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CLIMATE SMART ANIMAL HUSBANDARY SYSTEMS; KEY TO IMPROVING ANIMAL PRODUCTION

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BODY WEIGHT CHANGES, HAEMATOLOGICAL AND SERUM BIOCHEMICAL PROPERTIES OF WEST AFRICAN DWARF RAMS FED GINGER FORTIFIED DIETS

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ABSTRACT

The effect of feeding diets fortified with 0, 0.5, 1.0 and 1.5% ginger powder on body weight changes, haematological and serum biochemical properties and described as T1, T2, T3 and T4 respectively was determined using sixteen 12 – 18 months old WAD rams weighing 15.86 ± 0.03kg. The animals were grouped into 4 treatments in a completely randomized design with 4 animals per treatment and fed the experimental diets for 28 days. Daily weight gain, feed intake and feed conversion ratio were monitored. Blood samples were collected and analyzed for haematological indices {Packed Cell Volume (PCV, %), Red Blood Cell (RBC, $10^6/mm^3$) and White Blood Cell (WBC, $10^3/mm^3$)} and biochemical parameters {Total protein (TP, g/dl), Blood urea nitrogen (BUN, mg/dl), Aspartate Transferase (AST, I.U. /l) and Alanine Transaminase (ALT, I.U. / l)}. PCV ranged from 33.75 (T4) to 39.00 (T2) and the values were within the recommended PCV value for WAD ram. Similarly, WBC values for rams on T4 (10.37) and T3 (8.80) were significantly higher than T2 (6.05) and T1 (4.87). Total protein and BUN increased linearly across the treatments. The values for AST and ALP ranged from 72.10 (T2) to 147.00 (T3) and 238.00 (T4) to 294.00 (T2) respectively. Consequently, it can be concluded that 1.5% fortification of ginger powder promoted body weight gain and had no deleterious effect on the haematological and serum biochemical profile of WAD rams.

Keywords: *WAD rams, Ginger, Diets, Haematology, Serum biochemistry*

INTRODUCTION

Blood contains diagnostically relevant parameters which act as a pathological reflector of the status of animals exposed to toxicants (Joshi *et al.*, 2002). Haematological parameters are those parameters that are related to the blood and blood forming organs (Waugh and Grant, 2001). The significance of determining haematological indices of domestic animals has been well documented (Etim *et al.*, 2013). Haematological traits are essential parameters for evaluating the health and physiological status of animals and herds (Kral and Suchy, 2007 and Etim *et al.*, 2013). It was indicated that it is very difficult to assess the current health status of animals without detailed examination of blood. This study was designed to evaluate the haematological and serum biochemical properties of West African dwarf rams fed ginger fortified diets. Ginger is an underground rhizome of plant Zingiber officinale belonging to the family Zingiberaceae and it is one of the most widely consumed spices worldwide (Chrubasik *et al.*, 2005). It has a long history of use as herbal medicine to treat a variety of diseases including nausea and vomiting, constipation, indigestion (dyspepsia), pain, and cold induced syndromes. More recently, it was reported that ginger also possesses

anti-cancer, anti-clotting, anti-inflammatory, and anti-oxidative characteristics, since it can scavenge superoxide anion and hydroxyl radicals (Elshater *et al.,* 2009). However, there is paucity of information on the use of ginger on growth, haematology and blood chemistry of ruminants. This study was designed to evaluate body weight changes, haematological and serum biochemical properties of West African dwarf rams fed ginger fortified diets.

MATERIALS AND METHODS

This study was carried out at the sheep unit of the Teaching and Research Farm of University of Ibadan, Ibadan. Sixteen WAD ram-lambs aged between 12 - 18 months and weighing 15.86 ± 1.24kg were divided into four treatments. Four experimental rations containing different inclusion levels of 0%, 0.5%, 1.0% and 1.5% ginger for T1, T2, T3 and T4 respectively. The diet included cassava peels, wheat offal, rice bran, groundnut haulms, cowpea husk, palm kernel cake, salt, urea, vitamins and mineral premix. Ginger was purchased from the market, thereafter, sliced and air dried. The dried ginger was then ground and added to the feed of the animals (Table 1).

Table 1: Gross Composition of Experimental Diets

Ingredient (%)	T1	T2	T3	T4
Cassava peels	35	35	35	35
Cowpea husk	20	20	20	20
Palm kernel cake	12	12	12	12
Wheat offal	11	11	11	11
Groundnut haulms	10	10	10	10
Rice bran	5	5	5	5
Dicalcium phosphate	3	3	3	3
Salt	2	2	2	2
Premix	1	1	1	1
Urea	1	1	1	1
Ginger	0	0.5	1.0	1.5

Body weight Measurements

Body weights of the rams were measured in kilograms by following the procedure as described by Akpa *et al. (*1998). The weight of the observer was taken first, and then the body weight of each animal was taken by carrying the animal individually and standing on a weighing scale. The difference between this weight and that of the observer provided the weight of the animal. Weighing was done at the beginning of the study and subsequently on weekly basis.

Haematological indices

Shown in Table 3 are the haematological parameters of WAD rams fed ginger fortified diets. At the end of the 28 days of feeding, 10ml of blood samples were collected from the jugular veins of the rams into different vacutainer tubes containing ethylene diamine tetra acetic acid (EDTA) as anticoagulant. Blood meant for serological studies were not mixed with EDTA, serum was obtained by centrifugation and serum sample stored in a refrigerator at -100 ^{0}C until analyzed. Haematological parameters determined were: Haemoglobin concentration (Hb) using

cyanmethaemoglobin method as described by Mitruka and Rawnsley (1977). Red Blood Cell (RBC) and White Blood Cell (WBC) were determined using the improved Neubauer haemocytometer as described by Dacie and Lewis (1991). Packed Cell Volume (PCV) was determined by Microhaematocrit method described by Dacie and Lewis (1991). Blood indices and corpuscular constants (mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) were determined using the appropriate formula of Jain (1986).

Serum biochemical indices

Serum total protein was determined by Biuret method (Kohn and Allen, 1995), while albumin was determined using the bromocresol (BCG) method (Peter *et al.*, 1982). Globulin concentration was obtained by subtracting albumin from the total protein, aspartate amino transferase (AST), alanine amino transferase (ALT) and alkaline phosphatase (ALP) activities were determined using spectrophotometric methods (McComb *et al.*, 1988; Rej and Hodder, 1983). BUN was determined using the method described by Chaney and Marbach (1962), creatinine by Folin-wu filtrate methods (Toro and Ackerman, 1975) and cholesterol was measured using appropriate laboratory kits (Gowenlock, 1988). Shown in Table 1 is the gross composition of the experimental diet. Data were subjected to analysis of variance (ANOVA) in a completely randomized design according to the procedure of SAS (2000), means were separated using Duncan Multiple Range Test option of same software.

RESULTS AND DISCUSSION

Body weight changes of West African dwarf rams fed ammonium sulphate fortified diets

Table 2 shows the performance characteristics of West African dwarf rams fed varied levels of ammonium sulphate

Table 2: Body weight changes of West African dwarf rams fed ammonium sulphate fortified diets

Parameters	T1	T2	T3	T4	SEM
Initial body weight(kg)	15.86	15. 80	15.82	15. 86	0.03
Final body weight(kg)	17.38^{b}	18.37^{b}	21.30^{a}	17.49^{b}	2.09
Body Weight gain(g/day)	54.17^{b}	91.67^{b}	195.83^{a}	58.34^{b}	13.07
Feed intake(g/day)	360.00^{ab}	388.00^{ab}	403.75^{a}	307.50^{b}	29.04
Feed conversion ratio(FCR)	6.68^{a}	5.70^{ab}	2.11^{b}	5.39^{ab}	1.16

Ab: means in the same row with different superscripts are significantly ($p<0.05$) different.

SEM: Standard Error of Mean; T1 - 0 % Ammonium sulphate; T2 - 0.5 % Ammonium sulphate T3 - 1.0 % Ammonium sulphate; T4 - 1.5 % Ammonium sulphate

Daily weight gain in rams was 54.17g/day, 91.67g/day, 195.83g/day and 58.34g/day for T1, T2, T3 and T4 respectively. Similarly, feed intake increased with the increase in ginger fortification up to T3. In addition, FCR decreased with the increase in ginger fortification with T3 having the best. Arkan *et al.* (2012) reported that the increase in levels of ginger in the diet improve performance and weight gain. Cabuk *et al.* (2006) reported that fortification of ginger powder at 1.5% showed significant difference with the control diet and elicited weight gain of broiler chicken at fifth week.

Presented in Table 3 is the result of heamatology of WAD rams fed ginger fortified diets.

Table 3: Haematological parameters of WAD rams fed ginger fortified diets.

Indices	T1	T2	T3	T4	S.E.M
Packed cell volume (%)	37.75	39.00	35.75	33.75	2.44
Haemoglobin (g/dl)	12.50	13.33	11.73	10.98	0.83
Red blood cell ($x10^6/mm^3$)	11.88	11.63	11.62	10.60	0.52
White blood cell ($x10^3/mm^3$)	4.87^b	6.05^b	8.80^a	10.37^a	0.14
Lymphocytes (%)	61.75	62.50	63.75	64.75	3.41
Neutrophils (%)	34.75	32.00	30.75	29.75	2.92
Monocytes (%)	1.00^b	1.25^b	1.25^b	2.00^a	0.18
Eosinophil (%)	2.25	2.75	2.00	1.25	0.46
MCV (μ^3)	32.47	32.86	32.11	31.93	1.32
MCH ($\mu\mu g$)	10.75	11.22	10.39	10.00	0.42
MCHC (%)	33.10^{ab}	34.17^a	32.50^b	32.79^b	0.42

^{a,b} means with different superscript in the same row differ significantly ($P< 0.05$)
SEM- Standard error of mean, MCH-mean corpuscular volume, MCH-mean corpuscular haemoglobin, MCHC-mean corpuscular haemoglobin concentration.

PCV ranged from 33.75 to 39.00%, Packed cell volume and haemoglobin showed no significant ($P>0.05$) difference but were higher than the normal range as reported by Mitruka and Rawnsley (1977). However, the WBC showed significant ($P<0.05$) difference, values obtained were 4.87%, 6.05%, 8.80% and 10.37% for T1 to T4 respectively. Similarly, there was significant ($P<0.05$) difference in monocyte count. The mean monocyte of animals in T4 was significantly ($P<0.05$) higher than the animals in all other treatments. There were no significant ($P>0.05$) difference in the values of neutrophils, eosinophils, mean corpuscular volume and mean corpuscular haemoglobin. Meanwhile, significant ($P<0.05$) differences were observed in the mean corpuscular haemoglobin concentration. Values obtained for MCHC varied from 32.79% to 34.17%.

Presented in Table 4 is the result of serum biochemistry of WAD rams fed varying levels of ginger supplemented diets.

The total protein and albumin of animals fed ginger was significantly (P<0.05) different from the control. The total protein and albumin was higher for T2, T3 and T4 respectively. However, the values obtained for all the treatments falls within the normal physiological range as reported by Mitruka and Rawnsley (1977).

Furthermore, there was no significant (P<0.05) difference in globulin but values obtained were within the normal physiological range as reported by Mitruka and Rawnsley (1977). This was in agreement with the result of Borjesson *et al.* (2000) in desert big horn sheep. Exact mechanisms through which blood metabolites are altered by ginger are not known (Singh *et al.*, 2014).

Table 4: Serum biochemistry of WAD rams fed ginger fortified diets.

Indices	T1	T2	T3	T4	S.E.M
Total Protein (g/dl)	7.50 [b]	8.73 [a]	8.88 [a]	8.95 [a]	0.12
Albumin (g/dl)	2.73 [b]	3.95 [a]	4.03 [a]	4.1 [a]	0.14
Globulin (g/dl)	4.76	4.75	4.58	4.85	0.12
AST (I.U./l)	108.75	72.00	147.00	138.00	31.92
ALT (I.U./l)	25.75	22.25	21.75	19.75	3.58
ALP (I.U./l)	284.00	294.00	288.00	238.00	59.00
BUN (mg/dl)	10.30 [b]	10.83 [b]	12.18 [a]	12.54 [a]	0.63
Creatinine (mg/dl)	1.0	1.08	0.83	1.00	0.14
Cholesterol (mg/dl)	63.75	63.75	59.75	58.5	2.75

[a,b] means with different superscript in the same row differ significantly (P< 0.05)
SEM- Standard error of mean, AST- Aspartate amino transferase, ALT-Alanine amino transferase, ALP-Alkaline phosphatase, BUN- blood urea nitrogen.

CONCLUSION

This study revealed that fortification of ginger at 1.5% elicited increase in weight gain, improved feed intake and best feed conversion in West African dwarf rams. Similarly, 1.5% fortification of ginger in diet of rams had no deleterious effect on blood and serum biochemical parameters of the animals and therefore can be included in ruminant diets up to 1.5%.

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