JAP&T
TPA-Timişoara

Available online at http://journal-of-agroalimentary.ro

Journal of Agroalimentary Processes and Technologies 2015, 21(2), 156-161

Journal of Agroalimentary Processes and Technologies

Growth performance, carcass characteristics and hematological parameters of West African Dwarf lambs fed cassava bran plus fish processing waste

Sikiru A.B.[1], Yousuf M.B.[1], Ademola S.G.[2]

[1]*Department of Animal Production, University of Ilorin, Nigeria*
[2]*Department of Animal Nutrition and Biotechnology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.*

Received: 26 May 2015; Accepted: 17 June 2015

Abstract

The experiment investigated effects of cassava bran and fish processing waste on performance, hematological parameters and carcass traits of growing West African dwarf lambs. There was significant increase in weight of the lambs fed 1.5% and 2.5% body weight equivalent quantity of concentrated diet produced from cassava bran and fish processing waste (P<0.05) right from week five of the experiment and continue to increase till the end of the experiment. The control animals (animals on ad-libitum dried cassava peel) showed decrease in weight and the loss in weights were critical at week four of the experiment but later improved although still lower than the weight at the beginning of the experiment. The animals fed 1.5% and 2.5% body weight equivalent quantity of the formulated diet showed high packed cells volume (PCV) and was significant although the control group also has good packed cells volume but below initial level. The highest packed cell volume (PCV) was 40.25%, Lymphocytes was 53.00% for the animals fed formulated diet. There was significant different in cold carcass weight between the treatments but there were no significant differences in the carcass yield percentages. The experiment suggested that cassava bran and fish processing waste are good feed resources for growing waste African dwarf lambs and there is need to investigate quality of meat from lambs fed these feed resources.

Keywords: Growth performance, hematological parameters, fish, processing, waste

1. Introduction

Ruminant animals (cattle, sheep and goat) stand important positions in production of foods for human consumption; because, apart from production of meat and milk for immediate human consumption; they convert poor feed resources and agro-industrial bye-products into high quality protein for human consumption. In countries of sub-Sahara Africa, small ruminants are life banks for women especially in the rural areas who seldom sell goats and sheep any time they are in need of cash for immediate household uses.

The exponential growth in human population and rapid development witnessed across the world are part of factors affecting supply of meat needed for human consumption. It was also postulated that more people will have capacity to consume more meat in the nearest future which can all result into huge increase in demand for meat across the world. By this period per capita meat consumption of people living in developing countries has been predicted to

Corresponding author: *e-mail:* akeembaba01@gmail.com

increase from 14.9kg between 1997 to date to 28.5kg by year 2020. This projection has been identified to increase the total demand for meat to increase from 209million tons in 1997 to 327million annually by year 2020. In preparation for the livestock revolution, there is need for development of small ruminant animal production qualitatively and quantitatively.

In contribution to world animal production, sheep plays crucial role, it was reported that about 1000 million sheep are currently being produce in the world supplying about 14 million tonnes of meat which if compare with other sources of animal products is low; because (FAO, 2008) reported meat supply from pig and cattle to be 100 and 65 million respectively. Major players in the production and supply of sheep meat in the world include New-Zealand and Australia, however; countries such as Nigeria and other developing countries have unexploited potential for production and supply of sheep to feed the world.

Meat is an important product derived from sheep production; it is important part of human diet because it supplies vital nutrients such as vitamins, proteins and minerals required by bodily systems. Although sheep meat consumption in the world is still small compare with other meats because just about 6% of world meat supply comes from sheep despite sheep meat being an important part of meat consumption in North Africa, Middle East, India and some part of Europe. Apart from meat, other products derived from sheep production include milk, skin and wool used in the clothing industry as well as in the furniture making; carpet making and others.

This research focused on dietary manipulations of the sheep nutrition through intensive feeding of growing lamb with the concentrate diet produced from cassava bran and fish waste in order to produce high quality meat from sheep and increase the share of sheep meat in world meat supply. The focus of this research was chosen because it was discovered that poor nutritional management is among factors limiting the production performance of sheep across developing countries such as Nigeria; the choice of cassava bran and fish processing waste was also an effort to provide alternative uses for these agro-industrial by-products in animal production.

2. Materials and Methods

Research Location: The research was carried out at the small ruminant unit of the teaching and research farms of university of Ilorin, Nigeria. Ilorin is located within the southern guinea savannah agro-ecological zone of Nigeria; the project location has moderate rainfall and temperature ranges; the location experience rainy season between April and October yearly and sometime extend to November.

Experimental Animals and management:Twelve (12) growing West African Dwarf (WAD) lambs were used for this study; the animals were sourced from open markets within Ilorin metropolis, before the commencement of feeding the experimental diet; the animals were quarantine and acclimatized for two weeks. During the acclimatization period the animals were dewormed with ivermectin at dosage dictated by their body weight, antibiotics treatment (Oxytetracycline L.A.), treatment against intestinal worms using albendazole bolus and other prophylactic treatments as well as boosted with multivitamins to make them suitable for the research.

Experimental diets: The animals were divided into three treatment groups of four(4) animals per treatment in a completely randomized design fed prepared concentrated diet on proportion based on their weekly body weight twice daily at 08:00hrs (GMT) and 15:00hrs (GMT) while feeding on dried cassava peel *ad-libitum*; water was also provided for the animals *ad-libitum*. The experimental diets formulated with cassava bran and fish processing waste is as presented below:

Table 1. Ingredients composition of the experimental diets fed to the animals

Ingredients	Quantity (%)
Cassava bran	60
Fish Processing Waste	40
Nutrients composition	
Dry Matter (%)	89.68
Crude Protein (%)	25.968
Crude Fibre (%)	13.84
Ash (%)	3.848
Energy (Kcal/Kg)	4872.208

Table 2. Feeding arrangement for the experimental animals

Feeds	T1	T2	T3
Dried Cassava Peel	*Ad-libitum*	*Ad-libitum*	*Ad-libitum*
Concentrate (% body weight)	0	1.5	2.5

3. Results

All animals were weighed at the beginning of the experiment and weekly throughout the experiment.

Blood samples were collected from the animals at the beginning of the experiment and were analyzed for Packed Cell Volume (PCV), White Blood Cell (WBC), Red Blood Cell (RBC), Heamoglobin (Hb), Neutrophil (Neu) and Lymphocytes (Lym).

At the end of the experiment before slaughtering, blood samples were also collected from the experimental animals for haematological studies as presented below in Table 5.

Nine of the experimental animals were slaughtered for carcass traits evaluation whereby parameters including hot carcass weight (HCW), cold carcass weight (CCW) (24hours after refrigeration), weight before slaughtering (WBS) were measured as presented below in Table 6.

Table 3. Weekly weights of WAD lambs fed cassava bran plus fish processing waste

Weeks	T1	T2	T3	SEM
1	8.75^{a}	10.75^{b}	12.00^{b}	0.5144
2	8.75^{a}	10.75^{b}	12.00^{b}	0.5144
3	8.37^{a}	10.75^{b}	12.00^{b}	0.5404
4	7.87^{a}	10.75^{b}	12.00^{b}	0.5953
5	8.12^{a}	11.00^{b}	12.75^{c}	0.6184
6	8.12^{a}	11.00^{b}	13.25^{c}	0.6684
7	8.00^{a}	12.00^{b}	14.00^{c}	0.7716
8	8.12^{a}	12.50^{b}	14.50^{c}	0.8294

Means with different superscripts (a, b, c) are significant ($P<0.05$)

Table 4. Initial haematological parameters of WAD lambs fed cassava bran plus fish processing waste

Parameters	T1	T2	T3	SEM
Packed Cells Volume (%)	36.97	35.97	34.70	0.6676
White Blood Cells ($\times10^3/\mu L$)	6.60	6.07	6.90	0.2222
Red Blood Cells ($\times10^6/\mu L$)	6.12	6.15	6.00	0.1235
Heamoglobin (g/dL)	11.57	11.72	12.15	0.3005
Neutrophil (%)	18.00^{a}	29.25^{b}	37.25^{c}	2.6512
Lymphocytes (%)	30.75^{a}	44.25^{b}	50.0^{b}	2.8326

Means with different superscripts (a, b, c) are significant ($P<0.05$)

Table 5. Final haematological parameters of WAD lambs fed cassava bran and fish processing waste

Parameters	T1	T2	T3	SEM
Packed Cells Volume (%)	31.00^{a}	37.00^{ab}	40.25^{b}	1.5606
White Blood Cells ($\times10^3/\mu L$)	6.12^{a}	6.75^{ab}	7.00^{b}	0.1642
Red Blood Cells ($\times10^6/\mu L$)	5.32	6.12	6.50	0.2542
Heamoglobin (g/dL)	10.50^{a}	12.25^{ab}	13.5^{b}	0.5289
Neutrophil (%)	18.50^{a}	33.75^{b}	41.00^{b}	3.0780
Lymphocytes (%)	30.75^{a}	48.75^{b}	53.00^{b}	3.2109

Means with different superscripts (a, b, c) are significant ($P<0.05$)

Table 6. Carcass traits of WAD lambs fed cassava bran plus fish processing waste

Parameters	T1	T2	T3	SEM
Weight Before Slaughtering (Kg)	8.16^{a}	12.00^{b}	14.66^{c}	0.9633
Weight After Slaughtering (Kg)	7.50^{a}	10.73^{b}	13.53^{c}	0.8966
Hot Carcass Weight (Kg)	7.10^{a}	10.22^{b}	12.45^{c}	0.7766
Cold Carcass Weight (Kg)	6.65^{a}	9.42^{b}	11.60^{c}	0.7166
Carcass Yield (%)	85.20	85.22	86.93	1.1266

Means with different superscripts (a, b, c) are significant ($P<0.05$)

Table 7. Non-carcass parameters of WAD lambs fed cassava bran and fish processing waste

Parameters	T1	T2	T3	SEM
Lungs (g)	184.81^{a}	200.86^{b}	201.62^{b}	3.40
Kidney (g)	29.05^{a}	37.42^{b}	48.13^{c}	2.86
Heart (g)	48.70^{a}	67.87^{b}	68.50^{b}	3.69
Liver (g)	184.51^{a}	234.31^{b}	349.21^{c}	25.14
Rumen pH	6.26	6.53	6.56	0.06
Muscle pH	6.43	6.70	6.73	0.09

Means with different superscripts (a, b, c) are significant ($P<0.05$)

4. Discussion

Reduction in the weight of experimental animals in the control group can be linked to poor feed consumption by the animals because it was observed during the course of the experiment that the animals refused feeding on the dried cassava peel as a sole diet; this is an indication that dried cassava peel which is widely fed to small ruminants in the study area may not be a good sole-feed resources for growing lambs under confined management; although our work could not explain the reasons for the poor consumption, but sole cassava peel definitely is not nutritionally sufficient to meet the nutritional requirement of the growing lambs therefore this may be one of the reasons for the reduced weight of the animals in the control group.

Our observations about the use of cassava peel by the animals in the control group was similar to observations made by Salami & Odunsi, (2003) [13] whereby dried cassava peel was used to replace maize in the diet of laying birds; the observation was poor consumption and subsequently reduction in weights of the birds. Although in the same study by these workers, it was discovered that treated cassava peel gave better response by the animals, the treatments includes ensiling, soaking in water and retting; these showed that the manipulation through soaking and others actually reduce the effect of cyanide in the peel. But, apart from the presence of cyanide in the dried cassava peel, poor nutritional quality of the cassava peel can be implicated for the poor performance of the animals because the rumen fermentation of the cassava peel by the animals is sufficient enough to remove the negative impact of the cyanide present in the dried cassava peel therefore if it will be incorporate into feeding of animals such as growing lamb; it can be processed to improve its nutritional quality.

The increase in weight of animals in the treatment two (2) and three (3) can be linked to the good nutritional composition of the experimental diets. It also suggest that poor feed resources such as cassava bran is a good animal feed resources when used with rich protein sources such as fish processing waste. The increase in weight agreed with findings of Adegbola *et al*, (1986) [2] who suggested that lambs can be reared on supplement prepared from cassava by-product and dried poultry manure. Nutritional composition of the cassava bran offered adequate source of energy for the animals while the blending with the fish processing waste complemented its usefulness. This also agreed with suggestion that are cassava and its by-products are energy rich feed resources which when well-fortified with nitrogen, minerals, vitamins, and roughage, promoted positive and high performance levels in dairy and beef cattle, sheep, and goats. The significant different in the weights of the animals in treatment two (2) and three (3) suggested that increasing quantity of the concentrated diet prepared in the experiment can lead to increasing weight gain in growing lambs.

Complete blood count of the experimental animals showed that the packed cells volume (PCV) in treatment two (2) and treatment three (3) was higher than that of treatment one (1) animals; the level of the packed cells volume was between 31.00% and 40.25%. The lowest packed cells volume was found in the control group which is lower than the packed cells volume of the same group before the feeding of dried cassava peel to the group. For the animals fed with the concentrated diet produced from cassava bran and fish processing waste; the initial packed cells volume was 35.97% and 34.70 respectively while the final packed cells volume are 37.00% and 40.25% respectively. These packed cells volume fall within the normal range for healthy sheep Njidda *et al*, (2014) [11] and a sign that the experimental diet promote animals' healthy conditions. Almost all hematological parameters of animals in the treatments two (2) and three (3) were higher in the final blood analysis compare with the initial blood analysis. This is an implication that feeding of the experimental diet to the animals is safe and enhances animal health and production performance. Generally, the results of the hematological parameter gave clear observations that feeding of cassava bran and fish processing waste is normal for growing lambs.

The results from statistical analysis of the carcass traits showed that the treatments are good for growing lambs given a significant level of difference in cold carcass weight ($P<0.05$) in animals fed the compounded diet. Although the percentage of carcass yield was not different in all groups but was highest in the treatment three (3); this mean the higher quantity of the feed given to the animals may be responsible for the higher yield. The carcass traits improvements in the treatments two (2) and three (3) can be linked with the high energy composition of the cassava bran and presence of rumen undegradable proteins in the fish processing waste which agreed with findings of Beerman *et al*, (1986) [4].

5. Conclusion

Our study established that cassava bran and fish processing waste are alternative feed resources for growing lambs since it has no negative impact on the health of the animals and it promote growth and performance of the animals. We also agreed with the position that feeding dried cassava peel alone to growing lambs is not sufficient for the animals nutritional requirements; hence lambs on dried cassava peel should be put on supplemental feeding of other high nutrient feeds. As a result, we recommend further studies into the quality of meat and milk from sheep fed diet from cassava bran and fish processing waste; also investigation of possibilities of incorporating these two agro-industrial by-products into production of silage for growing lambs.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

References

1. Abdul Waheed Adeyemi Bello, Daniel Nma Tsado, Haematological and Biochemical Profile of Growing Yankasa Rams Fed Sorghum Stover Supplemented with Graded Levels of Dried Poultry Droppings Based Diets. *Pakistan Journal of Biological Sciences*, **2013**, *16*, 1922-1928.
2. Adegbola A.A., Smith O.B., Okeudo N.J., Responses of West African Dwarf sheep fed cassava peel and poultry manure based diets, **1986**
3. Alborés, S., Pianzzola, M. J., Soubes, M., & Cerdeiras, M. P., Biodegradation of agroindustrial wastes by Pleurotus spp for its use as ruminant feed. *Electronic Journal of Biotechnology*, **2006**, *9*(3), 0–0.
4. Beerman D.H., Hogue D.E., Fishell V.K., Dairymple R.H. and Ricks C.A., Effect of cimaterol and fishmeal on performance, carcass characteristics and skeletal muscle growth in lambs. *J. Anim. Sci*., **1986**, *62*, 370-380.
5. Dong, N. T. K., *Evaluation of agro-industrial by-products as protein sources for duck production in the Mekong delta of Vietnam*. Doctoral thesis, Swedish University of Agricultural Sciences, **2005**
6. Hutagalung, R. I., The use of tree crops and their by-products for intensive animal production. *BSAP Occasional Publication*, **1981**, *4*, 151–188.

7. Islam, M. S., Khan, S., & Tanaka, M., Waste loading in shrimp and fish processing effluents: potential source of hazards to the coastal and nearshore environments, *Marine Pollution Bulletin*, **2004**, *49*(1), 103–110.
8. Jayathilakan, K., Sultana, K., Radhakrishna, K., & Bawa, A. S., Utilization of byproducts and waste materials from meat, poultry and fish processing industries: a review. *Journal of Food Science and Technology*, **2012**, *49*(3), 278–293.
9. Morris S.T. 2009. Economics of sheep production. *Small Ruminant Res*. *86*, 59 - 62.
10. Mussatto, S. I., Dragone, G., Roberto, I. C., Brewers' spent grain: generation, characteristics and potential applications. *Journal of Cereal Science*, **2006**, *43*(1), 1–14.
11. Njidda A.A., Shuai'bu, Isidahomen C.E., Haematological and serum indices of sheep in semi-arid environment of Northern Nigeria. Global Journal of Science Frontier Research. Global Journals Inc. (USA)., **2014**, ISSN: 2249-4626.
12. Perez, R., Fish silage for feeding livestock. *World Animal* Review, **1995**, *82*, 34–42.
13. Salami, R. I., Odunsi, A. A., Evaluation of processed cassava peel meals as substitutes for maize in the diets of layers. *International Journal of Poultry Science*, **2003**, *2*(2), 112–116.
14. Zygoyiannis, D., 2006. Sheep production in the world and in Greece, *Small Ruminant Res.*, **2006**, *62*, 143–147.