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*Full Length Research Paper*

# Evaluation of biscuit waste meal and *Leucaena leucocephala* leaf hay as sources of protein and energy for fattening "yankassa" rams

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**A total of twenty apparently healthy Yankassa rams, 9 to 11 months of age and weighing 11.83 to 12.50 kg were used in a completely randomized design unpinning to determine the effect of partial and total replacement of maize and wheat offal with Biscuit Waste Meal (BWM) and *Leucaena leucocephala* leaf hay (Llh) as a source of protein and energy. The animals were assigned to five groups of four rams per group, balanced for weight and used in the trial that lasted for 84 days. BMW and Llh mixture was used to replace maize and wheat offal mixture at 0, 25, 50, 75 and 100% in formulated diets. Dry matter intake, crude protein intake and daily weight gain were all significantly (P<0.05) affected by the dietary treatments. It was also observed that dry matter digestibility, crude protein digestibility, energy digestibility and feed cost per gram declined significantly (P<0.05) with increase in inclusion level of BWM and Llh mixture in the diet. Gross energy intake and chilling loss were not significantly (P>0.05) influenced by dietary treatments. However, dry matter intake followed the same pattern as crude protein intake while crude fibre intake increased (P<0.05) with higher inclusion levels of the test mixture. In addition, the values obtained for wholesale cuts in terms of the shoulder, the rack, the breast shank and flank and the loin as percentage of carcass weight were significantly (P<0.05) affected. This could be attributed to feed conversation (feed: gain) ratio. Based on the performance of the animals, it was concluded that BWM and Llh mixture could be used as a potential source of protein and energy for fattening small ruminant.**

**Key words:** Evaluation, fattening, biscuit waste, *Leucaena leucocephala*, yankassa ram.

## INTRODUCTION

Biscuit Waste Meal (BWM) is an agro industrial waste product found in substantial quantities in biscuit producing industries located at different industrial areas in Nigeria. It is a palatable, high energy feed produced from wheat flour, skimmed milk, powder, vegetable fat, sugar, salt and flavor materials. The waste meal was analysed and found to contain substantial amount of nutrients such as protein, energy and minerals required for animal growth and performance (Longe, 1986; Olayeni et al., 2007). Longe (1986) however noted that the Crude Protein (CP) and energy contents BWM were 10.80% and 4.70 MJ/kg respectively. BWM has no anti-nutritional factor and could make a good replacement for maize and other cereal grains in fattening ram for market or for slaughter.

Animals should be adequately fed on rich balanced rations so that they could grow rapidly to attain desired weight within a short period. However, earlier reports showed that animals under a fattening programme would tend to use metabolizable energy more efficiently if provided as carbohydrate than as protein (MacDonald et al., 1995). Similarly, Ranjahan (2004) reported that if a growing animal is provided with insufficient protein, the efficiency with which it utilizes metabolizable energy would probably be altered. Therefore, *Leucaena leucocephala* leaf hay (Llh) was used in the present study to supplement the formulated feed as source of protein.

*L. leucocephala* leaf hay is a browse plant and has great potential as sources of high quality nutrients for animals, being high in protein, minerals and vitamins (Odeyinka 2001), Reynolds and Atta-krah (1986) also reported that the browse plant has the ability of being

**Table 1.** Composition of experimental diet.

| Ingredients | Dietary treatments | | | | |
|---|---|---|---|---|---|
| | B0 | B25 | B50 | B75 | B100 |
| Maize | 32.50 | 24.37 | 16.25 | 8.13 | - |
| Wheat offal | 30.00 | 22.50 | 15.00 | 7.50 | - |
| BWM | - | 8.13 | 16.25 | 24.37 | 32.50 |
| *L. leucocephala* leaf hay | - | 7.50 | 15.00 | 22.50 | 30.00 |
| Palm Kernel Cake | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| Brewer's Dried Grain | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| Bone meal | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Oystarshell | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Premix | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Salt | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

available all year round because of its drought resistance, persistence, vigorous growth and re-growth and palatability. Though biscuit waste is produced in our district, its usage is very limited due to poor understanding of its nutritional and economic values as well as its proper use in ruminant rations. The present study therefore is to evaluate biscuit waste and *L. leucocephala* leaf hay as a potential source of protein and energy for fattening rams.

## MATERIALS AND METHODS

### Processing of biscuits waste meal and *L. leucocephala* leaf hay

Biscuit Waste Meal (BWM) was purchased from a biscuit producing factory located in Oluyole industrial area in Ibadan, Oyo State Nigeria. The waste was sundried on large tarpaulin sheets for 4 days. The advantage of sun drying is to eliminate protozoa and fungi as well as to reduce bacterial contamination. *L. leucocephala* leaves, obtained from the University Teaching and Research farm were also sun dried for 3 days. The constituent of BWM and *L. leucocephala* leaf hay were industrially ground in the hammer mill to allow for proper mixing with other dietary ingredients.

Twenty growing yankassa rams approximately 9 to 11 months of age with an average initial weight of 12.17 ± 0.33 kg were purchased from a village market around Zaria and used for the study. The animals were quarantined for 8 weeks, dewormed with Banmith II at 12.5 mg kg/ BW (Pfizer products), sprayed with Asuntol (Bayer product) against ecto-parasite and treated with Oxytetracycline HCL (a broad spectrum anti biotic-pfizer product). Prior to the commencement of the experiment the animals were managed intensively and group fed with cowpea hay, maize offal and Brewer dried grain, clean water was provided *ad libitum*.

The animals were equally allocated to five groups for similar body weight and variability in body weight within group. Each group was randomly allocated to one of the five dietary treatments. Treatment consisted of combined levels of BWM and *L. leucocephala* leaves that was used to replace maize and wheat offal at 0, 25, 50, 75 and 100% inclusion levels (Table 1). The rations were designated as diets $B_0$, $B_{25}$, $B_{50}$, $B_{75}$ and $B_{100}$ in the experiment that lasted for 98 days including the first 14 days for adaption and subsequent 84 days for measurements.

Rams were housed individually in a concrete floor well ventilated pen (1.2 x 1.00 x 1.20 m) which bedding materials was periodically placed and later removed. There was free access to clean waters. Animals were weighed once weekly and the level of feeding adjusted depending on live weight changes. Daily feed intake was estimate by differences of the feed offered and residue collected.

After 70 days of the feeding trial, 2 rams from each treatment were transferred to individual metabolism crates (90 x 75 x 90 cm) made of welded wire mesh fitted with removable feeders and arranged for quantitative collection of faeces and urine separately. The trial lasted for 14 days with a 7 day adaptation period to accustom the animals to crates prior to a 7 day collection and measurement procedure. Total faecal output was collected in the mornings before feeding the watering. Total faeces voided by each ram during the 5-day collection period were collected and weighed fresh daily. 10% aliquots of the daily faecal output was oven dried at 60℃ for 48 h in a forced draught air oven, ground to pass through 2 mm sieve, bulked for the individual animal and preserved for the determination of Dry Matter (DM) and proximate composition. Samples of BWM, *L. leucocephala* leaves, experimental diets and feaces were analysed for their proximate compositions AOAC, 2002 (GE) level of the diet were determined in a ballistic bomb calorimeter using benzoic acid as standard. The various fibre components were determined according to Van Soest and Robertson (1985).

The data obtained from these analyses were used to calculate the digestibility and nutrient intake by the growing "yankassa" rams. Data were subjected to Analysis of Variance for a Completely Randomized Design using SAS (2002) and means compared by Duncan's Multiple Range Test (Steel and Torrie, 1960).

## RESULTS AND DISCUSSION

The proximate analysis of BWM, *L. leucocephala* leaf hay and experimental diets are presented in Table 2. The high CP content (21.75%), CF (15.90) and GE (2140 kcal/kg) obtained for *L. leucocephala* leaf hay would seem to suggest its suitability as a fodder tree. Browse plants were reported to have high CP of high digestibility and are also high in minerals and vitamins (Dutta et al., 1999; Osakwe, 2003).

BWM composition was similar to the findings (CP 10.8%, EE 4.9%, CF 1.40%, Ash 5.9%, NFE 77%, GE

**Table 2.** Chemical composition of biscuit waste meal, *L. leucocephala* leaf hay and experimental diets (% of DM).

| Parameters | B0 | B25 | B50 | B75 | B100 | Leucaena | Biscuit waste |
|---|---|---|---|---|---|---|---|
| Dry matter | 92.62 | 93.08 | 93.08 | 92.15 | 93.05 | 88.18 | 96.85 |
| Organic matter | 83.40 | 87.52 | 84.11 | 82.56 | 82.05 | 71.67 | 90.85 |
| Crude protein | 15.15 | 14.48 | 14.3 | 14.19 | 14.05 | 21.75 | 9.65 |
| Crude fiber | 11.20 | 13.61 | 13.16 | 13.00 | 14.15 | 15.90 | 2.10 |
| Ether extract | 3.17 | 3.56 | 2.34 | 2.21 | 2.08 | 3.05 | 5.25 |
| Ash | 10.40 | 9.66 | 9.80 | 8.56 | 9.25 | 8.60 | 6.00 |
| Nitrogen free extract | 60.08 | 58.69 | 60.4 | 62.04 | 60.47 | 50.70 | 77.00 |
| Neutral detergent fiber | 43.50 | 68.44 | 67.21 | 67.16 | 67.55 | 49.90 | - |
| Acid detergent fiber | 28.85 | 25.68 | 25.00 | 25.37 | 26.15 | 30.60 | - |
| Acid detergent lignin | 58.95 | 32.12 | 35.91 | 36.15 | 41.28 | 15.90 | - |
| Gross energy (MJ/Kg) | 3.15 | 3.10 | 2.95 | 2.92 | 2.85 | 2.14 | 3.99 |

a,b,c -Means on the same row with the different superscripts are significantly different (P<0.05).

**Table 3.** Dry matter Intake, Nutrient intake and Digestibility in yankassa rams fed varying levels of biscuit waste meal and *Leucaena Leucocephala* leaf (g/day/$W^{0.75}$).

| Parameters | $B_0$ | $B_{25}$ | $B_{50}$ | $B_{75}$ | $B_{100}$ | SEM |
|---|---|---|---|---|---|---|
| Dry matter Intake (g/day) | $647.23^{b}$ | $673.73^{a}$ | $664.63^{ab}$ | $653.17^{ab}$ | $591.17^{c}$ | 22.26 |
| Dry matter Intake (% of body weight) | $3.44^{a}$ | $3.27^{b}$ | $3.31^{b}$ | $3.39^{b}$ | $3.36^{b}$ | 0.12 |
| Dry matter Intake (g/d/kg $W^{0.75}$) | $76.96^{a}$ | $77.17^{a}$ | $76.84^{a}$ | $76.31^{a}$ | $71.83^{b}$ | 2.83 |
| Drymatter digestibility (%) | $87.54^{a}$ | $77.80^{b}$ | $77.30^{b}$ | $83.60^{ab}$ | $75.5^{b}$ | 1.88 |
| Crude protein intake (g/d/kg $W^{0.75}$) | 10.83a | 11.66a | 11.16a | 10.99a | 8.41b | 0.84 |
| Crude protein digestibility (%) | $80.88^{a}$ | $78.65^{b}$ | $76.10^{c}$ | $75.39^{c}$ | $73.02^{d}$ | 2.50 |
| Crude fiber Intake (g/d/kg $W^{0.75}$) | $8.61^{c}$ | $9.92^{b}$ | $10.11^{a}$ | $10.18^{a}$ | $10.50^{a}$ | 0.76 |
| Energy Intake (MJ/Kg/d) | $2.03878^{b}$ | $2.08856^{a}$ | $1.96065^{c}$ | $1.90726^{d}$ | $1.68483^{e}$ | 0.034 |
| Gross energy intake (MJ/Kg/d/$W^{0.75}$) | 0.5808 | 0.5736 | 0.5425 | 0.5330 | 0.4876 | 0.094 |
| Energy Digested (MJ/Kg/d) | $1.92317^{a}$ | $1.69293^{b}$ | $1.58394^{d}$ | $1.64978^{c}$ | $1.41978^{e}$ | 0.035 |
| Energy Digestibility % | $84.28^{a}$ | $82.13^{ab}$ | $79.90^{b}$ | $77.38^{b}$ | $75.06^{c}$ | 2.92 |

a,b,c -Means on the same row with the different superscripts are significantly different(P<0.05).

4.7 MJ / kg and DM 97.0%) reported by Longe (1986) except for the CP and CF contents which were 9.65 and 2.10% respectively. Discrepancies such as this might be due to product differences and post manufacturing management of the biscuit waste. The GE (MJ/Kg) obtained for BWM (3.2) in the present study was similar to those of maize (3.4) and wheat offal (3.1) which are conventional feed stuffs.

Dry matter contents of the experimental diets (Table 2), which varied from 92.15 to 93.08% were similar to those obtained by Maigandi and Nasiru (2006) for replacement value of Faidherbic albid pods fed to Ouda sheep but higher than those reported by Oladotun et al. (2003) who evaluated formulated agro industrial waste as dry season feeds for sheep. Crude protein contents of the diets (14.05 to 15.15%) were very close to the values of 15 to18% recommended by ARC (1990) for growing sheep but were within the range of values (13.13 to16.63%) reported by Olayeni et al. (2007) in a biscuit waste meal based ration for layer birds. Also the range of dietary CP values obtained seemed to be adequate for sheep nutrition as the recommended level of 9.50 to 10.0% reported by NRC (1980) and NRC (1985) as being crude fiber content and its fractions however increased (P<0.05) with higher level of BWM/ *L. leucocephala* leaf hay inclusions. The gross energy and crude fat content followed the same pattern with CP content which declined as the level of replacement of maize and wheat offal mixture with BWM/ *L. leucocephala* leaf hay mixture

Inclusion of BWM/ *L. leucocephala* leaf hay mixture significantly (P<0.05) influenced dry matter intake (DMI) (Table 3). The animals had adequate DMI (g/d) that ranged from 591.17 to 673.73 which amounts to an average of 3.35 ± 0.08% (NRC, 1985; Devendra and McLeroy, 1982) of the body weight. Rams treated on 25, 50 and 75% BWM and *L. leucocephala* leaf hay mixture exhibited significantly (P<0.05) higher DM consumption (673.73, 664.63 and 653.17 g/day respectively) than the

**Table 4.** Live weight changes and feed cost per kg/gain of "yankassa" rams fed concentrate containing varying levels of biscuit waste meal and *L. Leucocephala* leaf.

| Parameters | $B_0$ | $B_{25}$ | $B_{50}$ | $B_{75}$ | $B_{100}$ | SEM |
|---|---|---|---|---|---|---|
| Initial weight (kg) | 11.83 | 12.33 | 12.33 | 12.50 | 11.83 | 1.26 |
| Final weight (kg) | 22.40b$^{c}$ | 23.62$^{a}$ | 23.21$^{ab}$ | 22.53$^{abc}$ | 21.40$^{c}$ | 1.17 |
| Average weight gain(g/day) | 125.83$^{c}$ | 134.40$^{a}$ | 129.52$^{b}$ | 119.40$^{d}$ | 113.93$^{e}$ | 3.05 |
| Metabolic weight /kg $W^{0.75}$ | 8.41b$^{c}$ | 8.73$^{a}$ | 8.65$^{a}$ | 8.56$^{ab}$ | 8.23$^{c}$ | 0.30 |
| Feed efficiency | 0.194$^{b}$ | 0.199$^{a}$ | 0.195$^{b}$ | 0.183$^{c}$ | 0.193$^{b}$ | 0.002 |
| Feed: gain | 5.14 | 5.01 | 5.13 | 5.47 | 5.19 | 1.02 |
| Feed cost: gain (USD/kg) | 1.057$^{a}$ | 0.933$^{b}$ | 0.885$^{b}$ | 0.835$^{b}$ | 0.667$^{e}$ | 0.17 |

a,b,c -Means on the same row with the different superscripts are significantly different (P<0.05).

rams on other diets including the control. However the DMI (g/d/kg$W^{0.75}$) depicted higher values (71.83 to 77.17) than the value (51.06g/d/kg$W^{0.75}$) reported by Robinson et al. (1991) for 7 months weaner lambs. Mba, et al. (1982) had also obtained DMI of 54.81 g/d/kg$W^{0.75}$ of West African Dwarf (WAD) goats of relatively lower body size maintained on Gliricidia sepium plus concentrate (1:1) ratio. Dry matter intake (g/d/kg$W^{0.75}$) was significantly higher for $B_{25}$ (P<0.05) but not different (P>0.05) for $B_0$ (76.96), $B_{50}$ (76.84) and $B_{75}$ (76.31) respectively.

However, FAO (1995) classified digestibility of feed high (>60%), medium (40 to 60%) and low (<40%). Thus, the range of Dry Matter Digestibility (DMD) (75.50 to 87. 54%) obtained in the present study was generally high and greater than what was reported for sheep and goats fed combinations of elephant grass, poultry droppings, crop residues and agio-industrial by products (Taiwo et al., 1995; Adebowale and Taiwo, 1996). DMD (%) decreased (P<0.05) from 87.54 in the control to 83.60, 77.80, 77.30 and 75.50 in ram receiving diets $B_{25}$, $B_{50}$, $B_{75}$ and $B_{100}$ respectively in which BWM/ *L. leucocephala* leaf hay mixture was used to replace 25, 50, 75 and 100% of maize/wheat offal mixture in diet $B_0$. Crude protein digestibility values of 78.65, 76.10, 75.39 and 73.02% obtained from rams on diets $B_{25}$, $B_{50}$, $B_{75}$, $B_{100}$ respectively were each significantly lower (P<0.05) than the value of 80.88% in the control ($B_0$).

The low protein contents of diets $B_{25}$, $B_{50}$, $B_{75}$ and $B_{100}$ seem to have played significant roles in depressing the digestibility of nutrient below that of $B_o$ (control). This is supported by Ranjahan (2004) that the concentration of CP in a feed affects its digestibility. High fiber content inhibits digestibility. Thus, diets $B_{25}$ $B_{50}$ $B_{75}$ and $B_{100}$ with high dietary fiber contents could have contributed to their low digestibility.

It could also be noted that the coefficients of gross energy digestibility was similar to those of dry matter which decreased (P<0.05) from the control diet to $B_{100}$ with increase in level of BWM/ *L. leucocephala* leaf hay inclusion. The similarly could be explained by the fact that the dry matter fraction of the diet, excluding the ash, is predominantly a source of energy.

Also, CP intake (g/d/kg$W^{0.75}$) of animals on diet $B_{25}$ W (11.66) was significantly (P<0.05) higher than he value (8.41) obtained for $B_{100}$ but not different (P>0.05) from 11.16, 10.99 and 10.83 recorded on diets $B_{50}$, $B_{75}$ and $B_0$ (the control) respectively. The result was in agreement with the report of Mtenga and Shoo (1990) that increased protein intake is associated with high dry matter intake resulting in a faster rate of passage of digest (from the reticulo-rumen/through the gastro-intestinal tract). Crude fiber increased from 8.61 for animals on $B_0$ to 9.92, 90.11, 10.18 and 10.50 for animals on diets $B_{25}$, $B_{50}$, $B_{75}$ and $B_{100}$ respectively.

This result was in agreement with the findings reported by Ademosun (1994) and Odeyinka et al. (2003) that CF intake increased with increase in *L. leucocephala* leaf hay in the diet of West African Dwarf goat. The performance of "yankassa" rams in terms of average daily weight gains, feed efficiency and cost of food per unit weight gain is presented in Table 4. It was observed that the BWM/ *L. leucocephala* leaf hay mixture with 0, 25, 50, 75 and 100% in dried $B_0$ $B_{25}$ $B_{50}$, $B_{75}$ and $B_{100}$ resulted in 125.83, 134.40, 129.52 119.40 and 113.93 g/daily weight gain of rams.

The mean daily weight gain recorded (113.93 to 134.40) g/day in the present study were higher than the value (79.3 g/day) reported by Akpa et al. (1994) when "yankassa" rams were fed on plane of nutrition. However, the rams on $B_{25}$ and $B_{50}$ indicated faster (P<0.05) growth rates (134.40 and 129.52 g/day) than those on other diets including the control ($B_0$). The higher (P<0.05) weights gained by rams on $B_{25}$ and $B_{50}$ were probably due to higher (P<0.05) DMI and more efficient utilization of the nutrients (0.199 and 0.195) (Table 4). The feed cost per kilogram weight gain reduced as the inclusion level of BWM/ *L. leucocephala* leaf hay mixture increased in the diet.

The least cost of concentrate was found in $B_{100}$ while the price of convectional feel stuffs was on the increase. Thus, "yankassa" rams fattened on diets containing 25 to 75% BWM/ *L. leucocephala* leaf hay mixture could be highly beneficial and cost saving. Generally, animal performance with the use of BWM/ *L. leucocephala* leaf hay mixture could be as good as convectional such as maize and wheat offal. The result could therefore be

**Table 5.** Carcass yield of yankassa rams fed concentrate containing varying levels of biscuit waste meal and *Leucaena Leucocephala* leaf.

| Parameters | $B_0$ | $B_{25}$ | $B_{50}$ | $B_{75}$ | $B_{100}$ | SEM |
|---|---|---|---|---|---|---|
| Live weight (kg) | 20.00$^{b}$ | 22.50$^{a}$ | 20.75$^{b}$ | 18.55 | 18.50 | 0.75 |
| Dressing (%) | 42.00$^{b}$ | 43.10$^{a}$ | 42.15$^{b}$ | 41.90$^{b}$ | 41.35$^{c}$ | 0.67 |
| Chilling loss (kg) | 0.21 | 0.22 | 0.24 | 0.26 | 0.26 | 0.06 |
| % Shrunkage | 18.75$^{cb}$ | 20.10$^{a}$ | 19.25$^{ab}$ | 18.50$^{b}$ | 17.90$^{c}$ | 0.75 |
| Shoulder as % CCW | 24.99$^{b}$ | 26.62$^{a}$ | 25.16$^{b}$ | 25.03$^{c}$ | 24.47$^{d}$ | 0.42 |
| Rack as % of CCW | 9.46$^{b}$ | 9.99$^{a}$ | 9.14$^{e}$ | 8.16$^{d}$ | 8.07$^{d}$ | 0.36 |
| Breast shank & flank as % CCW | 16.15$^{b}$ | 17.48$^{a}$ | 17.13$^{a}$ | 16.39$^{b}$ | 15.99$^{b}$ | 0.67 |
| Leg as % of CCW | 33.56$^{c}$ | 37.93$^{a}$ | 35.27$^{b}$ | 34.23b$^{c}$ | 33.53$^{c}$ | 1.05 |
| Neck as % of CCW | 9.57$^{b}$ | 10.15$^{a}$ | 9.70$^{ab}$ | 9.08c | 9.50b$^{c}$ | 0.50 |
| Loin as % CCW | 7.65$^{b}$ | 8.05$^{a}$ | 7.78$^{ab}$ | 7.13c | 8.00$^{a}$ | 0.27 |
| Rib eye area | 5.38$^{c}$ | 8.29$^{a}$ | 5.94$^{b}$ | 6.04 | 6.06 | 0.43 |
| Messenteric fat (kg) | 1.61$^{c}$ | 1.74$^{b}$ | 1.85$^{a}$ | 1.87$^{a}$ | 1.85$^{a}$ | 0.09 |
| Omentum (kg) | 0.83$^{d}$ | 1.07$^{c}$ | 1.36$^{b}$ | 1.46$^{b}$ | 2.79$^{a}$ | 0.13 |
| Weight of kidney fat | 0.25 | 0.27 | 0.28 | 0.31 | 0.37 | 0.13 |

a,b,c -Means on the same row with the different superscripts are significantly different (P<0.05). CCW – means carcass weight.

related to the findings of Umuna et al. (1995) and Yakubu et al. (1997) where better animal performance was obtained on Palm Kernel Meal (PKM) diet used as major source of protein and energy for "yankassa" rams.

Table 5 showed the carcass yield of "yankassa rams fed formulated diet containing varying inclusion levels of BWM and *L. leucocephala* leaf hay mixture. The means of results were calculated based on percentage carcass of the animals, mean dressing percentage of rams in the present study was similarly (P>0.05) slightly lower than what was reported by Yakubu et al. (1997), but was in agreement with the funding reported by Ahmed and Davis (1986) who noted that dressing percent was related to the quality of diet and DMI. Chilling loss (kg) was not significantly affected (P<0.05) by dietary treatment.

The values obtained for wholesale cuts in terms of the shoulder, rack, breast, shank and flank and the loinas percentage of carcass weight were significantly (P<0.05) influenced by treatments but were all best in B25 which was quickly followed by $B_{50}$ and $B_{75}$ respectively. This could be attributed to feed conversion (feed: gain) ratio. The result was comparable to the report by Yakubu et al. (1997). The carcass fat obtained in the present study confirms the report by Adu and Brickman (1981) that lambs fed high energy diets had greater amount of fat. The meseutric and the omentum fats were higher for animals receiving diets – ($B_{25}$, $B_{50}$, $B_{75}$, and $B_{100}$) which BWM/ *L. leucocephala* leaf hay mixture replaced maize/wheat offal mixture at 25, 50, 75 and 100% respectively.

## CONCLUSION AND RECOMMENDATION

Reports of the study reveals that 25, 50, and 75% inclusion levels of BWM and *L. leucocephala* leaf hay mixture could be tolerated by "yankassa" rams with significant improvement in daily gain, carcass yield and economically affordable cost of produlatory. Thus, for successful ram fattening operation it could be cheaper to use up to 75% BWM/ *L. leucocephala* leaf hay mixture as a replacement for maize/wheat offal mixture. It also indicated that BWM/ *L. leucocephala* leaf hay mixture could serve as a potential source of protein and energy for fattening process in ruminants especially in some areas where there are seasonality in feed supply.

## REFERENCES


Adebowale EA, Taiwo AA (1996). Utilization of crop residues and agro-industrial by-products as a complete diet for West African Dwarf goat and sheep. Niger. J. Anim. Prod., 23(1): 153-160.

Ademosun AA (1994). Constrain and prospects for small ruminant research and development in Africa. (T.A. publication series. Sh.B. Labbie B. Rey and E.K. Irungu (eds). Bk. of proceed 2nd Benin. Conf. Pro. of the Afi. Rum. Res network Tanzania. p. 226.

Adu IF, Brickman WL (1981). Feedlot performance and carcass characteristics of sheep fed varying levels. J. Anim. Prod. Res., 1: 1 – 12.

Ahmed NA, Davis KL (1986). Effect of sex and dietary energy concentration on feed ratio, growth and carcass characteristics in Merino X Border Leicester Lambs. Nutr. Abs Rev., 57: 165.

Akpa GN, Osinowo OA, Dim NI, Oyedipo EO (1994). Effect of plane of nutrition and rearing method on Yankassa Lambs: Growth rate, scrotal development and puberty. Nig. J. Anim. Prod., 21(1): 101-103.

AOAC (2002). Association of Official Analytical Chemists. Official methods of analysis. 18th Edition. Washington, D.C. USA.

ARC (1990). The nutrients requirement of ruminant livestock. Technical Review by Agricultural Research Council Working Parties, CAB International. Wallingford, UK.

Devendra C, McLeroy GG (1982). Goat and sheep production in the tropics, Longman, London, New York.

Dutta N, Sharma K, Hasan QZ (1999). Effect of supplementation of rice straw with *Leucaena leucocephala* and *Prosopis cineraci* leaves in nutrient utilization by goats. Asian Aus. J. Anim. Sci., 12(5): 742-746.

FAO (1995) (Food and Agricultural Organization). Tropical animal

feeding – A mammal force research workers. Food and Agricultural Organization. Animal production and Health paper, Rome, Italy.
Longe O (1986). Replacement value of biscuit waste for maize in broiler diet. Niger. J. Anim. Prod., 13: 70-78.
MacDonald P, Edwards RA, Greenhalgh JFD, Morgan CA (1995). Animal Nutrition. 5th edn. Pearson Education Limited, Edinburgh Gate, UK, pp. 232-235.
Maigandi SA, Nasiru A (2006). Replacement value of *Fidher albida* Pods (Fap) fed to Uda Sheep in a Semi-Arid zone, Nigeria. Dept. of Anim. Sci., Faculty of Agriculture, Usman Danfodio University, Sokoto, Nigeria. Pro. 31st Ann. Conf. Nig. Soc. For Anim. Prod. (NSAP). March 12th-15th. 2006. Bayero University, Kano Nigeria.
Mba AU, Manigu SA, Awah, AA (1982). Influence of concentrate supplement on browse plant (*Gliricidia sepium*) on nutrient utilization and growth of the West African Dwarf (Fouta Djallon) Kids. Niger. J. Anim. Prod., 9(2): 63-73.
Mtenga L, Shoo R (1990). Growth rate, feed intake and feed utilization of Small Est. African goats supplemented with *Leucaena leucocephala*. Small Rum. Res., 3: 9-18.
NRC, National Research Council 1985.Nutrient Requirements of Sheep (6th Edition). National Academic Press Washington D.C.
NRC (1980). National Research Council Academy of Science, National Research Council Washington D.C.
Odeyinka SM (2001). Effect of feeding varying levels of *Leucaena leucocephala* and *Gliricidia sepium* on the performance of West African Dwarf goats. Niger. J. Anim., Prod., 28(1): 61-64.
Odeyinka SM, Hector BL, Orskov ER (2003). Evaluation of the nutritive value of the browse species *Gliricidia sepium* (Jacq). Walp, *Leucaena leucocephala* (Lam) de Wit, and *Cajanus cajan* (L.) Millsp from Niger. J. Anim. Feed Sci., 12: 341-349.
Oladotun OA, Aina ABJ, Oguntona EB (2003). Evaluation of formulated agro-industrial wastes as dry season feed for sheep. Nig. J. Anim. Prod., 30(1): 71-80.
Olayeni TD, Farinu GO, OO Ojebiyi (2007), Replacement Value of biscuit waste on the performance and egg quality parameters of laying hens. Proc. 32nd Ann., 313-230.
Osakwe II (2003). Effect of feeding a hay diet supplemented with Daniellia olivrei leaves to sheep on volatile fatty acid concentration and nitrogen balance. J. Sust. Agric. Environ., 5(1): 26-31.
Ranjahan SK (2004). Animal nutrition in the tropics. Published by Vikas Publishing House. PVT. LMD, 5th Edition. pp. 36-37.
Reynolds L, Atta-krah AW (1986). Alley farming with livestock. Paper presented at the International workshop on Alley farming for sub-humid region of tropical Africa, IITA, Ibadan, Nigeria.
Robbinson PH, Mcqueen RE, Burgess PL (1991). Influence of rumen undegradable protein levels on feed. Intake and milk production of dairy cows. J. Dairy Sci., 74: 1623-1631.
SAS (2002). Statistical Analysis software, SAS/STAT user's Guide. SAS. Int. Inc. Cary. N.Y.
Steel RGD, torries JH (1960). Principles and Procedures of Statistics, pp. 107 – 111. McGraw-Hill Books Company Inc.
Taiwo AA, Adenowale EA, Akinsoyimi AO, Ghreehaly JFD (1995). Comparative study on the use of four protein supplements by West African Dwarf (WAD) sheep. Niger. J. Anim. Prod., 22(1): 68-75.
Umuna NN, Osuji PO, Nsahlai JV, Khahli H, Mohammed – saleem, MA (1995). Effect of supplementary oat hay with LabLab, Sebanic, Tagasaste and Wheat middings on volountary intake Nutirizal on and weight gain of Ethopia man sheep. Small Ruminant Res., 18: 113 – 120.
Van Soest PJ, Robertson, J.B. (1985). Analysis of forages and fibrous food. A laboratory manual for Animal Science, Ithaca, NY. Cornell University. 613: 202.
Yakubu IM, Umunna NN, Njoku PC (1997). Evaluation of palm kernel meal as a major source of energy and protein for fattening Yankassa rams. Nier. J. Anim. Prod., 24(2): 155-160.