Assiut J. Agric. Sci., (46) No. (5) 2015 (11-18) *ISSN: 1110-0486*
Website: http://www.aun.edu.eg/faculty_agriculture/arabic *E-mail: ajas@aun.edu.eg*

Dry Matter Intake and Digestibility of Nutrients by Yankassa Sheep Fed Diet in Which Biscuit Waste and Leucaena Leucocephala Leaf Replaced Maize and Wheat Offal Mixture

[*]Eniolorunda, O.O. ; M.A. Ogungbesan and A.F. Adebusola

Department of Animal Production, College of Agricultural Sciences, Olabisi Onabanjo University, Yewa Campus, Ayetoro, Ogun State, Nigeria.

[*]Corresponding author's E-mail: O1ueniolorunda@gmail.com

Abstract:

A 21-day trial was conducted to find out the digestibility and utilization of biscuit waste meal/*Leucaena leucocephala* leaf hay (B WM/*Llh*) mixture in the diet of growing sheep. The test mixture was used to formulate diets in which it replaced maize/wheat offal mixture at 0 (control), 25, 50, 75 and 100% inclusion levels and were designated as B0, B25, B50, B75 and B100 respectively. Twenty entire Yankassa rams with average initial live weight of 12.16±0.34kg were used in the completely randomized design experiment with 4 animals per treatment. Statistical analysis result showed that the Dry Matter intake (g/d) values of 673.73, 664.63 and 653.17 obtained on diets B25, B50 and B75 were each higher ($p<0.005$) than (647.23) offered to the control. Percentage Dry Matter digestibility decreased ($p<0.05$) from 87.54, 83.60, 77.90, 77.30 and 75.50 respectively in sheep receiving the test mixture diets. The digestibilities of crude protein, crude fibre and its fractions, nitrogen free extraction and energy which followed the same pattern as dry matter digestibility decreased ($P<0.05$) as the level of BWM/*Llh* mixture increased. However nitrogen absorbed and retained by animals on the mixture based diets B_{25}, B_{50} and the control (B_0) were similar ($P> 0.05$). In conclusion, replacing maize, wheat offal mixture with biscuit waste meal, *Leucaena leucocephala* leaf hay mixture may be used until less than 75% in the diet of growing sheep.

Keywords: *Digestibility, utilization, Yankassa sheep, Biscuit waste,* Leucaena leucocephala

Received on: 31 /12/2015 **Accepted for publication on:** 24/1/2016

Referees: Prof. Mostafa Kobeisy Prof. Soliman M. Mousa

Introduction:

Biscuit waste meal (BWM) is an agro industrial by product found in substantial quantities from biscuit producing industries located in different parts of the country. It is a palatable, high energy livestock feed produced from wheat flour, skimmed milk powder, vegetable fat sugar, salt and other flavor materials. Analyses showed that the waste contained substantial amount of nutrients such as protein, energy and minerals required for animal growth and performance (Longe, 1987). The same author also noted that biscuit waste meal is a potential source of high metabolizable energy though with low crude fibre content which could make it a good replacement for maize and other cereal grains in non-ruminant feed. However the utilization of such potentially high energy but low fibre feed by ruminants would require supplementation with a sufficient protein and fibre feed source as suggested by Mc. Donald *et. al.* (1995). As a result, *Leucaena leucocephala* leaf hay *(Llh)* was used with biscuit waste as a source of protein and fibre.

Leucaena leucocephala is a leguminous browse plant which has great potentials as a source of high quality nutrients for ruminants in the tropics. It has a crude protein of high digestibility and is also high in minerals and vitamins (Odeyinka and Ademosun 1995; Eniolorunda and Rowaiye, 2008). It also has the ability of being available all year round because of its drought resistance, persistence, vigorous growth, regrowth and palatability (Odeyinka, 2001). Effect of biscuit waste on performance has been studied in non-ruminant animals, but the data on ruminant animals are limited.

Objectives of the study:

This experiment was designed to assess the dry matter intake (g/d) and digestibility of nutrients by growing Yankassa sheep fed diets in which biscuit waste meal/*Leucaena leucocephala* leaf hay mixture replaced 25, 50, 75 and 100% of maize/wheat offal mixture in the control diet.

Materials and Methods:

Two test ingredients were used in this stud biscuit waste meal (BWM) and *Leucaena leucocephala* leaf hay *(Llh)*. Biscuit waste meal was obtained from a biscuit factory located at Oluyole Industrial Estate in Ibadan, Oyo State, Nigeria, while *Llh* leaves was obtained from the Teaching and Research Farm, Olabisi Onabanjo University and initially air dried. The Biscuit waste meal and *Llh* were later individually sun-dried on large tarpaulin sheets and were ground in a hammer mill to allow for proper mixing with the other dietary ingredients. The milled test ingredients were mixed and used to formulate diets in which the mixture replaced maize and wheat offal mixture at 0 (control); 25, 50, 75 and 100% inclusion levels. The control and test diets at 0, 25, 50, 75 and 100% replacement levels were designated as B0, B25, B50, B75 and B100 respectively (Table 1).

The 20 growing Yankassa rams with an average body weight of 12.16±0.34 kg used in the study were purchased from a village market around Zaria in Kaduna State. The animals were quarantined for 8 weeks and treated against internal and external parasites with ivomec at 1 ml/50kg BW. Prior to the commencement of the experiment, animals were managed intensively and grouped fed with cowpea hay and dried cassava peels. Water was available all the time.

Animals were divided into five groups of four animals each, balanced for weight and individually housed in metabolism crates (90cm x 75cm x 90cm). The crates were made of welded wire mesh, fitted with removable feeders and arrangements were made for quantitative collection of faeces and urine separately. Each group was assigned to one of the experimental diets and fed ad libitum daily in the morning. Clean drinking water and mineralized salt lick were also freely provided. The trial lasted for 21 days with 16 days for adaptation and 5 days for collection of faecal and urine samples.

Data of daily feed intake were recorded for each ram from the difference between feed offered and refusals. Samples of experimental diets and faeces were weighed and oven dried at 60 ^{0}C for 48 hours. The dried faeces for each animal was ground to pass through a 2mm sieve, bulked for the individual sheep and preserved in sample bottles. Urine was also collected with the aid of plastic containers placed under the metabolic crates. Meanwhile, 10 ml of 10% concentrated H_2S0_4 was placed in each container in order to trap ammonia in the urine. In the morning total amount of urine that was collected in each container was measured and 5% of it was retained and stored at 5 ^{0}C and used for analysis.

Thoroughly mixed representative samples of the experimental diets, biscuit waste meal, *Leucaena leucocephala* leaf hay and faeces were analysed for chemical composition. The various fibre contents were determined by the methods of Van Soest, *et. al.* (1985). Urinary nitrogen estimation was carried out according to the procedure of AOAC, (2002). Gross energy of feed and faeces was determined in a Ballistic Bomb Calorimeter using benzoic acid as standard. Statistical Analyses was carried out using SAS (2002) with Duncan multiple range test.

Results and Discussion:

Table 1 shows the percentage composition of the experimental diets as fed to animals during the trial. While the chemical composition of Experimental diets and some ingredients (%) are shown in Table 2. The dry matter (DM) content of the experimental diets varied between 92.62 and 93.05, while the crude protein (CP) content also varied between 14.05 and 15.15%. The range of CP (%) content in this study was however slightly lower than the range of values (15-18%) reported by Adu, (1985) and Ademola *et. al.* (2003), but was within the range values quoted by Aduku, (1993) .In addition, as the percentage inclusion of Biscuit Waste Meal (BWM) and *Leucaena leucocephala* leaf hay (Llh) increased, the CP (%) value decreased as well as the crude fat content (3.17/2.08). crude fiber (CF) and its fractions increased while the gross energy (GE) (Kcal/g) decreased with higher inclusion levels of BWM and *Llh* mixture.

Table (1): Percentage composition of experimental diets fed to Yankassa Ram

Ingredients	Dietary treatment				
	B0	B_{25}	B_{50}	B_{75}	B_{100}
Maize	32.50	24.37	16.25	8.13	-
Wheat offal	30.00	22.50	15.00	7.50	-
Biscuit Waste Meal	-	8.13	16.25	24.37	32.50
Leucaena leucocephala leaf meal	-	7.50	15.00	22.50	30.00
PKC	10.00	10.00	10.00	10.00	10.00
BDG	23.50	23.50	23.50	23.50	23.50
Bone meal	2.50	2.50	2.50	2.50	2.50
Oyster shell	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

B_0 – Zero replacement value of BWM/Llh mixture
B_{25} – 25% replacement value of BWM/Llh mixture
B_{50} – 50% replacement value of BWM/Llh mixture
B_{75} – 75% replacement value of BWM/Llh mixture
B_{100} – 1005% replacement value of BWM/Llh mixture

Table (2): Chemical Analysis of Biscuit Waste meal, Leucaena leucocephala leaf hay and experimental diets

Nutrient (%)	Dietary treatment					
	B0	B25	B50	B75	B100	BWM	Llh
DM	92.62	93.08	93.02	92.95	93.05	85	92.50
OM	84.06	83.77	83.36	83.15	82.65	90.85	83.90
CP	15.15	14.48	14.30	14.17	14.05	9.65	21.75
CF	11.20	13.00	13.16	13.16	14.15	2.10	15.90
C fat	3.17	3.06	2.34	2.21	2.08	5.25	3.05
Ash	8.56	9.31	9.66	9.80	10.40	6.00	8.60
NFE	61.92	60.21	60.54	60,21	59.32	77.00	50.70
Cross energy (kcal/g)	3.15	3.00	2,95	2.92	2.85	3.99	2.14
NDF	60.95	05.21	66.44	67.16	67.55	Nd	49.90
ADF	29.50	32.12	35.91	36.15	41.28	Nd	30.60
ADL	27.85	25.68	25.00	25.37	26.45	Nd	15.90

BWM - Biscuit Waste Meal
LIh - *Leucaena* leucocephala leaf hay
B_0 - Zero replacement value of B WM/Llh Mixture
B_{25},-25% (8.13/7.50) replacement value of BWM/Llh mixture
B_{50}- 50% (16.25/15.00)replacement value of BWM/Llh mixture
$B_{;75}$ - 75% (24.37/22.50) replacement value of BWM/Llh mixture
B_{100}- l00% (32.50/30.00) replacement value of BWM/Llh mtixture

Dry matter and organic matter intakes (g/d) were significantly (P<0.05) influenced by dietary treatment (Table 3). Dry matter intake (g/d) values of 673.73, 664.63 and 653.17 obtained from sheep on diet B_{25}, B_{50} and B_{75} respectively were each significantly (P<0.05) higher than the value of 647.23 offered for the control. This value (647.23 g/d) was however higher (P<0.05) than 591.17 g/d obtained for animals receiving diet B_{100}. Percentage dry matter digestibility (DMD) decreased (P<0.05) from 87.54 in the control group (B_0) to 83.60, 77.90, 77.30 and 75.50 in sheep receiving diets B_{25}, B_{50}, $B_{75;}$ and B_{100} respectively in which BWM and *Llh* mixture was used to replace 25, 50, 75 and 100 maize and wheat offal mixture in diet B_0. Crude protein digestibility (CPD) values of 78.65, 76.10, 75.39 and 73.02 obtained from sheep on diet B_{25}, B_{50}, B_{75} and B_{100}respectively were each significantly (P<0.05) lower than the value of 80,88 for the control group (B_0). The digestibility of dietary energy, crude fiber and its fractions were also observed to decrease with increasing amount of BWM in the diets. The general trend was a decline in digestibility of nutrients from B_0 (control) to diet B_{100} as the quantity of BWM/*Llh* mixture increased in the diets.

Table (3): Dry Matter intake and Nutrient Digestibility by Yankassa sheep fed experimental diets

Measurement	Dietary treatment					
	B0	**B25**	**B50**	**B75**	**B100**	**SEM**
Dry matter Intake (g/d)	647.23^{b}	673.73^{a}	664.63^{ab}	653.17^{a}	591.17^{c}	22.26
(g/kg)	3,44	3.27	3.31	3.39	3.36	0.12
Organic Matter (g/d)	532.67	590.41	559.05	539.19	484.50	2.81
(g/kg)	2.85^{a}	2.86^{a}	2.78^{a}	2.79^{a}	2.75^{a}	0.09
DM1 (g/d/$W^{0.75}$kg)	76.96^{a}	77.17^{a}	76.84^{a}	76.30^{a}	71.83^{a}	2.83
Organic matter	85.84^{a}	81.00^{b}	75.83^{c}	74.52^{c}	71.53^{d}	2.10
Dry matter	87.54^{a}	83.60^{b}	77.80^{c}	77.30^{c}	75.50^{d}	1.88
Crude protein	$80.8\ 8^{a}$	78.65^{b}	76.10^{c}	75.39^{d}	73.02^{d}	2.50
Crude fiber	85.09^{a}	80.05^{b}	73.54^{c}	73.00^{d}	70.09^{d}	2.50
Crude fat	73.61^{a}	$69,85^{b}$	65.47^{c}	66.65^{c}	73.65^{a}	1.77
Ash	73.99^{b}	79.28^{a}	78.99^{a}	73.80^{b}	71.10^{c}	1.54
Nitrogen free extract	78.56^{a}	76.57^{b}	70.54^{c}	68.12^{c}	69.25^{c}	1.69
Energy	84.28^{a}	82.13^{ab}	79.90^{b}	77.38^{b}	75.06^{c}	2.92
Neutral detergent fiber	80.58^{a}	79.47a	75.95^{b}	75.35^{b}	69.33^{c}	1.27
Acid detergent fiber	79.74^{a}	75.13^{b}	69.60^{c}	69.37^{c}	69.33^{c}	1.70

Mean followed by the same letter in a row are not significantly difference from each other at (p<0.05)

B_0 – Zero replacement value of BWM/Llh mixture
B_{25} – 25% replacement value of BWM/Llh mixture
B_{50} – 50% replacement value of BWM/Llh mixture
B_{75} – 75% replacement value of BWM/Llh mixture
B_{100} – 1005% replacement value of BWM/Llh mixture

Nitrogen utilization by growing Yankassa sheep fed diets in which maize and wheat offal were replaced with biscuit waste meal and *Leucaena leucocephala* leaf hay is presented in (Table 3).

Table (4): Nitrogen utilization by Yankassa sheep feed experimental diets

Item	Dietary treatment					
	B0	**B25**	**B50**	**B75**	**B100**	**SEM**
Nitrogen intake (g/d)	22.18^{a}	22.22^{a}	21.43^{b}	21.40^{b}	20.81^{c}	0.24
Fecal Nitrogen (g/d)	2.19^{c}	2.25^{c}	2.32^{c}	2.62^{b}	3.45^{a}	0.13
Urinary Nitrogen (g/d)	0.47^{a}	0.21^{c}	0.22^{c}	0.22^{c}	0.34^{b}	0.09
Total Nitrogen output (g/d)	2.66^{c}	2.46^{c}	2.54^{c}	2.84^{b}	3.79^{a}	0.28
Nitrogen balance (g/d)	19.52^{a}	19.76^{a}	18.89^{ab}	18.56^{b}	17.02^{c}	0.95
Nitrogen retention (%)	88.00^{a}	88.93^{a}	88.15^{a}	86.73^{b}	81.79^{c}	1.09

Mean followed by the same letter in a row are not significantly difference from each other at ($p<0.05$)
B_0 – Zero replacement value of BWM/Llh mixture
B_{25} – 25% replacement value of BWM/Llh mixture
B_{50} – 50% replacement value of BWM/Llh mixture
B_{75} – 75% replacement value of BWM/Llh mixture
B_{100} – 1005% replacement value of BWM/Llh mixture

From the table (4) it could be seen that nitrogen intake (g/d) was significantly higher ($P<0.05$) for B_{25} (22.22) compared with B_{50} (21.43), B_{75} (21.40) and B_{100} (20.18). The value is however not different ($P>0.05$) from the value obtained for B_0 (22.18). Fecal nitrogen (g/d) was significantly the highest ($P<0.05$) for B_0 (0.47) and the lowest ($P<0.05$) for B_{25} (0.21) among all groups. There were no differences ($P>0.05$) in the nitrogen balance (g/d) between B_{25} (19.76) and B_0 (19.52) and also between B_{50} (18.89) and B_{75} (18.56) with B_{100} recording the lowest ($P<0.05$) value of 17.02g/d. Nitrogen retention (%) was the highest ($P<0.05$) in B_{25} (88.93) and the lowest in B_{100} (81.79). However the value of nitrogen retention obtained for B_{25} was not different ($P<0.05$) from the value obtained for B50 (88.15) and B0 (88.00) respectively.

The mean dry matter intake was 3.35% of live weight obtained for sheep on diets B0 to B100 compared with 3.50% recommended by NRC (1985) reported by Devendra *et. al.*, (1982).

The decline in DM, OM, CP, CF, NDF, ADF, ADL, NFE and GE digestibilities in tested diets (B25, B50, B75 and B100) indicated that BWM and *Llh* mixture were less digestible than the maize and wheat offal mixture in those diets (Table 3). The reduction in dry matter digestibility (DMD) of the diets with decreasing level of dietary protein in the present study was in agreement with that reported of Mc Donald, *et. al.,* (1995). However, Adegbola, (2002) found out that the level of dietary protein did not affect only DMD. The reduction in the digestibility of protein with lower dietary protein levels had been reported by Nicholson, (1984). The relative decrease in digestion coefficient of fiber fraction of the diets with increasing levels of biscuit waste meal/*Leucaena leucocephala leave hay* indicated moderate digestion of the crude fiber content of the diets when compared with the control (B_0). Although the total crude fiber content of the diets increased with increasing BWM, the higher BWM inclusion might no doubt, could lead to a reduction of rumen microorganism which might be responsible for the breakdown of crude fiber (Adegbola, 2002). In contrast however, the presence of *Leucaena leucocephala* leave hay in the mixture might have enhanced the activities of rumen microbes. Thus the relatively lower CF digestibility values could indicate moderate fibre quality of BWM and *Llh.* mixture (Odeyinka and Ademosun, 1995 and Eniolorunda, *et. al.,* 2008). It was also noted that the coefficients of gross energy (GE) digestibility was similar to those of the dry matter. The similarity could be explained by the fact that the DM fractions of the diet excluding the ash, is predominantly a source of energy. In addition, the decrease in nutrient digestibility for diets B25, B50, B75 and B100 was due probably to the bulkiness of the diets as a result of high levels of BWM inclusion. Bulky diets tend to move more rapidly out of the rumen resulting in lower digestibility (Preston and Leng, 1987). Also it is known that rumen microorganisms have the ability to synthesize microbial protein from nitrogenous substances and carbon skeleton originating from the diet (Mc Donald, *et. al.,* (1995). The authors further noted that the microorganism could also, synthesise some vitamins especially B-complex vitamins. In the present study, situation was slightly different as the limitation of these nutrients in BWM and *Llh* mixture, as a result of high level of BWM inclusion, could have modified the degree of utilization of the diets containing the test mixtures.

Conclusions and Recommendations:

Despite the low digestibility values obtained from BWM/Llh mixture based diets, the test mixtures still showed a better promise as dry season feed stuff for fattening sheep based on its nutritive value. However when higher levels of maize/wheat offal mixture are replaced by BWM/Llh mixtures in practical diets, the digestibility of nutrients especially, dry matter, crude protein, crude fiber and energy could be significantly depressed. The depression ($P<0.05$) in nutrient digestibility on B_{100} therefore suggest that the levels of BWM/Llh inclusion in the diet should be less than 75%. Percentage nitrogen absorbed and the mean DM intake of 3.35% of live weight obtained for sheep on diets B_{25} to B_{100}.

References:

Adegbola, T.A. 2002. Nutrient intake, digestibility and rumen metabolites in Bull fed rice straw with or without supplement *Nigerian journal of Animal Production* 29(1) 40-45,

Ademola, S.G., T.B. Olayeni, and L.O. Ojedapo. 2003. Effect of antibiotic on the utilization of wild sunflower leaf meal fed to laying birds. Proc. 28'" Annual Conf. Nig. Soc. Anim. Prod. Pp 162-165

Adu, LF. 1985. Utilization of graded levels of brewer's dried grain by growing finishing sheep. *J. Anim. Prod. Res.* 5(1):59-66

Aduku, A.O. 1993. Tropical feed stuff analysis table. Department of Animal Sciences, Abu Samaru, Zaria

A.O.A.C. 2002. *Association of Official Analytical Chemistry.* Official methods of analysis 18''' edition Washington D.C USA

Devcndra, C. and G.G. Mc Lerog. 1982. *Goat and sheep production in the tropics,* Longman, New York.

Eniolorunda, O.O and G.A. Rowaiye. 2008. Effect of Sohabilization on corn husk and supplementation with cassava leaf or Leucaena leucocephala leaf meal based diet on feed intale and digestion in Yankassa Sheep. *Research Journal of Animal Production* 2(6): **1**64-**1**69

Longe, O.G. 1987. Replacement value of Biscuit waste for maize in broiler diets. *Nigerian Journal of Animal Product* **1**3.1:70-78

McDonald, P., R.A. Edward, J.F.D. Green Halgh and C.A Morgan. 1995. Animal *Nutrition, 5th edition* Addison Wesley L.T.D. Edinburgh, U.K. 135-157.

Nicholson, J.W.G. 1984. Digestion and Utilization of nutrients in oak browse by goats.*Journal Animal Science* 52 (2):283-290

NRC, 1985. *Nutrient Requirement of sheep.* National Academy of Sciences National Research Council, Washington, D.C., 2-53

Odeyinka, S.M. 2001. Effect of feeding varying levels of leucaena leucocephala and Gliricidia septum on the performance of West African Dwarf Goats. *Nigerian Journal of Animal Production* 28 (1) :601 -604

Odeyinka, S.M and A.A. Ademosun. 1995. The effect of season on the yield and nutritive value of *Gliricidia sepium* and *Leucaena leucocephala. Nigerian Journal of Animal Production* 20 (1): 96-101

Preston, T.R and R.A. Leng. 1987. Marching ruminant production system with available resources in the tropics and sub tropics. CTA Publication Armidale, 3-15.

SAS 2002. Statistical analysis system, Users Guide. Statistical Analysis Institute, Inc, Carry, North Carolina, USA.

Van Soest, P.J and J.B. Robertson. 1985. Analysis of forage and fibrous foods. A laboratory manual for Animal Science, Ithaca, N.Y. Cornels University, USA.