EFFECT OF DIETS MIXED WITH SOYABEAN OIL AND PALM KERNEL OIL ON RUMEN FERMENTATION GASES AND MICRO-FLORA OF WEST AFRICAN DWARF SHEEP

Jinadu, K. B., Adekanbi, A. O., Akingbade, A. O., Olona, J. F., Olaniyi, T. A. and Abdulsalam. S
Federal College of Animal Health and Production Technology, Ibadan Nigeria
Corresponding author: kabir.jinadu@fcahptib.edu.ng

ABSTRACT

The efficacy of palm kernel oil and soya bean oil was assessed in modulating rumen fermentation of West African Dwarf Sheep (WAD).Sixteen (16) West African Dwarf Sheep weighing 12.50±0.5kg were randomly allotted into four dietary treatments in a completely randomized design. The experiment lasted for 16weeks. Mixtures of palm kernel oil (PKO) and soya bean oil (SBO) were incorporated into the diets of sheep at 0:0g/day, 10:5g/day, 7.5:7.5g/day and 5:10g/day as treatments 1, 2, 3 and 4 respectively. The results showed that the rumen fluid pH ranged from 5.60- 6.50 which was not significantly influenced by the dietary treatments. The rumen fluid temperature ranged from (36.25-37.00ºC, propionic acids (6.05-6.84) and Valeric acids (6.08-7.56) which were significantly ($P<0.05$) influenced by addition of palm kernel oil (PKO) and soya bean oil (SBO) to the diets of sheep. The protozoan count recorded in this trial decreased from T1 to T4. Treatment 4 recorded the least amount of protozoan count of 1.34×10^6 cfu/ml which was significantly affected by plant oils included into diets of sheep. The fungi count (4.05-8.13 × 106 cfu/ml was significantly different across the treatments. It was therefore concluded from this study that the diets mixed with palm kernel oil (PKO) and soya bean oil (SBO) at 5:10g/day improved the total volatile fatty acids (Acetic, Propionate and Butyrate) which can be subsequently used as energy, with reduced protozoan population

Key words: palm oil, rumen, sheep, soya oil, liquor

INTRODUCTION

The rumen is principally a fermentation space in which microbial attack helps digest the diet. The partly fermented food and the micro-organisms pass through the omasum, into the abomasum and then into the small intestine. The products of microbial fermentation, mainly volatile fatty acids (VFA) and microbial protein, are available for absorption in the small intestine while the gases (carbon dioxide and methane) are eructated (Bayat and Shingfield 2012). The emission of methane from the rumen can represent a loss of up to 15% of the digestible energy, depending on the type of diet and enteric methane contributes approximately 30-40% of the total methane produced as greenhouse gas from agricultural sources (Jurgens, 2002). Organic acids and oils have attracted attention for their potential as alternatives to feed antibiotics and growth promoters in livestock (Wallace, 2004).Dietary manipulations using these alternative feed additives have been found to also result in methane reduction by decreasing fermentation of organic matter in the rumen by shifting the site of digestion from the rumen to the intestines, diverting hydrogen away from methane production during ruminal fermentation, inhibiting methanogenesis by ruminal bacteria or by optimizing the rumen fermentation and thereby decreasing methane emission per unit of organic matter digested (Benchaar *et al.,* 2001).

MATERIALS AND METHODS

The experiment was carried out at Small ruminant unit of Agricultural Research and Training, (IAR&T), southern farm, moor plantation, Ibadan in south west part of Nigeria. The area lies within the rain forest ecological zone and fall within longitude and latitude 7º, 27ºN and 3º, 25ºE respectively.
A total number of sixteen (16) WAD sheep were used for t. These plant oils were incorporated into the diets of sheep at varying levels of 0:0g/day, 10:5g/day, 7.5:7.5g/day, 5:10g/day as treatments 1,2,3.and 4 respectively as indicated in Table 1. The rumen fluid was collected by the use of a suction tube. The rumen fluid collected was filtered through the layers of cheese cloth. The sample was divided into three parts; first portion was used for ammonia nitrogen analysis with 5ml of H_2SO_4 added to 50ml of rumen fluid. The mixture was centrifuged at 60,000 for 15 minute and the supernatant yellow fluid was pipetted and stored at 20ºC for analysis using Kjeldah method and volatile fatty acid concentration by using HPLC(Slavica, 2010). The data were analyzed using statistical analysis software (SAS 2004)

Table 1: Gross (%) compositions of the experimental diet

Feed ingredient (%)	T_1(g/day) PKO : SBO 0 : 0	T_2(g/day) PKO : SBO 10 : 5	T_3 (g/day) PKO : SBO 7.5 : 7.5	T_4 (g/day) PKO : SBO 5: 10
Dried Cassava Peel	37.00	37.00	37.00	37.00
Groundnut Haulms	20.00	20.00	20.00	20.00
Cowpea Haulms	10.00	10.00	10.00	10.00
Soybean Husk	10.00	10.00	10.00	10.00
Corn Bran	12.00	12.00	12.00	12.00
Palm kernel cake	10.00	10.00	10.00	10.00
Premix	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis (%)				
Crude Protein (%)	12.90	12.90	12.90	12.90
Crude Fibre (%)	17.50	17.50	17.50	17.50
Metabolizable Energy (MJ/Kg)	12.05	12.45	12.45	12.46

PKO- Palm kernel Oil, SBO- Soybean Oil

RESULT AND DISCUSSION

The result revealed that ruminal fluid pH and rumen liquor temperature were significantly affected by the inclusion of SBO and PKO in the diets as shown in table 2. Church, 1993 indicated that rumen liquor P^H is an important factor that measures the alkalinity and acidity of rumen contents. Thus, The rumen P^H values observed in this study lies within the range of values (6.00 and 7.20) for maximum microbial growth reported by (Demba e*t al.*, 2001). The rumen liquor temperature (^{0}C) observed were significantly differences in heat evolution from microbial fermentation as reported by (Hall *et al.*, 2001). Ammonia nitrogen (NH_3-N) concentration observed in this study has a good profile within the range values (2 and 5mg|dL) as a minimum rumen fluid to maximize rumen microbial protein synthesis (Ososanya *et al*., 2014). The ammonia nitrogen concentration reported in this study does not exceed the concentration that leads to urea toxicity in ruminants. The most suitable rumen ammonia-nitrogen levels for microorganism activities were 5 to 20mg|100mi in ruminant fed low quality roughages (Wanapat and Pimpa, 1999)

Table 2: Rumen fermentation parameters of West African dwarf Sheep fed diets mixed with palm kernel oil and soybean oil

	Inclusion levels of Palm kernel oil and Soybean oil (g/day)				
Parameters	**0:0**	**10:5**	**7.5:7.5**	**5:10**	SEM±
P^H	6.20	6.05	5.60	6.50	0.18
NH_3-N (mg/dL)	0.78^a	0.55^b	0.88^a	0.44^b	0.05
Temperature (^{o}c)	36.25^b	36.40^{ab}	36.90^a	37.00^a	0.12
Acetic Acid (g/dL)	6.06	6.27	6.25	6.80	0.17

Butyric Acid (g/dL)	6.59	6.14	6.88	6.48	0.14
Propanic Acid (g/dL)	6.05^{b}	6.84^{a}	6.26^{ab}	6.20^{b}	0.14
Valeric Acid (g/dl)	6.77ab	6.08^{b}	7.56^{a}	6.28^{b}	0.20
TOTAL VFA (g/dL)	18.70	19.25	19.39	19.48	0.15

^{a,b,c} means along the same row with different superscripts are significantly different ($p<0.05$)

Table 3 shows the rumen microbial population of West African Dwarf Sheep fed diets mixed with palm kernel oil and soybean oil. Micro-organism yield in the rumen is an index or a function of the amount of microbial proteins made available to the ruminants daily Jyotti *et al.*, (2009).Marked significant difference was observed in rumen protozoa for rams on diet 1(7.55×106cfu/ml).The significant increase in the protozoa count from 1.34×10^{6} in the diet 4 to 7.55×10^{6}cfu/ml in the diet 1 agreed with the findings of Eryavus and Dehority,(2004) who investigated the effects of Yucca schidigera extract on the P^{H} and the concentration of protozoa ,bacteria and fungi in the sheep rumen contents at a level of 30g/head/day. The significant decrease in the rumen count recorded in this study was in line with the findings of Sliwinski *et al.*, (2002) who investigated rumen fermentation and Nitrogen balance of lambs fed diet containing plant extract rich in tannins and saponin at level of 1 and 2kg/dry matter (DM)

Table 3: Rumen microbial populations of West African dwarf Sheep fed diet mixed with palm kernel oil and soybean oil

	Inclusion levels of Palm kernel oil and Soybean oil (g/day)				
Parameters	0:0	10:5	7.5:7.5	5:10	SEM±
Coliform count ($x10^{6}$ cfu/ml)	7.00	7.70	6.65	7.38	0.43
Bacillus count ($x10^{6}$ cfu/ml)	8.65	8.15	8.25	9.00	0.54
Lactobacillus count ($x10^{6}$ cfu/ml)	2.00	3.00	3.12	3.50	0.20
Fungi count ($x10^{6}$ cfu/ml)	6.63^{ab}	5.10^{ab}	8.13^{a}	4.05^{b}	0.68
Protozoan count ($x10^{6}$ cfu/ml)	7.55^{a}	3.50^{b}	3.30^{b}	1.34^{c}	0.97

^{a,b,c} means along the same row with different superscripts are significantly different ($p<0.05$)

CONCLUSION AND RECOMMENDATION: It was concluded that PKO and SBO can be mixed at 5:10g/day to improve the total volatile fatty acids which can be subsequently used as energy sources

REFERENCES

Bayat, A .and Shingfield, K. J. (2012): Overview of nutritional strategies to lower enteric methane emission in ruminants. Maataloustieteen paivat. Pp201-240

Benchaar, C., Pormar, C. and Chiquette, J. (2001): Evaluation of dietary strategies to reduce methane emission from ruminants. Modelling Approach . *Canadian Journal of Animal Science.* 81: 563-574.

Church, D.C (1993). The ruminant Animal digestive physiology and Nutrition. Waveland press New jersey. Illinois, U.S.A. pp. 130-145.

Demba, C. and. Liang, G.B. (2001): effect of six feed supplement on ruminal degradation charateristics and amino acid profile of sheep. *International Journal on Animal and Veterinary Advance* 3(5):367-373.

Eryavus, A. and Dehority, B. A. (2004): Effects of *Yucca Schidigera* extracts on the concentration of rumen micro-organisms in sheep. *Animal Feed Science and Technol*ogy.117:215-222.

Hall J.B. and Silver, S. (2001): Nutrition and feeding of cow – calf herd; Digestive system of the cow. Virgina Cooperative Extension pp. 1-2

Jyotti, M., Nem, S. and Vihan, V. S. (2009):Patho-haematobiochemical observations of induced *prosposisjulifora* feeding in goats. 7th International Conference goats in France. Pp. 301-303.

Ososanya, T.O., Adewumi, M. K and Jinadu, K. B. (2014): Impact of pineapple waste silage on intake, digestibility and fermentation patterns of WAD Sheep. African *Journal of Biotechnology.* 13(25): 2575-2581.

SAS (2004): statistical Analysis software. Guide for personal cpmputer. Release 8.1. SAS Institute Inc. Cary, NC.U.S.A. Version. 4th Edition VOL. 1 and 2.

Slavica A. (2010). Fatty acid composition of various system products. *Journal of the institute of food Technology in Novisad*. 37(2) : 65-70. Retrieved 21 June 2013.

Sliwinski, B.J., Kreuzer, M., Wettstein, H.R. and Andrea Machmuller. (2002): Rummen fermentation and Nitrogen balance of lambs fed diets containing plant extract rich in Tannis and Saponins, and Associated Emissions of Nitrogen and methane. *Arch. Anim. Nutr*. 56:379-392.

Wallace, R. J. (2004): Anti-microbial properties of plant secondary metabolites. *Pakistan Nutrition Society.* 63: 621-629.

Wanapat, M., Mapato, C., Pilajun, R. and Toburan, W. (2011). Effects of vegetable oil supplementation on feed intake, rumen fermentation, growth performance, and carcass characteristic of growing swamp buffaloes. *Livestock Science*. 135: 32–37.