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Effect of Graded Level of Sesame Waste Meal on Growth Performance, Nutrient Digestibility and Volatile Fatty Acids on Yankasa Rams

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ABSTRACT

This study was carried out to evaluate the effect of graded level of sesame waste meal on growth performance, nutrient digestibility and volatile fatty acids of Yankasa rams. A total of twenty (20) Yankasa rams were randomly allotted into four dietary treatment groups consists of 0, 5, 10 and 15% graded level of sesame waste meal in a completely randomized design (CRD) with five replicate and each replicate consist of one ram. Data were collected and analysed using analysis of variance (ANOVA) of Genstat statistical software 2012 version in which treatment means were separated using Duncan Multiple Range Test (DMRT). The growth performance result revealed that there were significant (P>0.05) differences in final weight, average daily gain, total feed intake, average daily feed intake and feed conversion ratio while no significant (P<0.05) changes were recorded in initial weight and weight gain. The rams fed graded levels of sesame waste meal showed significant (P>0.05) changes in crude protein and neutral detergent fibre nutrient digestibility. There were significant (P>0.05) differences in nitrogen balances of Yankasa rams fed graded level of sesame waste meal and rumen ecology with the exception (P<0.05) of rumen fluid pH and temperature. It could be concluded that rams fed 5% of graded level of sesame waste meal (T2) had outstanding growth performance compared to control and other groups. It was observed that sesame waste meal greatly influenced nutrient digestibility and nitrogen balances in this study. Rams fed 5% sesame waste meal had favourable rumen ecosystem while 15% had the best total volatile fatty acids. It is therefore, recommended that sesame waste meal can be incorporated into rams diet up to 15% for growth performance, nutrient digestibility, nitrogen balance and rumen ecology.

Key Words: Sesame, Waste, Yankasa rams and graded level

Introduction

The insufficient supply of animal source of protein from the principal livestock species (cattle, sheep, goats, pigs and poultry) has made it of the utmost importance that attention needed to shift to other micro-livestock. Global poverty and food insecurity, particularly in rural population, remain critical issues despite on-going efforts to address these inequities (FAO, 2009). The shortage of animal protein in the developing countries in the tropics has been long recognized and has remain one of the major limiting factors to the attainment of food security in Nigeria. The minimum protein requirement is estimated at about 75g/person/day out of which 40g should come from animal protein. The problem lingers due to the fact that 85% of the country`s meat supply comes from the cattle whose banditry, cattle rustling, climatic condition and nomadic system of production does not encourage rapid production of meat (Ajala, *et al.,* 2008).

Usage of other alternative feed source is fast gaining popularity in Nigeria and many other developing in Nigeria and many other developing countries. One of such feed is sesame seed which is rich in protein, carbohydrate fibre and some minerals and has amino acid profile with good nutritional value similar to soyabean (Omar *et al.,* 2002).

There has been much interest over the past decade regarding the manipulation and enhancing the performance of small ruminant animal, through the use of alternative feed ingredient. This is because the nutritive value of sesame seed can also be comparable with that of groundnut cake if the anti-nutritional factors are reduced or eliminated by heat treatment. Sesame (*Sesamum indicum L.*), also known as benniseed, belongs to the family *Pedaliaceae,* and is reputed to be one of the most ancient oil seeds crop known since historic times and plays an important role in human nutrition. The high nutritional content of sesame seed cake meal makes it a potential sources of livestock feed as it contain relatively good source of crude protein (Omar *et al.,* 2002).

Materials and Methods

The study was conducted at the Teaching and Research Farm of Federal University Dutsin-Ma, Katsina State, Nigeria. The farm is situated within latitude 12°27'18' North and 7°29'29' East and 605 meters above sea level with an annual average rainfall of 700mm and situated in the Northern Sudan Savannah zone (Gaddafi *et al.,* 2019).

Twenty (20) Yankasa rams were of approximately 16kg purchased and used for the study. The Rams were divided into four treatment groups of 0, 5, 10, and 15% of sesame waste meal with five (5) rams each per treatment in a completely randomized design (CRD). Prior to the commencement of the trail animals were allowed to acclimatized to the environment were prophylactic treatment were given to the animals.

The experimental animals were fed ad libitum in the morning and evening for 90 days other husbandry management was strictly adhered to. Thoroughly mixed representative samples of the experimental diets and sesame was analyzed for proximate composition and fiber fractions like acid detergent fibre (ADF), neutral detergent fibre, ADL, hemicellulose, cellulose and lignin.

The animals were weighed prior to the commencement of the experiment and at bi-weekly between 8 and 9hrs after an overnight fasting throughout the study period. Daily record of feed intake was taken and recorded. Rumen fluid was collected with the aid of section tube monthly, and was taken to the laboratory for analysis and determination of Ammonia nitrogen and volatile fatty acids (acetate, butyrate and propionate). Digestibility trial was conducted to determine the utilization of the feed by the animals. This was involve the use of metabolic cages, feacal samples were collected for seven days using harness bag after fourteen days adaptation period. The urine was collected using urinary funnel piped into the bottle containing 2 ml 10% hydrogen tetra-oxosulphate VI to prevent the escape of ammonia. Representative samples of the faeces and urine was preserved and taken to laboratory for analysis.

Result and Discussion

Proximate composition of experimental diet

The proximate composition of the experimental diets were presented in table 1 below. The result revealed that diets in T3 (10%) had the highest dry matter content and Neutral detergent fibre (NDF), highest organic content (88.96), and crude protein (CP) (13.68%) were found in diet T4. Higher ash content and acid detergent fibre were found in T2 while lignin were higher in T1. The proximate composition obtained in this study were within the dietary requirement of Yankasa rams reported by Amodu *et al.,* (2008); Abdu *et al.,* (2012).

Table 1: Proximate composition of the experimental diet

Parameters	T1	T2	T3	T4
Dry matter	94.86	94.62	94.87	94.83
Organic matter	87.21	86.96	88.64	88.96
Crude protein	13.31	13.48	13.50	13.68
Ash	5.62	6.11	5.88	5.96
NDF	67.86	68.09	68.92	68.71
ADF	32.30	33.51	32.81	32.96
Lignin	12.78	12.60	11.86	11.26

NDF = Neutral detergent fibre, and ADF = Acid detergent fibre

Effect of Graded Level of Sesame Waste Meal on Yankasa Rams Growth Performance

The result on the effect of graded level of sesame waste meal on Yankasa rams growth performance were presented in table 2. The result revealed that there were no significant ($P<0.05$) differences in initial weight. This clearly shown that the weight of animals were appropriately balanced before the commencement of the experiment and this will help to improve weight homogeneity of the experimental animals thereby reducing experimental error and biasness. Significantly ($P>0.05$) higher final weight were recorded in T2 (28.100kg) followed by T3, T4 and T1. Rams in T2 had significantly ($P>0.05$) higher average daily gain (ADG), total feed intake and average daily feed intake compared to other groups. The result further revealed that there were no significant ($P<0.05$) differences in weight gain of Yankasa rams fed graded levels of sesame waste meal although there were considerable numerical variations in which rams in T2 had the highest weight gain values (4.865kg). while lowest weight gain value were recorded in T1 (3.345kg) the result showed that there were significant ($P>0.05$) differences in total feed intake, average daily feed intake (ADFI) and Feed conversion ratio where rams in T2 had the highest Total feed intake and ADFI values followed by T1, T4 and T3.

Table 2: Effect of Graded Levels of Sesame Waste Meal on Growth Performance of Yankasa Rams

Parameters	T1	T2	T3	T4	SEM	LOS
Initial weight (kg)	23.255^{a}	23.235^{a}	23.600^{a}	23.370^{a}	0.048	NS
Final weight (kg)	26.600^{b}	28.100^{a}	27.750^{b}	27.450^{a}	1.995	*
ADG (g/day)	55.20^{c}	81.45^{a}	67.45^{d}	66.86^{b}	0.004	*

Weight gain (kg)	3.345[a]	4.865[a]	4.15[a]	4.08[a]	2.014	NS
Total feed intake (kg)	47.77[b]	50.59[a]	41.41[d]	47.47[c]	0.009	*
ADFI (g/day)	0.796[b]	0.843[a]	0.690[d]	0.791[c]	0.001	*
FCR	14.28[b]	10.39[d]	9.97[a]	11.63[c]	0.007	*

ADG = Average daily gain, ADFI = Average daily feed intake, FCR = Feed conversion ratio, SEM = Standard error mean and LOS = Level of significance.

Effect of Graded Level of Sesame Waste Meal on Yankasa Rams Nutrient digestibility

Table 3 shows nutrient digestibility of Yankasa rams fed graded levels of sesame waste meal. The result revealed that there were no significant (P<0.05) differences in dry matter (DM) organic matter (OM) crude fibre (CF), acid detergent fibre (ADF) and lignin. The result were however, showed significant (P>0.05) differences of crude protein and neutral detergent fibre of Yankasa rams fed graded levels of sesame waste meal in this study. The nutrient digestibility of Yankasa rams fed graded levels of sesame waste meal are in agreement with the nutrient digestibility values of Awassi lambs fed sesame oil cake reported by Omar (2002).

Table 3: Effect of Graded Level of Sesame Waste Meal on Yankasa Rams Nutrient digestibility

Parameters	T1	T2	T3	T4	SEM	LOS
DM	53.81	60.75	64.36	63.86	5.01	NS
OM	54.51	61.10	62.87	63.77	4.23	NS
CP	42.60[b]	42.61[b]	48.26[a]	49.36[a]	0.847	*
CF	39.87	41.00	41.30	41.19	1.544	NS
ADF	63.49	66.16	70.62	69.90	3.30	NS
NDF	63.62[b]	66.41[ab]	65.73[ab]	68.60[a]	5.01	*
LIG	58.78	61.09	62.16	62.33	1.348	NS

DM= Dry matter, OM= Organic matter, CP = Crude protein, CF = Crude protein, ADF = Acid detergent fiber, NDF = Neutral detergent fiber, LIG = Lignin, SEM = Standard error means and LOS = Level of significance

Effect of Graded Level of Sesame Waste Meal on Nitrogen balance of Yankasa Rams

The result on the effect of graded levels of sesame waste meal in Yankasa rams nitrogen balances were presented in table 4 below. The result clearly indicated there were significant (P>0.05) linear increases with increases graded levels of sesame waste meal in nitrogen intake, urine nitrogen, and nitrogen retained. Significantly (P>0.05) irregular trend of increases were obtained in faecal nitrogen and total nitrogen output. Higher faecal nitrogen were recorded in T4 (4.40g/day) followed by T2 (4.30g/day), T1 (4.19g/day) while T3 had the lowest faecal nitrogen concentration (3.83g/day) in this study. Similarly T4 had the highest total nitrogen output (8.29g/day) followed by T2, T3 and T1. Nitrogen intake was positive for rams across all the treatments. This indicates that all the nitrogen absorbed was well tolerated and utilized effectively, however, the lower level of nitrogen retained on diets containing no sesame waste meal may be due to the presence of protein sources in the diet which will be hydrolysed into ammonia more rapidly than the ammonia could be fixed into microbial protein. This could account for the greater urinary N loss.

Table 4: Effect of Graded Level of Sesame Waste Meal on Nitrogen balance of Yankasa Rams

Parameters (g/day)	T1	T2	T3	T4	SEM	LOS
Nitrogen intake	13.62[c]	13.63[c]	16.12[b]	16.78[a]	0.030	*
Fecal nitrogen	4.19[c]	4.30[b]	3.95[c]	4.40[a]	0.014	*
Urine nitrogen	3.55[d]	3.65[c]	3.83[b]	3.88[a]	0.016	*
Nitrogen retained	5.87[c]	5.69[d]	8.32[b]	8.49[a]	0.017	*
Total nitrogen output	7.75[c]	7.97[b]	7.78[c]	8.29[a]	0.019	*

Effect of Graded Level of Sesame Waste Meal on Yankasa Rams Rumen ecology

The result on the effect of graded levels of sesame waste meal on Yankasa rams rumen fluid characteristics were presented in table 5. The result clearly showed that there were no significant ($P<0.05$) differences in rumen pH and rumen fluid temperature (°C) while Ammonia nitrogen (NH_3-N) and total volatile fatty acids (TVFA) were found significantly ($P>0.05$) affected by Yankasa rams fed graded levels of sesame meal waste. pH is very essential in providing conducive and enabling environment for rumen microbes to work efficiently. Van soest (1994) states that pH range for optimal microbial activity as 6.2 - 7.2 which were in accordance with the value range in this study. The values recorded in this study fell within the range of 6.00 - 7.20 suitable for the growth and activities of microbes reported by Jallow and Hsia (2011).The Total Volatile Fatty Acids (VFA) recorded in this study is correspond with the VFA reported by Jokthan, *et al*., (2013), and Ngele (2008) . The increase in TVFA recorded in the present study may be attributed to the increase in cellulose digestion due to addition of sesame waste meal that contain dietary fibre which was reported to increase satiety, promote the intestinal peristalsis and digestion and prevent cardiovascular diseases and digestive system diseases. It also involves in the building block for protein, fat and vitamins synthesis necessary to allow for the increase in weight gain and feed efficiency (Habeeb, 2017).

Table 5: Effect of Graded Level of Sesame Waste Meal on Yankasa Rams Rumen ecology

Parameters	T1	T2	T3	T4	SEM	LOS
pH	6.25	6.49	6.14	6.19	0.41	NS
Temperature (°C)	30.70	30.95	31.34	30.70	0.36	NS
NH_3-N	21.85^a	20.41^c	21.30^b	20.73^c	0.129	*
TVFA (mmol/L)	46.66^c	50.69^b	51.57^b	59.02^a	0.657	*

NH_3-N = Ammonia nitrogen, TVFA = Total volatile fatty acids

Conclusion

It could be concluded that rams fed 5% of graded level of sesame waste meal (T2) had outstanding growth performance compared to control and other groups. It was observed that sesame waste meal greatly influenced nutrient digestibility and nitrogen balances in this study. Rams fed 5% sesame waste meal had favourable rumen ecosystem while 15% had the best total volatile fatty acids. It is therefore, recommended that sesame waste meal can be incorporated into rams diet up to 15% for growth performance, nutrient digestibility, nitrogen balance and rumen ecology.

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