THE USE OF RUMEN WASTE AS PROTEIN SOURCE IN REPLACEMENT FOR PALM KERNEL MEAL AND ITS EFFECT ON FEED INTAKE, NUTRIENT DIGESTIBILITY AND RETENTION OF WEANED WEST AFRICAN DWARF GOATS.

Inweh D. A.
Department of Animal Production, Faculty of Agriculture, Dennis Osadebay University, Asaba, Delta State, Nigeria.
Email**: iwedan26@gmail.com**

ABSTRACT
Rumen wastes are abattoirs wastes, available in enormous amount in most slaughter houses in Nigeria. Owing to their nutritional value, utilizing them as a protein source in the diets of ruminants has become of interest. This study was carried out to investigate effect of replacing palm kernel meal with rumen waste on feed intake, digestibility and nitrogen retention of West African Dwarf (WAD) goats. Twenty five West African Dwarf goats were fed five diets containing Cattle Rumen Waste (CRW) and Goat Rumen Waste (GRW) at 0%, 20% and 40% inclusion levels, respectively, using a completely randomized design for a period of 12 weeks. At the end of the 10th week, a digestibility trial was conducted for a period of 14 days; daily feed intake and weekly weight changes were recorded. Urine samples were collected in plastic containers and acidified with few drops of 25% sulphuric acid. Aliquots and feed samples as well as urine samples were subjected to proximate analysis. Dry Matter Intake, Organic Matter Intake, Weight Gain as well as Dry Matter (DM) and Organic Matter (OM) digestibilities, were similar (P>0.05) for all the treatments. Except for goats on diet 5 (40% GRC), which had the least Dry Matter and Organic Matter digestibility. This is an indication that rumen waste can adequately replace PKM as a protein source in the diets of WAD goats, with an adequate and commensurate feed intake, digestibility and nitrogen retention.

KEYWORDS: nutrient intake, rumen waste, weight gain

INTRODUCTION
Most conventional protein concentrates are generally too expensive and unaffordable to many farmers; this has necessitated the use of cheaper protein sources or ingredients like Palm Kernel Meal (PKM). PKM is a byproduct of oil palm processing, containing a moderate amount of energy and protein. Alimon (2006) reported a crude protein of 16-18%. It use as protein source for ruminants is limited due to its high protein degradability in the rumen. RW are partially digested food materials (Adeniji and Balogun, 2001) rich in crude protein as asserted by Cherdthong (2019) who reported a protein content varying between 13.5 - 46.1%. While earlier findings by Okorogbona (1994) and Dairo *et al* (2005) was a crude protein of 13.19% and a range of value of 9 -20% respectively. RW has been used to replace groundnut cake in the diets of Rabbits up to 10% dietary levels without any deleterious effect (Dairo et al., 2005) as well as in the diets of broilers (Esonu et al., 2012).
This study was undertaken to ascertain the value of RW as a protein source in replacement for palm kernel meal and its effect on feed intake, digestibility and nitrogen retention of weaned West African dwarf goats.

MATERIALS AND METHODS
The study was carried out at Ruminant Unit of the University of Benin Farm Project in Benin City, Edo State, Nigeria; located on latitude 6^0 and 30^0 N and longitude 5^0 40' and 6^0 E in the rainforest zone; with an average temperature of 27.6^0C; annual rainfall of 2162mm and mean relative humidity of 72.5% (Orheruata *et al*., 2010).
RW of cattle and goats were collected into a clean plastic at abattoirs located in Benin City, Edo State. The wastes were sun-dried on concrete slabs for 4-5 days and milled in a 2mm hammer mill. Samples of the RW were kept for proximate analysis. The dried RW were used to replace PKM in four experimental diets at 20% and 40% for cattle rumen waste (CRW) and goat rumen waste (GRW) respectively, while control diet (diet 1) was without RW. All diets were made to be isocaloric and isonitrogenous.
Twenty post weaned WAD goats, 6 – 8 months old and with an average weight of 7.60 – 8.73kg were divided into five groups of four goats per diet. Goats were balanced for weight and randomly assigned to the five diets in a completely randomized design (CRD). Animals were fed twice daily at 0800hr and 1600hr for a period of

12 weeks. Feed intakes were recorded daily, while weights of animals were determined on weekly basis. On the 10th week, the goats were moved into metabolism cages for digestibility studies for a period of 14 days. The quantity of faeces and urine collected daily were recorded, with daily aliquots and feed samples were kept for proximate analysis. Also, urine collected in plastic containers was acidified with few drops of 25% sulphuric acid. Data obtained was subjected to analysis of variance (AOAC, 2000).

RESULTS AND DISCUSSION

Crude protein values of 10.14% and 6.13% respectively for cattle and goat rumen waste were obtained. The CP value obtained exceeded 7 - 8% (except CP of GRC) needed for normal rumen function to enhance feed intake in ruminants. But the CP values were lower than findings of Cherdthong (2019) and Okorogbona (1994) on crude protein obtained from rumen waste. This contrast may be due to the nutritive value of diets and the retention time between feeding and slaughter. There was no significant difference (P>0.05) between dry matter intake (DMI) values of 284.94 g/day (control) and 270.28g/day, 274.49g/day, 205.63g/day, 239.48g/day (for CRW and GRW respectively). Adeniji (2008) reported a similar trend in DMI values. This observation was also corroborated by findings of Whyte and Wadak (2002) which attributed the similarity in DMI to the isonitrogenous nature of the diets. There was no significant difference (P>0.05) between the weight gains on control diet (2.93kg) and diets with RW (2.93, 2.90, 2.90kg, 1.70kg). All the goats gained weight, indicating that intake of energy and protein of these diets were well above maintenance requirement. Thus, corroborating the report of Whyte and Wadak (2002) that rumen wastes incorporated into livestock feeding improved growth performance. Also, an increase in RW from 20% to 40% had no effect on DMI and organic matter intake (OMI), which are determinant of growth. Hence, live weight gain was similar among the diets.

Also, digestibility values were similar (P>0.05) between the control diets and diets on RW. However, the least DM (53.05%) and OM (58.58%) digestibility was observed for diet 5 (40% GRW). Anigbogu and Okocha (2003) stated that an OM digestibility of 58.58% observed in diet 5 (40% GRW) is still capable of supporting productivity in goats. The goats ate more feed since nutrient digestibility was negatively correlated to feed intake.

Table 1: Composition of diets

Ingredients	Control	20%CRW	40%CRW	20%GRW	40%GRW
Cattle rumen waste	-	20.00	40.00	-	-
Goat rumen waste	-	-	-	20.00	40.00
Palm kernel meal	48.00	40.00	20.00	40.00	20.00
Wheat Offals	5.04	19.04	17.39	19.04	17.39
Maize	22.73	7.50	5.00	7.50	5.00
Soyabean meal	2.00	2.00	2.00	2.00	2.00
G. nut cake	13.19	7.46	11.61	7.45	11.61
Bone meal	1.00	1.00	1.00	1.00	1.00
Lime stone	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50
Vit/Min Premix	1.50	1.50	1.50	1.50	1.50
Total	100.00	100.00	100.00	100.00	100.00
ME Kcal/kg	2452.64	2324.28	2471.85	2324.28	2471.85

CRW – Cattle Rumen Waste, GRW – Goat Rumen Waste

Table 3: Proximate Composition (g/100gDM) of Diets

Ingredients	Control	20%CRW	40%CRW	20%GRW	40%GRW
Dry matter	88.90	88.21	86.89	88.15	87.84
Organic matter	91.01	89.80	89.07	87.52	84.06
Crude Protein	17.99	18.92	18.41	17.96	16.48
Neutral Detergent Fibre	60.71	63.49	73.66	65.80	74.00
Acid Detergent Fibre	30.35	34.01	39.13	41.95	40.98
Acid Detergent Lignin	16.65	15.11	3.38	24.53	3.17
Ash	8.99	10.20	10.93	12.48	15.94
Cellulose	13.70	18.90	35.75	17.42	37.81
Hemicellulose	30.36	29.48	34.53	23.85	33.02

Table 4: Weight gain, Feed Intake and Digestibility

Variables	Control	20%CRC	40%CRC	20%GRC	40%GRC	SEM
Final LW (kg)	11.53	11.00	11.63	10.50	10.30	2.01
Initial LW (kg)	8.60	8.07	8.73	7.60	8.60	ND
Total No. of days)	82	82	82	82	82	ND
Total weight gain (kg)	2.93	2.93	2.90	2.90	1.70	0.83
Total feed intake (g)	3756.41	3617.28	2959.18	2929.29	3695.65	ND
FCE	0.78	0.81	0.98	0.99	0.46	0.31
Dry matter intake (g/day)	284.94	274.49	270.28	205.63	239.48	70.66
Organic matter intake (g/day)	259.33	246.50	240.74	179.94	201.31	62.65
Crude protein intake (g/day)	34.91	36.71	49.68	29.70	34.58	12.98
Dry matter digestibility (%)	72.53a	59.45a	71.62a	68.84a	53.05b	3.80
Organic matter digestibility (%)	74.65a	72.73a	74.81a	70.59a	58.58b	3.62

FCE-Feed Conversion Efficiency; SEM – Standard Error of Mean; abc – means along the same row with different letters are significantly different ($p<0.005$).

Nitrogen intake (g/d) was similar for the diets irrespective of the amount of RW in diets. Also, nitrogen loss in faeces and urine were similar for the diets, except diet 4 (40% GRW) which showed higher faecal nitrogen loss. Obviously this higher faecal loss is a consequence of lower digestibility of diet 4 due to lower protein content of diet. However, nitrogen retention showed no significant difference among the various diets, indicating that RW was effectively utilized as a protein source just as PKM.

Table 5: Nitrogen Retention Pattern

Variables	Diet 1	Diet 2	Diet 3	diet 4	Diet 5	SEM
Intake						
Nitrogen Intake (g/d)	12.95	12.86	11.01	12.85	11.00	4.58
Nitrogen Intake ($g/W_{kg}^{0.75}/d$)	2.17	2.20	1.85	2.25	1.86	0.51
Nitrogen Output						
Faecal (g/day)	2.61	1.67	1.62	3.69	1.76	1.00
Urinary (g/day)	0.86	0.17	0.86	0.47	0.88	0.29
Total	3.47	1.84	2.48	4.16	2.64	1.02
N-balance (g/day)	9.48	11.02	8.54	8.69	8.36	1.77
N-balance ($g/W_{kg}^{0.75}/d$)	1.62	1.88	1.43	1.52	1.43	0.13
% N-Retention	73.20	85.69	77.54	67.63	75.00	7.04

SEM – Standard Error of Mean

CONCLUSION

This study showed that rumen wastes can adequately replace palm kernel meal as a protein source in diets of WAD goats with a considerable and adequate feed intake, digestibility and nitrogen retention, culminating in weight gain comparable to goats on parm kernel meal. Diets 3 and 4 with 20% CRW and 40% GRW respectively, having higher feed conversion efficiencies are hereby recommended as adequate and more economical for farmers use.

REFERENCES

Adeniji A.A. and Balogun O.O. (2001). Evaluation of Blood Rumen Content mixture in the diets of starter chicks. Nigerian Journal of Animal Production: 28(2). Pp. 153-157.

Adeniji, A.A., (2008). The feeding value of Rumen Content-maggot meal mixture in the diets of early weaned piglets. AJAVA. 3:115-119.

Alimon, A. R. (2006). The Nutritive value of Palm Kernel Cake for animal feeds. Palm Oil Dev. 40:12-14. In: *Asian Journal of Animal and Veterinary Advances*. Vol. 8:527-534 (2013).

Anigbobu, N.M and Okocha. (2003). Feed value and digestibility of three sources of poultry litter and untreated sawdust in sheep nutrition. *Proceedings of the 28th Annual Conference of the Nigeria Society for Animal Production Institute of Agricultural Research and Training. (16-20th May).* OAU, Ibadan, Edited by: Taiwo. A.A., Raji A.M. Ogbonna J.U. and E.A. Adebowale. Pp. 283-286.

AOAC. 2000.Association of Official Analytical Chemists. Official Method of Analysis, 15th edition, 22 Wilson Boulevard, Arlington Virginia USA

Cherdthong A (2019). The potential of rumen digesta as ruminant diet. A review. Tropical Animal Health and production, Available at: https://doi.org/10.1007/s11250-019-02018-6

Dairo F.A.S., Ama O. O and Asafa A. R (2005). Performance evaluation of growing rabbits fed rations containing rumen content. *Proceedings of 7th Annual Conference of Animal Science Association of Nigeria*. September 16-19th., University of Agriculture, Abeokuta, Nigeria. Editors: Fanimo A. O and Olanite J. A. Pp. 131

Duncan B. (1955). Multiple ranges and multiple F test. Biometrics. 11: 1-41

Esonu, B.O., Azubuike, J.C., Udedibie, A.B.I., Emenalom, O.O., Iwuji, T.C., Odoemenam, V., (2011). Evaluation of the nutritive value of mixture of fermented bovine blood and rumen digesta for broiler finisher. *J. Nat. Sci.*1 (4): 1–8. FAOSTAT. 2012. FAO Stat

Okorogbona A. O (1994). Changes in the microbial population and proximate composition of decomposed blood rumen content mixture and abomasum content. B. Agric, project, University of Ilorin. In: The feeding value of Rumen content – maggot meal mixture in the diets of early weaned piglets. (Adeniji A. A.). *Asian Journal of Animal and Veterinary Advances* 3:115-119.

Orheruata A. M., Nwokoro S. O., Oyekpan and Ojo A. E. (2010). Modeling the growth of rabbits raised in humid climate for improving breeding. *African Journal of Agricultural Research.* Vol. 5 (22): 3126-3129.

Statistical Analysis Software (2000). Guide for personal computers. Statistical Analysis Software Institute Inc., Cary, NC, USA.

Van Soest P. J., Robertson J. B and Lewis B. A. (1991). Methods for dietary fibre, neutral detergent fibre and non starch polysachandes in relation to animal nutrition. *Journal of Dairy science* 74:3583-3593.

Whyte E.P. and I. Wadak. (2002). Evaluation of rumen content on the growth performance of weaner rabbits. Proceedings of the 7th Annual Conference of Nigeria. Sept. 16-19 University of Agriculture, Abeokuta, Nigeria. 143-144.