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Replacement Value of Avocado Seeds with Orange Peels Meal for Guinea Grass on Growth Performance and Nutrient Digestibility of Growing Sheep

***M. I. Okoruwa, E. T. E. Ehebha, E. Omoragbon**

Department of Animal Science, Ambrose Alli University, P.M.B. 14, Ekpoma, Edo State, Nigeria

ABSTRACT

Twenty-four growing West African Dwarf male sheep (rams) balanced for weight 8.00 ± 0.12kg were fed avocado seeds with orange peels meal as replacement for guinea grass to evaluate their growth rate and nutrient digestibility. Sheep were assigned to three treatment diets in a completely randomised design with eight sheep per treatment. The compared treatment diets were as follows: Diet A (consisted of 60% guinea grass, which serves as the control group), while diets B and C comprised combination of avocado seeds with orange peels meal in a ratio 25 : 35 and 20 : 40 respectively. Concentrate supplement of 40% was added to each of the treatment diet. The results showed that diet A was significantly ($P < 0.05$) best in total feed intake (8.01kg), feed conversion ratio (3.87) and digestibility of ash (40.00%) compared to other treatment diets. Final Bodyweight (13.40kg), total body weight gain (5.32kg), and digestibility of dry matter (70.13%), crude protein (68.11%) with crude fibre (70.01%) were significantly ($P < 0.05$) highest in diet B compared to diets A and C. Digestibility of ether extract (50.03%) was highest in diet C and significantly ($P < 0.05$) different from the other treatment diets. Significant difference ($P > 0.05$) did not occur in initial body weight and average daily weight gain (kg) with average daily feed intake (kg) among the treatment diets. It is concluded that combination of avocado seeds with orange peels in a ratio of 25: 35 (diet B) has the potential to improve growth rate and nutrient digestibility of growing sheep.

Keywords: Avocado seeds, orange peels, growth, digestibility, sheep.

INTRODUCTION

Livestock production represent approximately ten percent of agricultural activity and less than five percent of the gross domestic product in Nigeria (Yousuf and Adeloye, 2010). This production rate of livestock needs to be increased due to the high geometric progression of present human population and quest for animal protein consumption by humans in Nigeria. However, sheep production is increasing and becoming one of the major sources of animal protein production in Nigeria. They also contribute a good percentage of the total wool production in the country as reported by Odeyinka and Okunade (2005). Energy and protein feed sources are of prime importance for sheep as they stimulate microorganisms in the rumen and enhance the productive functions of the animals. However, the persistent shortage of forages and conventional feedstuffs for sheep are caused largely by seasonal fluctuation of farm produces to meet the needs of both human and their domestic animals. Thus, the scarcity of feed sources that often impose a major challenge in small ruminant production, has forced sheep nutritionists to intensify research into the feeding values of potentially useful cheaper and readily available unconventional feed sources.

Avocado (*Persea Americana*) seeds and orange (*Citrus sinensis*) peels are some of these unconventional feed sources that are potentially useful and alleviate the problem of feed shortage in sheep production. They also have diverse application as feeding of avocado seeds meal to livestock produce ethno-medicine that treat diarrhoea, intestinal parasites and skin diseased (Alhassan *et al.*, 2012). In addition, citrus peels meal can drastically reduce the prevalence of pathogenic bacteria in their gastro intestinal tracts and help to reduce the livestock industry's dependence on potentially dangerous anti-biotics (Funa *et al*., 2010). However, despite their potential as feed for sheep, the

Address for correspondence:

odionokos@yahoo.com; okosmich@gmail.com

presence of anti-nutritional factors like phenolic that was found to be greater than 70% in avocado seeds (Alhassan *et al.*, 2012) and d –limonene in orange peels can reduce their intake growth and utilization if not detoxified. Notwithstanding, very little published information is known about avocado seeds and orange peels meal digestibility and utilization. This is important because the true value of any feedstuff depend on the amount of nutrients that can be utilised upon ingestion by the animal for growth performance.

Hence, the objective of the study was to assess the replacement value of avocado seeds with orange peels meal for guinea grass on growth performance and nutrient digestibility of growing sheep.

MATERIALS AND METHODS

Study Area: The study was carried out at the Sheep and Goat Unit of the Teaching and Research Farm, Ambrose Alli University, Ekpoma, Nigeria. Ekpoma is on longitude 6.09^0E and latitude 6.42^0N. The area is characterised by long rainfall pattern that begins in April and ends in October, while the short period of dry season last from October to March. The average annual rainfall and temperature of the area are about 1556mm and 31^0C respectively.

Preparation of Experimental Diets: Orange peels were collected fresh in convergence of local processors located within Ekpoma before they were chopped into small sizes of about 4cm and sun dried. Avocado seeds were obtained from a plantation vicinity and market areas within Ekpoma. The fresh seeds were carefully examined, selected, sliced into approximately 3cm cubes and sun dried. The dried orange peels and avocado seeds were then milled and stored in airtight containers separately. Guinea grass that was harvested from the Teaching and Research Farm was manually chopped into smaller sizes of about 4cm. the composition of the concentrate were as follows: 78% wheat offal, 20% brewery dried grain, 0.78% oyster shell, 0.5% bone meal, 0.5% salt and 0.25% vitamin premix respectively. The experimental diets constituted guinea grass and avocado seeds with orange peels. The concentrate was used as supplement to the experimental diets. The treatment diets were offered at the rate of 5% (dry matter basis) of the animals' body weight. The experimental diets and concentrate supplement were given in the ratio 60: 40 respectively. Diet A which served as the control group constituted 60% solely, guinea grass, while diets B and C comprised combination of avocado seeds with orange peels in a ratio of 25: 35 and 20: 40 respectively. Concentrate supplement of 40% was added to each of the experimental diet.

Experimental Animals and Design: Twenty four growing West African Dwarf male sheep (rams), aged between 8 and 9months with mean body weight of 8.00 ± 0.12kg were used for the study. The rams were source from Ekpoma and nearby villages. They were balanced for weight and randomly assigned to the three dietary treatments in a completely randomised design. Each treatment group was replicated with eight animals.

Experimental Management and Feeding: The experimental house and pens were cleaned and disinfected before the arrival of the rams. On arrival, the West African Dwarf (WAD) rams were given prophylactic treatments against ecto and endo parasites and allowed a period of 21days for acclimatization.

They were later individually housed in demarcated pens. The pens were adequately ventilated; cleaned daily and wood shavings were changed fortnightly. The experimental diets were fed rams once daily at about 8:00am in the morning with concentrate supplement first followed by the experimental diets. Drinking water and mineral salt lick were provided *ad libitum* throughout the experimental period. The experiment lasted for 84days excluding the 21days of adaptation period.

Growth Study: The quantity of experimental diets offered to animals and leftovers were weighed daily every morning prior to feeding to determine daily feed intake.

Subsequently, live body weight measurement were carried out prior to feeding by using handling scale on weekly basis to determine body weight gain. Data derived from the daily feed intake and daily body weight gains were computed and feed conversion ratio was calculated as the ratio of feed intake over body weight again.

Digestibility Study: Six growing rams randomly selected from each treatment group were used for the digestibility trials at the end of growth study. Growing rams (totalling 18) were then housed in individual metabolic cages with slated floors adapted for faecal collection. Growing rams were fed

with their weighed treatment diets for the last 7 – day after 7 – day adjustment period of metabolic cages.

The quantity of feeds offered which represented the fraction of the quantity of the feed offered to each ram per day and the leftover which represented the one that was not consumed were weighed daily. The weight difference between them were recorded and taken as the feed intake. Daily faecal sub – samples were weighed, dried bulked together and stored in airtight containers and frozen until they were required for analysis.

Thus, the apparent nutrient digestibility of the diets were calculated as the difference between nutrient intakes and excreted in faeces expressed as a percentage of nutrient intakes

Chemical and Statistical Analyses: Samples of the experimental diets, concentrate supplement and faecal outputs were analysed for proximate composition using the procedures of AOAC (2002).

Date obtained on growth and digestibility studies were subjected to analysis of variance (ANOVA) to determine the significant of treatment effects following the methods described by SAS (2001). While significant difference between means were separated using the Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

The proximate composition of the guinea grass, avocado seeds with orange peels and concentrate supplement diet are presented in Table 1. Dry matter (DM) content of the experimental feedstuffs and concentrate supplement ranged values (70.82 to 86.02%) were high, indicating less moisture content and good stored ability for a longer period of time without spoilage. The crude protein value for guinea grass 7.00%,avocado seeds 5.00%,and orange peel 7.49% were below the 10% crude protein level recommended by Bengaly *et al*. (2007) for minimum growth in ruminant animals. Hence, concentrate supplement (20.01% of crude protein) was added to the feedstuffs to provide adequate nitrogen for rumen microbes to maximally digest the components of dietary fibre leading to the production of volatile fatty acids (Okoruwa and Igene, 2014a). Crude fibre and ash were highest in guinea grass (38.00 and 10.00%) and lowest in avocado seeds (4.20 and 2.70%), respectively. This suggests that the total crude fibre and mineral contents present in guinea grass were higher compared to other feeds used in the study. Ether extract values that ranged between 0.90 to 5.60% were low in guinea grass, avocado seeds and concentrate supplement with exception of orange peels. This explains the better quantity of fats and oil in orange peels compared to other feeds used in the study. Nitrogen free extract values (44.11% to 57.92%) were highest in concentrate supplement and lowest in guinea grass, reflecting the proportion of energy content in the feeds used in this study.

Table1. *Proximate composition (% DM) of the experimental feedstuffs and concentrate supplement*

Parameters	GG	AS	OP	Concentrate Supplement
Dry Matter	78.44	70.82	74.30	86.02
Crude Protein	7.00	5.00	7.49	20.01
Crude Fibre	38.00	4.20	25.01	13.00
Ash	10.00	2.70	6.72	7.98
Ether Extract	0.90	2.00	5.60	1.09
Nitrogen Free Extract	44.11	56.92	55.18	57.92

GG = Guinea Grass, AS = Avocado Seed, OP = Orange Peels

The growth performance of sheep fed avocado seeds with orange peels meal as replacement for guinea grass is shown in Table 2. Initial body weight sheep that ranged between 8.08 and 8.15kg was not significantly ($P < 0.05$) different among treatment diets, indicating that all the sheep were similar in weight at the commencement of this study.

Table2. *Growth performance of growing sheep fed avocado seeds with orange peels meal as replacement for guinea grass.*

Parameters	Diets			
	A	B	C	SEM±
Initial body weight (kg)	8.15	8.08	8.14	0.05
Final body weight (kg)	10.22^{c}	13.40^{a}	11.75^{b}	0.07
Total body weight (kg)	2.07^{c}	5.32^{a}	3.61^{b}	0.08
Average daily weight gain (kg)	0.03	0.06	0.04	0.01
Total feed intake (kg)	8.01^{a}	6.98^{c}	7.39^{b}	0.12
Average daily feed intake (kg)	0.10	0.08	0.09	0.02
Feed conversion ratio	3.87^{a}	1.31^{c}	2.05^{b}	0.09

[a,b,c] means within the same row with different superscripts differ significantly (P < 0.05).

SEM = Standard Error of Means

Table3. *Apparent nutrient digestibility (% DM) of growing sheep fed experimental diets*

Parameters	Diets			
	A	B	C	SEM±
Dry matter	60.44[c]	70.13[a]	68.32[b]	1.06
Crude protein	59.98[c]	68.11[a]	64.90[b]	0.98
Crude fibre	61.92[c]	70.01[a]	66.96[b]	0.82
Ether extract	39.68[c]	46.23[b]	50.03[a]	0.07
Ash	40.00[a]	32.14[c]	36.99[b]	0.52

[a,b,c] means within the same row with different superscripts differ significantly (P < 0.05).

SEM = Standard Error of Means

Final body weight for growing sheep was significantly (P < 0.05) different across the treatment diets, with lowest values being recorded in diet A (10.22kg) followed by diet C (11.75kg) and then B(13.40kg) that recorded the highest value. The low value obtained in diet A could be a good indication of the diet that was not well utilized due to the fibre combination of the treatment diet which then interfered with final body weight. Similarly, total body weight gain was significantly (P < 0.05) highest in diet B (5.32kg), followed by diet C (3.61kg) before diet A (2.07kg). However, the average daily weight gain that ranged between 0.03 and 0.06kg followed a similar pattern of variation as observed in total body weight gain; though no significant (P > 0.05) difference was observed among the treatment diets. The observed highest final body weight and total body weight gain values for sheep on diet B could be as a result of the ability of the sheep to properly utilise the nutrient in the treatment diet for their body weight when compared with either treatment diet A or B. This is in agreement with the report of Shalu *et al*., (2004) that an efficient utilization of nutrients in a diet that supply adequate energy and protein is required for optimum growth performance in ruminants.

Furthermore, Ososanya (2010) reported that feed intake is an important factor in the utilization of feed by livestock and is also a critical determinant of energy and protein as well as performance in small ruminant. However, the different mechanisms involved in determining feed intake such as particles size, chewing frequency with indigestible fraction allow the understanding of differences observed in intake of feed in this study. The total feed intake values that range from 6.98 to 8.01kg appeared to decline significantly (P < 0.05) with highest level of avocado seeds inclusion in the diet B. Though the average daily feed intake that ranged between 0.08 and 0.10kg was not significant (P < 0.05), it follows the same trend as observed in total feed intake. However, the highest total feed intake value obtained in diet A might be as a result of palatability of the diet, nature of diet preparation and the nutrient content of the diet which make the sheep to consume more to meet up with their energy and protein requirement. It is well established that feed intake does not directly proportional to the rate of growth in animal performance, even when the nutrient intake requirement of the animal are met (Migwi *et al.*, 2006). Feed conversion ratio (FCR) that is measured by feed intake per unit weight gain was significantly (P < 0.05) highest in sheep on diet A (3.87) and lowest in those on diet B (1.31). This implies that, the efficiency at which sheep converted feeds for their body weight gain in diet B is lowest, indicating a better feed conversion ratio of the feed. Moreover, the positive response between average daily weight gain and better feed conversion ratio obtained in diet B could be probably used to further attest the superiority of sheep on diet B in terms of nutrient utilization for body weight gain over others.

Presented in Table 3, is the apparent nutrient digestibility (% DM) of growing sheep fed experimental diets. Nutrient digestibility in animals is the classical and direct method for estimating feed digestion by ruminants; hence studies on digestibility of ruminant feeds are very important as they allow for the estimation of nutrients actually available for ruminant nutrition (Okoruwa *et al.*, 2012). Significant difference (P<0.05) was observed in dry matter digestibility, with diet B (70.13%) being the highest and diet A (60.44%) the lowest. This difference could probably explains nutrient accumulation rate in the diets. Sheep on diet B (68.11%) were significantly (P < 0.05) best for crude protein digestibility compared to diet C (64.90%) and diet A (60.02%) respectively. The high percentage of avocado seeds inclusion in the diet B might have allowed the fermentable products for rumen micro-organism which resulted in synthesis of microbial protein and hence the amount of protein digestibility available to the

sheep. This corroborates the earlier observation of Sayed (2009) who reported that an increase in the dietary protein intake level may cause changes in the process of rumen fermentation and allow more protein digestibility with increase in the body weight gain of animals. Crude fibre digestibility that ranged between 61.92 and 70.01% was significantly ($P < 0.05$) highest in sheep on diet B and lowest in those on diet A. The lowest value recorded in diet A could be attributed to its relatively high lignin content of the guinea grass and the fibre combination of the diet that was not well utilized by the animals. Wampana *et al.* (2008) have reported that the extent at which fibre degraded in the rumen of ruminants depend on the lignin content of the crude fibre in a diet. Ether extract digestibility values of 39.68, 46.23 and 50.03% were obtained for diets A, B and C respectively. The trend of the values appeared to increase with increased in inclusion levels of orange peels in the diets, suggesting positive effects of high level of orange peels which might probably increased other extract digestibility in the diet. Ash content was optimally digested in sheep on diet A (40.00%) compared to diets B (32.14%) and C (36.99%). This observed difference in ash digestibility could probably be a true reflection of the mineral component of the diets. Since nutrient digestibility, among other factors would depend on the proximate composition of a diet (Okoruwa *et al.*, 2014b).

Notwithstanding, the better performance of sheep on diet B in terms of nutrient digestibility further ascribed the best average daily weight gain observed in sheep on diet B (Table 2). Thus, the study on nutrient digestibility is said to be important as it allow the estimation of nutrient really available for ruminant performance (Okoruwa and Adewumi, 2010)

CONCLUSION

Results obtained in this study, showed that avocado seeds with orange peels meal could be used as feeds to replace guinea grass for growing sheep in ruminants nutrition, most especially during the off-season.

However, based on the outcome of this study, it can be concluded that sheep on diet B promoted the best growth rate and nutrient digestibility of the experimental diet without any adverse effect on the sheep.

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