MORPHOSTRUCTURAL CHARACTERISTICS AND BLOOD CONSTITUENTS OF DWARF RAM LAMBS FED MIXTURE OF ORANGE AND PINEAPPLE PULPS

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Abstract

The study was conducted to assess the mixture of orange and pineapple pulps using morphostructural characteristics and blood constituents by ram lambs. Thirty growing ram lambs with mean weight of 8.00±0.52kg and aged between 9 and 10 months old were randomly allotted to three dietary treatments with ten ram lambs per treatment in a completely randomized design. The experimental diets which comprised A, B and C constituted mixture of orange and pineapple pulps in the following ratios respectively A = 30:40, B=35:35 and C=40:30. The results showed that treatment A was significantly (P<0.05) highest for bodyweight gain, height at wither, body length, fore and hind legs length, packed cell volume, haemoglobin, red blood cell, lymphocytes, monocytes, total protein. Albumin, calcium and phosphorus. Ear length, white blood cell, neutrophile, cholesterol and urea were significantly (P<0.05) better in treatment C. No significance (P>0.05) was observed for heart girth, tail length, eosinphils, basophils, globulin and creatinine. It can be concluded that mixture of orange and pineapple pulps in a ratio of 30:40 has a good potential to enhance body measurements and blood constituents of ram lambs.

Keywords: Orange with pineapple pulps, morpho-structure, blood, lambs.

Introduction

Small ruminants in Nigeria especially sheep if well managed, can improve its production to increase animal protein availability thus alleviating the problem of malnutrition. Afolabi *et al*. (2011) had noted that sheep production in Nigeria is confronted with hindrances or militating factors such as poor quality of feed, climate and diseases. However, contemporary ruminant feeding development in developing countries is partly geared towards searching for inexpensive and readily available feed resources which can partially or wholly substitute the scarce and expensive feedstuffs. This is because of the low level of ruminant production, scarcity of natural pasture during the dry season and the stiff competition existing between humans and the livestock industry for conventional feeds which have greatly reduced the animal protein intake in Nigeria (Oluremi *et al*., 2007).

Orange (*Citrus sinensis*) and pineapple (*Ananas comosus*) pulps are agro-industrial by-products generated from fruit cannery industry. They consist of high fibre and energy that can be converted to high quality protein sources in terms of meat and milk (Fung *et al*., 2010; Okoruwa and Adewumi, 2002). However, information is lacking on the suitability of using mixture orange and pineapple pulps as feedstuff for sheep. This therefore, suggests the need to use graded levels of these pulps as feeds with a view to improving sheep performance and health condition most especially during the dry season when forages are scanty.

Body measurements in addition to live weight of ruminants have been used to evaluate animal performance (Salako, 2006), while blood indices are used to evaluate the general animal health condition and diagnosis with prognosis of various types of diseases in animals (Isidahomen *et al*., 2011). Hence body dimension with live weight taken in conjunction with a comprehensive blood profile records can aid in evaluating the nature of animal performance and health status during the various stages of animal growth and development. Several studies have examined various body dimension and blood profile in sheep to describe more thoroughly biological variation and interpret the relationships with measures of performance and health status (Otoikhian *et al*., 2008; Isidahomen *et al*., 2011). This study was therefore carried out to assess morphostructural characteristics and blood constituents of dwarf ram lambs fed mixture of orange and pineapple pulps.

Materials and Methods

Experimental Site: The study was conducted in the Small ruminants Section of the Teaching and Research Farm, Ambrose Alli University, Ekpoma.

Experimental Diets Preparation: Orange and pineapple pulps were obtained from fruits processing points within Edo State, sundried and milled separately. Combination of orange and pineapple pulps at different proportion were used as basal diets, while ingredients composition (%) of the concentrate supplement is shown in Table 1. The basal and concentrate supplement diets in a ratio of 70:30 respectively were given to the ram lambs at 5% of their body weight in dry matter basis. The experimental diets A, B and C constituted mixture of orange and pineapple pulps supplemented with concentrate in the following ratios respectively: A=30:40:30; B=35:35:30 and C=40:30:30.

Table 1: Ingredient composition (% DM basis) of the concentrate diet.

Ingredients	Composition
Brewery dried grain	80.00
Rice bran	18.00
Limestone	0.75
Dicalcium phosphate	0.50
Salt	0.50
Vitamin premix	0.25
Total	**100**

Management of Experimental Animals: Thirty (30) West African dwarf ram lambs, aged between 9—10 were source from an open market at Ekpoma. The ram lambs were randomly assigned to the three compared dietary treatments (A, B and C) with ten replicates per treatment in a completely randomized design.

On arrival, the ram lambs were given prophylactic treatments against ecto and endo parasites. They were allowed 21 days adaptation period before ram lambs were housed individually in their experimental pens. Experimental diets were offered once daily at 8.00am in the morning to the ram lambs. They also have free access to clean cold water daily. The study lasted for 3 months excluding 21 days of adaptation period.

Body weight and linear body measurement: Initial bodyweight of each ram lambs was weighed at the commencement of the study before administering the experimental diets. Subsequently bodyweight measurements were carried out prior to feeding by using hanging spring balance scale on weekly basis to determine bodyweight gain (BWG).

Linear body measurement were also taken on weekly basis with the aid of flexible measuring tape and a ruler as reported by Ogungbayi (2003). The following linear body measurements of ram lambs were taken on each of the animals examined:

Height at Withers (HW): This is measured vertically from the ridge between the shoulder bones to the ground.

Body Length: This is the distance measured vertically from the tip of the shoulder to the tip of the pelvic girdle.

Heart Girth (HG): This is measured as the circumference of the body at the morrow point just posterior to the body axis.

Ear Length (EL): This is measured as the distance between the tip of the ear and the base of the ear.

Tail Length (TL): Measured as the distance between the base of the tail close to the body of the lamb and the tip of the tail.

Fore Leg Length (FLL): Measured as the distance from the shoulder blade of the lamb to the base of the hoof.

Hind Leg Length (HLL): This is measured as the distance from the pelvic bone to the base of the hoof.

Haematological and serum biochemical studies: Blood samples were collected from each of the thirty (30) ram lambs on the last days of the experiment. The ram lambs were bled before feeding by jugular venipuncture and an average of 10ml of blood was collected from each animal. Two different test tubes were used to collect the blood from each of the ram lambs. Blood samples (5ml) were placed into labelled sterile universal bottles containing ethylene diamine tetra-acetic acid (EDTA) for haematological studies. The haematological parameters were determined as reported by Cheesbrough (2004). The other 5 ml blood samples were placed in the universal bottles without anticoagulant and allowed to stand for 2 hours at room temperature. The universal bottles were thereafter centrifuge at 4000rpm for 15 minutes and thereafter stored at $–20^0$C for blood biochemical parameters analysis as described by Singh (2004).

Chemical and Statistical Analysis

Proximate analysis of orange pulps, pineapple pulps and the concentrate supplement diet were carried out using the procedure described by AOAC(2000).

Data obtained from parameter investigated were subjected to Analysis of Variance (ANOVA) using the General Linear Modelling Procedure (SAS, 1999). Significant differences between treatment means were separated using Duncan's Multiple Range Test.

Results and Discussion

Proximate composition of the experimental diets are shown in Table 2. Dry matter values ranged between 76.64% (OP) and 86.24% (CS). The high values observed in dry matter indicate the ability to accumulate more nutrients. Crude protein and ether extract values ranged from 4.43 and 1.26% in PP to 16.92 and 7.01% in CS respectively. The crude protein values for OP and PP appeared to be lower than the 15—18% crude protein requirement for growing lambs (Aruwayo *et al*., 2009). Hence the CS was added to augment the crude protein content of the diets. Crude fibre and ash values were highest in CS (18.65 and 5.86%) and lowest in OP (11.41 and 3.62%). Nitrogen free extract values were 74.40, 78.82 and 51.56% for OP, PP and CS respectively. The values were reasonably reflecting the high energy content of the diets. The crude protein and fibre content for OP and PP obtained in this study were similar to the values reported by Fung *et al* (2010); Okoruwa and Adewumi (2010).

Table 2: Proximate composition (%DM basis) of orange pulps, pineapple pulps and concentrate supplement diet.

Composition	**Diets**		
	OP	**PP**	**CS**
Dry matter	76.64	82.08	86.24
Crude protein	5.99	4.43	16.92
Ether extract	4.58	1.26	7.01
Crude fibre	11.41	17.29	18.65
Ash	3.62	4.20	5.86
Nitrogen free extract	74.40	78.82	51.56

OP=Orange pulps, PP=Pineapple pulps,
CS=Concentrate supplement.

Indicated in Table 3, are body weights and linear body measurements of ram lambs fed experimental diets. Bodyweight gain values were 35.0, 29.80 and 27.30kg for treatments A, B and C respectively. Ram lams on treatment A were significantly (P<0.05) higher than those on treatments B and C. This could probably due to the nutrient composition of the dietary treatment A that was well utilized by the ram lambs. Previous finding by Costa *et al*. (2007) reported that feeding high quality of pineapple pulps with other feedstuffs to small ruminants can bring about appreciable weight gain and check weight losses during the off-season. Height at withers followed similar trend as observed in bodyweight gain. The highest value was obtained in treatment A (48.50 cm) while the lowest value was recorded in treatment C (44.71 cm). The low height at wither observed in treatment C could be as a result of increased in Lectins content of orange pulps that deprive them of gaining more height of withers. Nutritional variation has been reported to influence the pattern of tissue growth and development in ram lambs (Osaiyuwu *et al*., 2012). Body length varied significantly between treatments with ram lambs on treatments A (43.45 cm) recorded the highest and treatment B (38.98cm) the lowest. Environmental factors or time taken to attain maturity could be attributed to such considerable variability in body length. This inconsistency in the dimension of body length agrees with the previous findings of Adewumi *et al*. (2011) who reported that growth pattern in body length dimension did not allow a definite pattern in lambs of the same age. Heart girth and tail length were not significantly affected

(P>0.05) by the dietary treatments. This observation might be related to the elements in each of the components that might have common genomic sites for their genetic control which means phenotypic is likely implicated (Salako, 2006). However, the values of heart girth obtained in this study were different from what some workers reported. Reasons for the differences in values obtained in the study and other related literatures reported (Osaiyuwu, *et al*., 2010; Aye and Adegun, 2010) could be due to difference in breeds used and management system. Ear length was significantly (P<0.05) highest in treatments B (9.89cm) and C (10.02cm) and lowest in treatment A (8.06cm). The inverse compared values recorded between bodyweight gain and ear length in ram lambs on treatment A could be indicative of the fact that the traits did not increase concurrently at their age or growth rate between the traits were disproportionate. This agrees with the findings of other authors who reported that there are variation for body weight gain and ear length as age increase in ram lambs (Osaiyuwu *et al*., 2010; Adewumi *et al*., 2011). Fore and hind legs length follow the same pattern of variation as observed in body weight. This further buttress the fact that nutrition play a vital role in linear body dimension. This is in line with what Otoikhian *et al*. (2008) who suggested that nutrition is the one of the major determinants of growth and physiological developments of animals.

Table 3: Bodyweights and linear boy measurements of ram lambs fed experimental diets.

Parameters	Treatment			SEM±
	A	B	C	
Bodyweight gain (kg)	35.10^{a}	29.80^{b}	27.30^{c}	0.21
Height at wither (cm)	48.50^{a}	45.92^{b}	44.71^{c}	0.69
Body length (cm)	43.45^{a}	38.98^{c}	40.01^{b}	0.67
Heart girth (cm)	49.01	48.96	48.99	0.58
Ear length (cm)	8.06^{b}	9.89^{a}	10.02^{a}	0.07
Tail length (cm)	16.25	16.50	16.01	0.48
Fore leg length (cm)	30.06^{a}	28.87^{b}	26.99^{c}	0.70
Hind leg length (cm)	45.32^{a}	43.99^{b}	40.04^{c}	0.62

$^{a, b, c}$ means within the same row with different superscripts differ significantly (P<0.05), SEM = Standard error of mean.

Moreover, this indicated that diet selected for ram lambs would have a better effect on body weights and dimension for animals.

Table 4 presents the haematological parameters of ram lambs fed mixture of orange and pineapple pulps. Haematological parameters observed were significantly (P<0.05) different except eosinophils and basophils that were not significantly (P>0.05) differed. Past and contemporary reports (Omoikhoje, 2011; Kolan *et al*., 2012) revealed that blood is very vital to life and before any meaningful work can be done on the biology of animals detailed haematological study is imperative. This is because any abnormal variation in the haematology of the cells impairs the primary physiological function of the animal's body. It is also recognized by most workers (Isidahomen *et al*., 2011; Isikulenu *et al*., 2012) that haematological constituents are always a reflection of animal's responsiveness to their internal and external environment.

Table 4: Haematological indices of ram lambs fed mixture of orange and pineapple pulps.

Parameters	**Treatment**			**SEM±**
	A	**B**	**C**	
Packed cell volume (%)	25.00^a	22.07^b	19.96^c	0.50
Haemoglobin (g/dl)	8.96^a	7.85^a	6.09^b	0.41
Red blood cell (x10^{12}/l)	11.02^a	8.89^b	9.01^b	0.21
While blood cell (x10^9/l)	9.04^b	9.69^b	14.02^a	0.32
Neutrophil (%)	30.03^b	30.92^b	35.36^a	0.53
Lymphocytes (%)	63.00^a	62.04^b	59.00^b	0.98
Monocytes (%)	3.07^a	2.90^b	2.40^b	0.42
Eosinophils (%)	5.01	4.99	5.00	0.50
Basophils (%)	0.31	0.32	0.31	0.02

$^{a, b, c}$ means within the same row with different superscripts differ significantly (P<0.05), SEM = Standard error of mean.

Packed cell volume (PCV) and haemoglobin (Hb) concentration were significantly (P<0.05) highest in treatment A (25.00% and 8.96g/dl) and lowest in treatment C (19.96% and 6.09g/dl). This indicates the quality of treatment A test diet that was properly utilized by the ram lambs for the formation of Hb concentration and compensatory accelerated production of PCV. This observation is further attested to by the higher significant (P<0.05) different recorded for red blood cell (RBC) values in treatment A $\left(11.02\times10^{12}/l\right)$ compared to treatments B $\left(8.89\times10^{12}/l\right)$ and C $\left(9.01\times10^{12`}/l\right)$. Thus, ram lambs on treatment A could be of greater advantage in oxygen transportation and delivery to the tissue. The PCV, Hb and WBC values obtained in this study were within the haematological standard values for sheep as reported by Isidahomen *et al*. (2011). However, the significant (P<0.05) positive relationship between linear body measurements, PCV, Hb and RBC ram lambs in treatment A, could probably be used to explain the better efficiency utilization of the diet. White blood cell (WBC) was significantly highest in ram lambs on treatment C $\left(14.02\times10^{9}/l\right)$ compared to treatments B $\left(9.69\times10^{9}/l\right)$ and A $\left(9.04\times10^{9}/l\right)$. Kolan *et al*. (2012) reported that WBC offer explanation for the defence mechanism of animals. This implies that ram lambs on treatments A and B remained healthy, because increase in number of WBC counts above the normal range as observed in treatment C was an indication of lambs fighting against the presence of foreign body in circulating system. Similarly, the higher neutrophil values observed in ram lambs on treatment C (35.36%) might testifly the destruction of bacterial infection or inflammatory diseases

(Bawala *et al*., 2007). The higher values for lymphocytes and monocytes values obtained in treatment A (63.00 and 3.07%) compared to treatments B (62.04 and 2.90%) and C (59.00 and 2.40%) suggest their immune system that were not impaired, hence they did not react to any infection (AACC, 2011). The non-significant difference (P>0.05) observed in eosinophils and basophils indicated that ram lambs used in the study showed no hypersensitivity reaction to the diets offered to the lambs thus, they did not suffer from parasitic infection (AACC, 2011).

Table 5: Serum biochemical profile of ram lambs fed experimental diets.

Parameters	Treatment			SEM±
	A	B	C	
Total protein (g/dl)	7.00[a]	6.80[b]	6.76[b]	0.92
Albumin (g/dl)	4.10[a]	4.00[a]	3.79[b]	0.62
Globulin (g/dl)	2.90	2.80	2.79	0.21
Cholesterol (mg/dl)	50.12[c]	56.31[b]	64.07[a]	1.02
Creatine (mg/dl)	1.10	1.06	1.09	0.03
Urea (mg/dl)	16.09[c]	18.02[b]	21.96[a]	0.76
Calcium (mg/dl)	6.22[a]	4.01[b]	3.94[b]	0.51
Phosphorus (mg/dl)	4.03[a]	3.99[a]	2.48[b]	0.51

[a, b, c] means within the same row with different superscripts differ significantly (P<0.05), SEM = Standard error of mean.

Presented in Table 5, is the serum biochemical parameters of ram lambs fed experimental diets. Total protein and albumen values were significantly (P<0.05) higher in ram lambs on treatment A (7.00 and 4.10g/dl) and C (6.76 and 3.79g/dl). No significant (P>0.05) difference was observed for globulin between treatments. However, serum total protein, albumen and globulin levels increased with increase in pineapple pulps inclusion in the diets. This could probably due to improved dietary protein intake following pineapple pulps inclusion. The observed total protein and albumen values obtained in this study were not in agreement with the findings of Konlan *et al*. (2012). Cholesterol values were significantly (P<0.05) highest in treatment C (64.07mg/dl) and lowest in treatment A (50.12mg/dl). The values increased correspondingly with the increase in levels of orange pulps inclusion in the diet. Besides, the sequential increment of serum cholesterol observed from treatment A to C in the study, dietary treatment A could also be linked with low oil level diet. This observation is of nutritional and health importance to ram lambs in treatment A as cholesterol has been reported (Omoikhoje, 2011) to associate with arteriosclerosis and other cardiovascular disorders associated with hypercholesterolemia. Serum creatinine was not significant (P>0.05) between treatment, this could probably revealed the non-muscular wastage that could have been possibly cause by the diets. Earlier study by Aruwayo *et al*. (2009) revealed that serum biochemical parameters are important in proper maintenance of the osmotic pressure between the circulating fluid and the fluid in the tissue of the animal, so that exchange materials between the blood and cells be facilitated. The urea level was significantly highest (P<0.05) in treatment C (21.96 mg/dl) compared to other treatments. The highest urea level observed in treatment C could be associated with the inferiority of efficiency utilization of nitrogen in the diet. This fact also confirmed the low total protein observed in the same treatment. Calcium and phosphorus levels were highest (P>0.05) in treatment A (6.22 and 4.03mg/dl) and lowest in treatment C (3.94 and 2.48mg/dl). Isidahomen (2011) reported that plasma protein help in transportation of calcium and phosphorus and other substance in the blood by attachment to the albumin.

Conclusion

It can be concluded from this finding that mixture of orange and pineapple pulps have the potential to reduce feed stress of the dry season and improve performance and productivity of ram lambs. However, the mixture in a ratio of 30:40 (treatment A) was more pronounce in body measurements and enhance blood constituents of ram lambs without any deleterious effect on the health status.

References:

AACC (American Association for Clinical Chemistry, 2011). White blood cell differential count. Lab. tests online. http://labtestsonline.org/understanding/analytes/differential/tab/test.

Adewumi, O.O., Kazeem, G. and Abloermeti, E.K. (2011). Effect of stage lactation on milk intake, body weight and linear body measurements of yankasa lambs. *Proc. 36th Conf. Nig. Soc. for Anim. Prod. Univ of Abuja, Nigeria*. Pp. 501–504.

Afolabi, K.D., Ososanya, T.O., Olajide, R., Alabi, O.M. and Balogun, L.O. (2011). Effect of season and management on the prevalence of pneumoenteritis of sheep in Ile-Ife, Nigeria. *Proc. 36th Conf. Nig. Soc. for Anim. Prod. Univ. of Abuja, Nigeria*. Pp. 267–270.

Aruwayo, A., Maigandi, S.A., Malami, B.S. and Daneji, A.I. (2009). Haematological and biochemical indices of growing lambs fed fore-stomach digesta and poultry litter waste. *Nig. J. Basic and Applied Sci*. **17**(2): 223–228.

Association of Official Analytical Chemist (A.O.A.C., 2000). Official method of analysis, 17th edition. Washington DC.

Aye, P.A. and Adegun, M.K. (2010). Digestibility and growth in west African dwarf sheep fed *gliricidia*-based multinutrient block supplements. *Agric. and Bio J. North America*. **1**(6):1133–1139.

Bawala, T.O., Adegoke, E.O., Ojekunle, A.O., Adu, I.F. and Aina, A.B.J. (2007). Utilization of cassava peel and rumen epithelial waste diets by west African dwarf sheep. *Asset series A* 7:168—180.

Cheesbrough, M. (2004). District laboratory practice in tropical countries, parts 1 and 2. Cambridge, UK: Cambridge University Press.

Costa, R.C., Correia, M.X.C., De-Silva, J.H.V., De-Medeiros, A.N. and De-Carvalho, F.F.R. (2007). Effect of different levels of dehydrated pineapple by-products on intake, digestibility and performance of growing goats. *Rum. Res*. **71**(1–3): 138–143.

Fung, Y.T.E., Sparkes, A.J., Van-Ekris, I., Chaves, A.V. and Bush, R.D. (2010). Effects of feeding fresh citrus pulp to merino wethers on wool growth and animal performance. *Anim. Prod. Sci*. 50:52–58.

Isidahomen, E.C., Ikhimioya, I., Njidda, A.A. and Okoruwa, M.I. (2011). Haematological parameter and blood chemistry of different species of ruminant animals in humid tropical environment. *Nigerian J. Agric and Forestry*. **3**(1):85–90.

Isikwenu, J.O., Udeh, I. and Ifie, I. (2012). Haematological response, performance and economic analysis of cockerel chicks fed enzymes supplemented brewer's dried grains groundut cake-based diets. *Pakistan J. Nutrition*. **11**(6): 541—546.

Konlan, S.P., Karikari, P.K. and Ansah, T. (2012). Productive and blood indices of dwarf rams fed a mixture of rice straw and groundnut haulms alone or supplemented with concentrates containing different levels of shea nut cake. *Paksitan J. Nutrition*. **11**(6): 566–571.

Ogungbayi, A.T., Abiola, S.S. and Ozoje, M.O. (2003). The study of linear body measurements of west African dwarf (WAD) lambs and kids under traditional management system. *Nig. J. Anim. Prod*. **30**(2):197–202.

Okoruwa, M.I. and Adewumi, M.K. (2010). Effect of replacing *Panicum maximum* with dried pineapple pulp on nutrient digestibility and nitrogen balance of west African dwarf sheep. *Nig. J. Anim. Sci*. 12:103–109.

Oluremi, O.I.A., Andrew, I.A. and Ngi, J. (2007). Evaluation of nutritive potential of the peels of some citrus fruits varieties as feeding stuffs in livestock production. *Pakistan Journal of Nutrition*. **6**(6):653–656.

Omoikhoje, S.O. (2011). Haematological traits and serum chemistry of broilers fed graded levels of cooked bambara groundnut meal. *Nig. J. Agric and Forestry*. **3**(1): 69—78.

Osaiyuwu, O.H., Akinyemi, M.O. and Salako, A.E. (2010). Factor analysis of the morphostructure of mature balami sheep. *Proc. 15th Conf. Anim. Sci. Assoc. of Nig. Univ. of Uyo, Nigeria*. Pp. 1–4.

Otoikhian, C.S.O., Otoikhian, A.M., Akporhuarho, O.P. and Isidahomen, C. (2008). Correlation of body weight and some body measurement parameter in ouda sheep under extensive management system. *African Journal of General Agriculture*. **4**(3):129–133.
Salako, A.E. (2006). Principal component factor analysis of the morphostructure of immature uda sheep. *International Journal of Morphology*. **24**(4): 571–774.
SAS (1999). Statistical analysis system SAS users guide. Cary, NY: SAS Institute.
Singh, S.P. (2004). Practical manual in biochemistry, 5th Edn. Satish Kuma, Jain, India.