids, 40 Doe-kids) from randomly selected herds using disposable needle and syringes. Sampling was done between 8.00hours and 10.00 hours on each day of sample collection. Three milliliters (3ml) of blood was collected from each animal and deposited into anticoagulant free plastic tubes and allowed to clot at room temperature for three (3) hours and then centrifuged at 3,000 revolutions per minute (RPM) for five (5) minutes for serum extraction. The sera were aspirated and stored in the refrigerator at -20ºC avoiding freezing and thawing and used for biochemical analysis.

Biochemical Analysis:

Albumin was determined photometrically using the method described by Johnson *et al.* (1999), Alanine aminotransferase (ALT) was determined quantitatively using the method of Moss and Henderson (1999), Creatinine was determined colorimetrically using the method of Newman and Price (1999), Blood urea Nitrogen (BUN) was obtained colorimetrically following the method of Burtis and Ashwood (1999), total Cholesterol was determined using enzymatic colorimetric method described by Artiss and Zak (1997) using a commercial kit (DIALAB; Wiener Neudorf, Austria). Total protein was determined using photometric test (Johnson *et al.*, 1999) and Globulin concentration was obtained by calculation as follows; Serum Globulins (g/dl) = Total Serum Protein (g/dl) - Serum Albumin (g/dl) (Cheesbrough, 2009).

Data analysis

The data collected were subjected to one way analysis of Variance (ANOVA) using statistical package for social sciences (SPSS), version 20.0. Differences in means were separated using Duncan's New Multiple Range Test (Steel and Torrie, 1980).

Results and Discussion:

The mean serum globulin concentration was significantly (P<0.05) lower in Doe-kid (1.27±0.21g/dl) compared to Doe (3.93±0.11g/dl) and Buck (3.43±0.31g/dl) but showed no significant variation (P>0.05) when compared to Buck-kid (2.58±0.37g/dl). The mean serum urea concentration was significantly (P<0.05) higher in Buck (28.39±3.73mg/dl) compared to Doe-kid (15.69±2.32mg/dl) but showed no significant difference (P>0.05) when compared to Buck-kid (21.79+0.96mg/dl) and Doe (24.25±4.73mg/dl). The mean total protein was significantly (P<0.05) lower in Buck-kid (5.25±0.31g/dl) compared to Doe-kid (6.47±0.35g/dl), Doe (6.63±0.16g/dl) and Buck (6.33±0.26g/dl). There were no significant variations (P>0.05) in the mean serum concentrations of Albumin, Cholesterol, Creatinine and Alanine aminotransferase (ALT) for all the groups.

Table 1: Some serum biochemical parameters of WAD goats according to sex and age groups

Parameters	Animals			
	Doe-kid	Buck-kid	Doe	Buck
Total protein(g/dl)	6.47±0.35[a]	5.25±0.31[b]	6.63±0.16[a]	6.33±0.26[a]
Albumin (g/dl)	5.20±0.31	2.67±0.38	2.70±0.19	2.90±0.13
Globulin (g/dl)	1.27±0.21[b]	2.58±0.37[b]	3.93±0.11[a]	3.43±0.31[a]
Cholesterol (mg/dl)	100.73±23.28	90.80±9.78	68.32±6.97	76.20±15.58
Urea(mg/dl)	15.69±2.32[b]	21.79±0.96[ab]	24.25±4.73[ab]	28.39±3.73[a]
Creatinine (mg/dl)	1.12±0.07	1.05±0.25	1.22±0.08	1.24±0.69
ALT (u/L)	3.00±0.57	5.28±1.56	4.75±1.07	3.27±0.27

[ab]Mean values in the same row with different superscripts are significantly different (P<0.05)

Table 2: Some serum biochemical parameters of WAD goats according to sex

	Sex	
Parameters	Male	Female
Total protein (g/dl)	5.79±0.54	6.55±0.08
Albumin (g/dl)	2.79±0.12	3.95±1.25
Globulin (g/dl)	3.01±0.43	2.60±1.33
Cholesterol (mg/dl)	83.50±7.30	84.53±16.21
Urea (mg/dl)	25.09±3.30	19.97±4.28
Creatinine (mg/dl)	1.15±0.10	1.17±0.05
ALT (u/L)	4.28±1.01	3.88±0.88

Table 3: Some serum biochemical parameters of WAD goats according to age

	Age	
Parameters	Young (WAD goats)	Adult (WAD goats)
Total protein (g/dl)	5.86±0.61	6.48±0.15
Albumin (g/dl)	3.94±1.27	2.80±0.10
Globulin (g/dl)	1.93±0.66	3.68±0.25
Cholesterol (mg/dl)	95.77±4.97	72.26±3.94
Urea (mg/dl)	18.74±3.05	26.32±2.07
Creatinine (mg/dl)	1.09±0.04	1.23±0.01
ALT (u/L)	4.14±1.14	4.01±0.74

Discussion

The result of the serum biochemical values obtained from 160 West African Dwarf (WAD) goats is shown in table I. In this present study, variations in physiologic values due to gender and age were assessed. Goat plasma parameters, including ALT, total cholesterol, blood urea nitrogen, creatinine, total protein, albumin and globulin were measured. Blood urea nitrogen (BUN), globulin and total protein concentrations differed significantly ($p<0.05$) between males and females and between kids and the adults. Comparison of all other parameters between the two genders (males and females) and two ages (adults and kids) revealed statistically non-significant differences ($p>0.05$).

Total protein is an important factor for blood viscosity, acid-base balance, and for supplying necessary enzymes (Keser and Bilal, 2008). The total protein concentration of the Doe was significantly higher ($p<0.05$) when compared to buck-kid. The mean total protein values obtained from goat males and females used in this study were within the range of 5.5-10.0 g/dl reported for various ruminant species (Kaneko, 1989). The values for total protein concentration obtained were higher in the Adult WAD goats (Doe) than the Buck and younger ones. This agrees with the report of (Kamalu *et al.*, 1988) that plasma protein helps to transport calcium and phosphorus and other substances in the blood by attachment to the albumin. The total protein values obtained in this study were close to the average value of 7.30 g/dl reported by Taiwo and Ogunsami (2003) for West African dwarf goats. Significantly higher total protein level had been reported in the females than in male guinea fowls (Oladele et al., 2005) and chickens (Oladele et al., 2000) and this agrees with our result but in contrast to the reports of (Oladele et al., 2001a) and (Oladele et al., 2001b) who reported that there was no sex variation in total protein concentrations in local ducks and pigeons respectively. Urea is an important metabolite synthesized from ammonia in the liver during protein metabolism (Keser and Bilal, 2008). Plasma urea level was significantly ($P<0.05$) higher in males than females. Similar observation was reported by Borjesson *et al*. (2000) in their study on desert bighorn sheep. A high level of serum urea has been attributed to excessive tissues protein catabolism associated with protein deficiency (Oduye and Adadevoh, 1976). The urea value obtained for the kids were within the range of 8 to 20 mg/dl (Banejee, 2007) reported in matured domestic animals. The synthesis of albumin and globulin is in the liver. Albumin is an important metabolite for plasma oncotic pressure; it can decrease in the case of malnutrition, hepatic diseases, protein deficiency, starvation and malignancy (Keser and Bilal, 2008). Albumin values were almost the same for males and females. Similarly, mean plasma Cholesterol, Alanine aminotransferase and

Creatinine were close in both genders and ages. There were no age and gender effect on these plasma parameters. Similar finding was reported in the study conducted by Khan (2013). The activity of alanine aminotransferase (ALT) was not affected by an increase in age in this study and this agrees with the findings of Dubreuil *et al.* (2005). The effect of sex on globulin concentration shows that the females (doe) have higher mean globulin values than the males and this agrees with Patodkar *et al.* (2010). This may be an indication that does have higher immune responses than the kids and buck.

Conclusion:

From the study, it can be concluded that the serum biochemical parameters of WAD goats studied falls within the normal range previously reported for the species by other workers except for Alanine aminotransferase (ALT) which was lower than the normal range. The differences observed may be from nutritional and environmental influences. The components of the serum biochemical parameters in WAD goats in this study seem to point out some differences from those obtained for other ruminants species. These observed differences further support the fact that the physiological parameters reported for other ruminant animals may not be applied on WAD goats kept in this ecological zone. Age and gender in this study were observed to have significant effects on the total protein, globulin and urea concentrations. The variations in the biochemical profile in this study may be due to the genetic differences that exist between sexes. The findings of this study may serve as references in which alterations due to nutrient deficiency, physiological and health status can be compared both for diagnostic and therapeutic purposes in WAD goats kept in this agro-ecological zone.

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