P-ISSN: 2305-6622; E-ISSN: 2306-3599
International Journal of Agriculture and Biosciences
www.ijagbio.com; editor@ijagbio.com

Research Article

Growth performance, Haematological and Serum Biochemical Profiles of West African Dwarf Goats Fed Dietary Guava Leaf Meal

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Article History: Received: January 24, 2016 Revised: May 22, 2016 Accepted: June 21, 2016

ABSTRACT

Twelve West African dwarf goats with an average weight of 7kg were used to study the effect of guava leaf meal on body weights and measurement (body length, chest width, chest depth and wither height), haematological and serum biochemical parameters of the animals. The goats were divided into two dietary treatments and fed for a period of eleven (11) weeks. Goats maintained on guava leaf meal had better growth performance compared with the goats fed solely with basal diet. The results of the body measurements analyzed showed significant difference ($P<0.05$) between dietary treatment. No significant influence ($P>0.05$) of diet was observed on all the haematological parameters studied. Serum biochemical values did not show significant effect ($P>0.05$) of diet except alkaline phosphatase and albumin whose values were however, within the normal range for healthy rabbits. Results of this study suggest that *Psidium guajava* leaf meal can be used to feed small ruminants most especially the WAD goat.

Key words: Body measurements, Guava leaf, Growth performance, Haematology, Serum biochemistry, West African Dwarf goats

INTRODUCTION

The West African dwarf (WAD) goat is a dominant breed of small ruminants, trypanotolerant and well adapted to humid forest and guinea savannah zones of Nigeria. The WAD goat has small body size, poor growth and low reproductive performance (Iheukwumere *et al*., 2004). Goats have a reputation for being able to survive on woody forages and browses low in quality than most other ruminant animals. Generally, the West African Dwarf goats scavenge for food to meet their daily nutrient requirements (Daramola *et al*., 2005). However, uncertainty over the consistency of production and quality of pasture forage or green fodder particularly in the dry season necessitates utilization of the abundant non-conventional feedstuffs by goats.

Guava (*Psidium guajava*) is a fruit tree of the family of Myrtaceae and widespread in the tropics. All parts of the plant are traditionally used for the treatment of diseases such as diabetes (Shen *et al*., 2008) and cancer (Ryu *et al.,* 2012). Some experimental studies on extracts from the leaves of *P. guajava* revealed anti-inflammatory, antibacterial or antimicrobial (Nwinyi *et al.,* 2008; Qadan *et al.*, 2005), hepato-protective (Roy *et al*., 2006) and antioxidant (Jimenez-Escrig *et al*., 2001) activities.

Assessment of haematological and biochemical values of livestock reflects their physiological disposition or health status. Babatunde and Pond (1987) reported that diets have serious effect on blood constituents, hence the need for evaluation when animals are fed non-conventional feedstuffs. Many studies have been conducted on the effects of non-conventional feedstuffs on growth performance, haematology and serum biochemistry of livestock (Belewu and Ogunsola, 2010; Oni *et al.,*2012; Aye, 2013), but information on the use of guava leaf meal for ruminant feeding, particularly regarding their effects on blood parameters of West African Dwarf goats is scanty. This study was therefore designed to determine the growth performance, haematological and serum biochemical parameters of West African dwarf goats fed dietary levels of guava leaf meal.

Cite This Article as: Okwori AI, Abu AH, Ahemen T, and Ojabo L, 2016. Growth performance, haematological and serum biochemical profiles of West African dwarf goats fed dietary guava leaf meal. Inter J Agri Biosci, 5(4): 188-191. www.ijagbio.com

MATERIALS AND METHODS

Management of experimental animals

Twelve (12) West African Dwarf (WAD) bucks aged between 1 – 2 years were purchased from the local market around Makurdi metropolis. The bucks were housed in clean pens located at the Teaching and Research Farm of Federal University of Agriculture Makurdi, Nigeria. The bucks were routinely dewormed with Levamisole hydrochloride at the dose of 1 ml per 20 kg body weight and vaccinated against *pestes des petit ruminant* (PPR) virus using PPR vaccine produced by National Veterinary Research Institute, Vom, Nigeria. Oxytetracycline hydrochloride was also administered at the dose of 1ml/10kg body weight. The animals were fed in the morning at 08 hours and in the afternoon at 14 hours. The feeding trial lasted for ten (10) weeks.

Test ingredients

The dietary ingredients were *Psidium guajava* leaves, maize offal and salt. The bucks were fed guava leaf meal at 10% inclusion level. Gamba grass (*Andropogon gayanus),* and guinea grass *(Pennisetum purpureum)* were cut and brought to the animals. Guava leaves were collected and harvested around the environment of the Federal University of Agriculture, Makurdi, washed using tap water and dried under shade in the Laboratory. Thereafter, the guava leaves were pulverized into coarse size suitable enough to mix with maize offal and other ingredients. Water was provided *ad libitum.*

Location of the study

This study was conducted at Small Ruminant unit of the Livestock Research Farm, Federal University of Agriculture, Makurdi, Nigeria. Makurdi is located at Latitude 7^{o} 14′ North and Longitude 8^{o} 21′ East and lies within the southern guinea savannah region of the country. The area is warm with ambient temperature range of 24^{0}C to 36^{0}C and high temperature is experienced between late February and April. The rainfall is between 508mm and 1016mm, and the mean monthly relative humidity at 12.00 GMT ranges from 66-80% in the rainy season with a mean annual value of 60%.

Experimental design and blood collection

Twelve (12) WAD bucks were randomly assigned to two dietary treatments with six animals per treatment. On the last day of the feeding trial period, two sets of blood samples were taken from all the animals via jugular venipuncture. The blood samples were preserved in a plastic container containing ice packs and taken to the Veterinary Teaching Hospital, College of Veterinary Medicine, Federal University of Agriculture, Makurdi, Nigeria for analysis.

One set of the blood samples was collected into plastic tubes containing the anti-coagulant, ethylene diamine tetra acetic acid (EDTA) for the determination of haematological parameters. The other set of blood samples was collected into anti-coagulant free plastic tubes, allowed to coagulate at room temperature and centrifuged at 3000G for 10 minutes. The supernatant sera were then stored at - 20^{o}C for subsequent biochemical analysis.

Haematological values of the blood samples were estimated for packed cell volume (PCV), haemoglobin (Hb) concentration, red blood cell (RBC), total white blood cell (WBC), and differential white blood cell counts following standard procedures (Schalm *et al*., 1975). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated as described by Jain (1986).

Serum enzymes (alanine transaminase, ALT; aspartate transaminase, AST; alkaline phosphatase, ALP), creatinine, bilirubin, total protein and albumin were analyzed spectrophotometrically by using commercial diagnostic kits (RANDOX® Test Kits). Standard procedures for the biochemical analysis were followed (Schalm *et al*., 1975; Jain, 1986)

RESULTS AND DISCUSSION

In Table 1, the body weight of animals fed guava leaf meal maize offal mixture was higher than the WAD goats fed only maize offal. The mean body length of the goats fed with diet containing the test ingredient is significantly ($P<0.05$) higher than the goats fed maize offal. There were significant differences ($P<0.05$) in the other body measurements studied. Researchers have reported that body weight is commonly used to measure growth performance of animals (Adeyinka and Mohammed, 2006).

Haematological and serum biochemical parameters are valuable in monitoring the use of non-conventional feeds especially their effects on blood and health status of animals. Isikwenu *et al* (2012) documented that haematological values reflect an animal's responsiveness to the state of its initial environment. PCV values obtained in this study (T_1, 33.10% and T_2 29.85%) were not significantly different ($P>0.05$) and were higher than the range reported in WAD goats fed dried cassava leaves (Oni *et al*., 2012). However, these values were within the range for WAD goats (21 to 35%) as reported by Daramola *et al* (2005), but lower than the values of 36.9% which Taiwo and Ogunsanmi (2003) reported for clinically healthy WAD goats respectively. The values in this study support the observation of other investigators (El-Barody and Luikart, 2000; Tambuwal *et al*., 2002; Daramola *et al.*, 2005) that PCV values for ruminants vary from breed to breed.

Haemoglobin (Hb) values of goats were not significantly different ($P>0.05$), but were within the normal range reported for goats (Babayemi *et al*., 2003). Also Hb value in this study fell within the range of 7-15g/dl reported for clinically healthy WAD goats (Daramola *et al*, 2005) and agreed with the finding of Misri *et al* (2000) for goats fed *Prosopis juliflora.* However, the value in this study was lower than 11.40g/dl reported for Red Sokoto goats (Tambuwal *et al*., 2002). This variation may be attributed to differences in breed.

Red blood cell values for the various treatments (Table 2) differed significantly ($P>0.05$) between the control and goats fed guava leaf meal, and were in agreement with the range reported by other investigators (Tambuwal *et al*., 2002; Daramola *et al*, 2005). The normal values of red blood cells in goats fed guava leaf meal indicates that oxygen carrying capacity of red blood

cells was not interfered with and perhaps, absence of anaemia. Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) values obtained in this study were not significantly different (P>0.05) and were within the normal range for goat (Babayemi *et al*., 2003). These normal values of RBC, and erythrocytic indices perhaps indicate that the guava leaf-based diet had no deleterious effect on the health status of the animals.

Although there was numerical difference in white blood cell count (WBC) of the control and treated goats obtained in this study, the values were not significantly different (P>0.05) and were within the range of 6.8-20.1x10^3/µl reported for clinically healthy WAD goats (Daramola *et al*., 2005; Ogunleke *et al*., 2014). The values were higher compared to the range of 2.23 – 3.43 x10^3/µl reported by Ukanwoko *et al* (2013) in WAD goats fed oil palm leaf meal–cassava peel based diets. The variation might be due to differences in feeding regimen and management. However, values obtained in the present study were higher than the reported values for Red Sokoto goats (Tambuwal *et al*., 2002). The values of lymphocytes obtained in this study agreed with the values of 47-82% (Daramola *et al*., 2005) and 51.6% (Tambuwal *et al*., 2002) reported for WAD goats.

Biochemical parameters are sensitive indicators for evaluating the functional integrity of organs. The results of AST and ALT (Table 2) revealed that there were no significant differences (P>0.05) among the dietary treatments. Values of serum AST and ALT under normal circumstance, are low in the blood, but might become high when the plane of nutrition is low or there is hepatocellular damage (Ekpeyong and Biobaku, 1986). In the present study, the mean values of AST and ALT obtained in this study were normal and in agreement with those obtained by Taiwo and Ogunsanmi (2002). Creatinine levels are indices often used to determine renal function test in mammals. There were no significant (P>0.05) variations in creatinine values suggesting that the animals have functional kidneys. Although, results obtained in this study were higher than 0.7 mg/dl reported by Opara *et al* (2010) for WAD goats, the levels were within the normal range.

Total protein and albumin values (Table 3) of the control and goats fed guava leaf meal did not differ significantly (P>0.05). Serum proteins are important in osmotic regulation, immunity and transport of several substances in the animal body (Jain, 1986). The values in this study compared favourably to reports by Tambuwal *et al* (2002), and Daramola *et al* (2005) suggesting that there were no antinutritional factors that could impair nutrient absorption in the gastrointestinal tract. The concentrations of serum total protein, albumin and bilirubin reflect hepatic injury and usually provide a good index of the health status of the animal. The normal levels of these biochemical parameters obtained in the present study (Table 3) suggest intact hepatocellular functions.

Conclusion

It is concluded from this study that guava leaf meal can be included in the diets of goats up to 10% in the ration without deleterious effect on growth performance, haematological and serum biochemical parameters of the goat.

Table 1: Effect of guava leaf meal on the body measurements of West African Dwarf Bucks

Parameter	Control	Treated	S.E.M
Body weight	5.26^b	8.11^a	0.98
Body length	41.21^b	45.15^a	2.12
Wither height	41.85^b	46.24^a	3.21
Chest width	22.07^b	23.85^a	1.36
Chest depth	38.13^b	41.36^a	2.89

ab= Means on the same row with different superscript are significantly different (P>0.05); SEM = Standard error of mean

Table 2: Haematological values of West African Dwarf (buck) goats fed dietary guava leaf meal

Parameters	T_1	T_2	SEM
Packed cell volume (%)	33.10	29.90	0.15^{ns}
Haemoglobin (g/dl)	8.80	9.00	0.23^{ns}
Red blood cells (x10^{12}/L)	7.60	8.20	1.10^{ns}
Mean Corpuscular Volume (fl)	25.00	26.00	0.12^{ns}
Mean Corpuscular Haemoglobin (pg)	5.70	5.50	0.09^{ns}
Mean Corpuscular Haemoglobin Concentration (g/dl)	29.60	30.20	2.27^{ns}
White blood cells (x10^9/L)	11.58	12.47	0.40^{ns}
Lympocyte (%)	62.20	61.50	1.03^{ns}
Neutrophil (%)	29.80	28.50	1.13^{ns}
Eosinophil (%)	2.00	3.00	0.30^{ns}
Monocyte (%)	6.00	5.00	0.15^{ns}
Basophil (%)	0.00	0.00	0.00^{ns}

ns = no significant difference (P<0.05).

Table 3: Effect of guava leaf meal on serum biochemistry of West African dwarf goats

Parameters	T_1	T_2	SEM
Aspartate transaminase (µ/l)	28.00	32.50	0.75
Alanine transaminase (µ/l)	3.00	3.25	0.26
Alkaline phosphatase (µ/l)	28.60^a	17.92^b	0.12
Protein (g/l)	58.10	59.10	0.29
Albumin (g/l)	29.90^b	30.40^a	0.18
Creatinine (mg/dl)	2.00	1.95	0.03
Bilirubin (mg/dl)	0.29	0.28	0.02

a b = Means on the same row with different super scripts are significantly different (P<0.05) SEM = Standard error of mean.

Authors' contributions and competing interests

The authors implemented the study design. Abu Adakole Hyacinth drafted and revised the manuscript. All authors read and approved the final version of the manuscript. The authors declare that they have no competing interests.

Acknowledgements

The authors express gratitude to Mr Jimmy Onoja of the Veterinary Teaching Hospital, Roma Inusa and Daniel Achanya of College of Veterinary Medicine, Federal University of Agriculture, Makurdi, Benue state, Nigeria.

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