

Research Article



Growth Performance and *In vivo* Nutrients Digestibility of Growing Yankasa Ram Lambs Fed Diets Containing Graded Levels of Sesame Residue

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Abstract | The study was carried out to evaluate the effect of including sesame residue (SR) in the diets of Yankasa ram lambs on feed intake, body weight gain, and nutrients digestibility. Twelve Yankasa ram lambs (initial body weight of 20.08 ± 3.08 kg) were allotted to three dietary treatments containing 0, 20 and 30% SR (A, B and C) respectively. A completely randomized design was used for the study which lasted twelve weeks. The results revealed that animals fed 30% inclusion level had higher dry matter, nitrogen free extract and ether extract intakes, which varied among the treatments. Organic matter, neutral detergent fiber and acid detergent fiber digestibilities were higher for the lambs fed 0% SR. Inclusion of sesame residue up to 30% in the diet of growing Yankasa lambs improved nutrients intake without adverse effects on growth performance. It is thus recommended that sesame residue could be incorporated in the diets of growing Yankasa lambs at 30% inclusion level for reduced feed cost in Sudan Savanna agro-ecological zone of Nigeria.

Keywords | Sesame residue, Growth performance, Nutrients digestibility, Proximate composition, Lamb

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INTRODUCTION

Over the past century, researchers have explored ways of reducing feed cost by enhancing the nutritional value of low-quality forages with the aim of reducing the high cost of livestock production in terms of feeding (Sarnklong et al., 2010). Scarcity of forage resources during the dry season in the semi-arid environment of Nigeria poses a big challenge to small ruminant fattening program in the region. Most ruminant farmers, majority of whom are small-holder, rely solely on low-quality forages and crop residues in feeding their animals (Babayemi et al., 2009).

Forages are in less supply during the dry season and are characterized by low nutritive value. Most of the crop residues often used by the livestock farmers have limitations in their use. Other than being poor in nutritive value, presence of high cellulose, hemi-cellulose and lignin contents,

and low protein content and digestibility have been reported (Mulugeta and Genrehiwot, 2013). Fattening performances of small ruminant animals depend largely on the quality of feed offered to them. The usual farmer practices of feeding low quality feed materials lengthens the fattening period of animals, thereby consequently influencing the income of the farmers negatively (Bonos et al., 2017).

In Nigeria, after harvest of sesame, residues are not efficiently utilized by small-holder farmers as livestock feed probably due to lack of knowledge about its potentials. Also, they are heaped in large quantities with little or no monetary value placed on them. Therefore, incorporating them in the diets of the animals will cause no significant additional cost on the production cost to farmers. In addition, its utilization as livestock feed will go a long way in reducing environmental pollution due to improper disposal (Jonathan et al., 2008).

The study was therefore conceived with the aim of evaluating the effects of including graded levels of sesame residue in the diets of growing Yankasa lambs on feed intake, body weight gain and nutrients digestibility.

MATERIALS AND METHODS

ANIMAL CARE

The experimental procedure was certified by the Bayero University, Kano, Animal Research Ethics Committee and was carried out in line with standard procedures. The study was conducted at the Livestock Teaching and Research Farm of the Centre for Dryland Agriculture, Bayero University, Kano (GPS Coordinates: N11°86.155', E8°98.955').

EXPERIMENTAL DIETS AND DESIGN

Diets offered to the animals contained 0%, 20%, and 30% inclusion levels of sesame residue and were designated as A, B and C, respectively (Table 1). A Completely Randomized Design (CRD) was used for the study where twelve lambs served as experimental units with each lamb serving as a replicate for the three dietary treatments.

Table 1: Gross composition (%) of experimental diets containing graded levels of sesame residue fed to growing Yankasa lambs.

Feed Ingredients	Experimental diets*		
	A (0%)	B (20%)	C (30%)
Sesame residue	0	20	30
Groundnut hay	20	20	20
Wheat offal	30	15	10
Cowpea husk	14	14	14
Cotton seed cake	20	10	5
Rice mill waste	15	20	20
Common Salt	0.5	0.5	0.5
Limestone	0.5	0.5	0.5
Total	100	100	100
Calculated CP (%)	15.45	15.46	15.56
Calculated Energy (kcal/kg)	2560	2680	2750

* A = 0% sesame residue (control), B = 20% sesame residue, C = 30% sesame residue

ANIMAL MANAGEMENT

Twelve growing Yankasa ram lambs with initial body weight (BW) of 20.08 ± 3.08 kg were used in the experiment. They were treated against internal parasites using a broad spectrum anthelmintic (Albendazole) at 1ml per 50kg body weight. The lambs were ear-tagged and assigned to the three dietary treatments. The formulated experimental diets were offered to the experimental animals between

the hours of 7:00 am - 8:00 am daily throughout the period of the study (12 weeks) at the rate of 5% of their body weights. Drinking water was also provided *ad libitum*. In the week prior to the commencement of the experiment, the lambs were offered only groundnut hay as feed for adaptation.

MEASUREMENTS AND SAMPLE COLLECTION

The daily feed intake was monitored and measured as quantity of feed offered minus quantity of left-over feed (kg). The initial weight (kg) of each animal was taken using a 100kg scale and the animals were thereafter weighed fortnightly in order to determine their live weight changes (kg). The live weight changes were calculated by subtracting previous live weight (kg) from current live weight (kg). At the end of the feeding trial which lasted nine weeks, digestibility studies were conducted. Two lambs from each dietary group were randomly selected and harnessed using harness bags for faecal collection. The study span 21 days (14 days for adjustment and seven (7) days for collecting faecal samples). Total faecal output was collected and weighed. Five (5) per cent of the total output was retained for oven-drying at 60°C overnight.

CHEMICAL ANALYSES

Homogenous samples of sesame residue, test diets, and faecal materials from the digestibility trial were analyzed for proximate compositions as outlined by AOAC (2005). Neutral detergent fiber and acid detergent fiber were analyzed as described by Van Soest and Roberts (1985). Feed and nutrients apparent digestibility co-efficient were calculated as outlined by McDonald et al. (2011).

STATISTICAL ANALYSIS

All data were subjected to Analysis of Variance (ANOVA) using general linear model procedure in JMP (JMP, 2007) at 5% significance level ($P < 0.05$).

RESULTS AND DISCUSSION

NUTRIENT COMPOSITION OF DIETS

The results of the nutrient composition of sesame residue and the experimental diets containing graded levels of sesame residue are shown in Table 2. The dry matter, crude protein, organic matter, ether extract, nitrogen free extract, neutral detergent fiber and acid detergent fiber of the sesame residue were 94.65%, 9.30%, 94.90%, 8.20%, 73.53%, 52.68% and 56.41%, respectively. The results showed that the proximate parameters analyzed differed significantly ($P < 0.05$) among the experimental diets with the exception of organic matter contents. The crude protein of sesame residue (9.30%) used in the experiment was close to the value documented by Yasothai (2014) who reported crude protein values of 8.00% but lower than 25.80% reported by

Table 2: Chemical composition of the experimental diets containing graded levels of sesame residue and sesame residue itself.

Parameters (%)	Diets*				
	A (0%)	B (20%)	C (30%)	Sesame Residue	SEM**
Dry Matter	93.53 ^b	92.78 ^b	95.48 ^a	94.65	0.25
Crude Protein	13.77 ^a	13.07 ^b	12.84 ^b	9.30	0.24
Organic Matter	96.05	96.37	96.25	94.90	0.46
Ether Extract	6.65 ^b	7.60 ^a	7.45 ^a	8.20	0.07
Nitrogen Free Extract	77.02 ^a	73.38 ^b	78.13 ^a	17.53	0.41
Neutral Detergent Fiber	33.21 ^a	28.60 ^b	32.11 ^a	52.68	0.23
Acid Detergent Fiber	63.05 ^a	60.78 ^b	50.21 ^c	56.41	0.13

a, b, c, means in the same row with different superscripts are significantly different (P<0.05)

* A = 0% sesame residue (control), B = 20% sesame residue, C = 30% sesame residue ** SEM = Standard Error of Mean

Table 3: Performance characteristics of growing Yankasa lambs fed graded levels of sesame residue.

Parameters	Treatments*			
	A (0%)	B (20%)	C (30%)	SEM**
Initial Body Weight (kg)	20.00	20.25	20.00	1.09
Final Body Weight (kg)	26.00 ^a	23.33 ^b	26.00 ^a	1.29
Body Weight Gain (kg)	6.00 ^a	3.08 ^b	6.00 ^a	0.20
Average Daily Weight Gain (g/day)	95.24 ^a	48.89 ^b	95.24 ^a	0.20
Average Daily Feed Intake (kg/day)	0.90 ^b	0.96 ^{ab}	1.00 ^a	0.02
Average Daily Dry Matter Intake (g/day)	756.67 ^c	845.78 ^b	945.48 ^a	0.02
Average Daily Crude Protein Intake (g/day)	124.04 ^c	125.62 ^b	127.79 ^a	0.63
Average Daily Organic Matter Intake (g/day)	865.18 ^b	926.28 ^{ab}	957.88 ^a	0.00
Average Daily Ether Extract Intake (g/day)	59.90 ^b	73.04 ^a	74.15 ^a	0.00
Average Daily NFE Intake (g/day) †	693.79 ^b	705.26 ^b	777.58 ^a	0.02
Average Daily NDF Intake (g/day)†	299.15 ^a	274.88 ^b	319.57 ^a	0.01
Average Daily ADF Intake (g/day)†	567.95 ^a	584.16 ^a	499.71 ^b	0.01
Feed Conversion Ratio	9.45	9.99	13.64	3.91
Cost/kg (₦)††	52.89	43.74	40.11	-

a, b, c, means in the same row with different superscripts are significantly different (P<0.05) * A = 0% sesame residue (control), B = 20% sesame residue, C = 30% sesame residue ** SEM = Standard Error of Mean

† NFE = Nitrogen Free Extract, NDF = Neutral Detergent Fiber, ADF = Acid Detergent Fiber

†† ₦ = Nigerian Naira (1 USD = 381 ₦)

Table 4: Nutrient digestibility in growing Yankasa lambs fed graded levels of sesame residue.

Digestibility Index (%)	Treatments*			
	A (0%)	B (20%)	C (30%)	SEM**
Dry Matter Digestibility	75.97	75.64	76.39	0.62
Crude Protein Digestibility	87.88 ^a	84.88 ^b	87.59 ^a	0.40
Organic Matter Digestibility	78.92 ^a	71.35 ^b	76.42 ^{ab}	0.99
Ether Extract Digestibility	77.92 ^b	77.60 ^b	79.52 ^a	0.89
Nitrogen Free Extract Digestibility	79.96	80.05	79.11	0.50
Neutral Detergent Fiber Digestibility	82.07 ^a	74.95 ^b	76.51 ^b	0.51
Acid Detergent Fiber Digestibility	88.10 ^a	85.19 ^b	81.30 ^c	0.29

a, b, c, means in the same row with different superscripts are significantly different (P<0.05) * A = 0% sesame residue (control), B = 20% sesame residue, C = 30% sesame residue

** SEM = Standard Error of Mean

Obeidat and Gharaybeh (2011). Variety of seed, harvesting time, seed processing method and environmental effects could account for the variations in the chemical composition of sesame residue reported (Ghorbani et al., 2018). In this study, the crude protein contents of the experimental diets (12.84% to 13.77%) obtained decreased with increasing inclusion of sesame residues. This result is similar to that of Ogunwole et al. (2014) who reported that crude protein decreased with increasing inclusion of toasted sesame seed meals in broiler starter and finisher diets. However, the crude protein values were within the range (9-14%) recommended for growing sheep (Aduku, 2005). Ether extract was higher in diets containing sesame residue compared to the control diet. This is likely due to high ether extract content of sesame residue obtained in the study.

PERFORMANCE CHARACTERISTICS OF ANIMALS FED EXPERIMENTAL DIETS

The performance characteristics of growing Yankasa lambs fed diets containing 0%, 20% and 30% sesame residue are presented in Table 3. The results indicated that the final body weight of the lambs differed significantly ($P < 0.05$), with the 20% inclusion level having the least (23.33kg) compared to 0% and 30% inclusion levels which were at par. This weight difference could be attributed to individual differences of the experimental lambs, as a lamb among those fed 20% inclusion level had zero net weight gain at the end of the experiment.

Result in this study disagrees with the report of Obeidat and Aloqaily (2010) who documented improvement in feed intake when 25% sesame hull was incorporated in the diets of Awassi lambs. However, it is similar to the report by Bonos et al. (2017) who documented improvement in final body weight when sesame hulls were included in the diets of Pelagonia lambs. The improvement in the final body weight was probably due to improved feed intake or enhanced nutrients utilization by the lambs.

All the nutrients intake analyzed differed significantly ($P < 0.05$) among the experimental treatments. Lambs fed diet containing 30% sesame residue had higher intakes ($P < 0.05$) of crude protein, dry matter, organic matter, nitrogen free extract, ether extract and neutral detergent fiber than those fed 0% or 20% sesame residue diets. Obeidat et al. (2009) reported improvement in feed intake when 25% sesame hull was incorporated in the diets of Awassi lambs. The authors attributed the enhanced feed intake to higher ether extract content of the diet, which helped reduce its dustiness thereby improving its palatability.

The crude protein intake differed significantly ($P < 0.05$) among the treatments. Crude protein intake increased with increasing inclusion level of sesame residue. Increased

crude protein intake by lambs fed diet containing 30% sesame residue was probably due to the increased total dry matter intake. Ether extract intake was higher ($P < 0.05$) in lambs fed diets containing sesame residue diets than those fed the control diet. This was probably due to high ether extract of sesame residue. Obeidat and Gharaybeh (2011) also reported higher ether extract intake in diets fed to Black goat kids containing sesame hulls compared to the control diet.

The cost/kg (naira) of feed varied from ₦40.11 to ₦52.89. It decreased with increasing sesame residue inclusion. Therefore, including sesame residue in the diet of growing Yankasa lambs could be an economically advantageous practice.

NUTRIENTS DIGESTIBILITY COEFFICIENTS OF ANIMALS FED EXPERIMENTAL DIETS

Nutrients digestibility coefficients of growing Yankasa ram lambs fed diets containing graded levels of sesame residue are shown in Table 4. Significant ($P < 0.05$) differences were observed among the experimental treatments for crude protein, organic matter, ether extract, acid detergent fiber and neutral detergent fiber digestibilities with the exception of dry matter and nitrogen free extract coefficients. The values obtained for the dry matter digestibility (75.64 - 76.39%) were similar to the values documented by Abdullah et al. (2011) who reported dry matter digestibility coefficients of 72.5 - 80.8% when sesame hull was incorporated in the diets of Black goat kids.

This study revealed that crude protein digestibility was higher in lambs fed control diet (0% sesame residue) compared to those placed on diets containing sesame residue. This is not in agreement with Omar (2002) who reported that incorporating sesame oil cake in lambs' diets improved crude protein digestibility. The neutral detergent and acid detergent fibers digestibilities decreased with increasing level of inclusion of sesame residue. Obeidat and Gharaybeh (2011) also documented similar observation in the neutral detergent fiber and acid detergent digestibilities when sesame hulls was incorporated in the diets of Black Goat kids, but digestibility coefficients did not differ significantly.

CONCLUSION

Incorporating sesame residue at 30% in the diet of Yankasa lambs increased feed intake by 11% than the control. However, digestibilities of neutral detergent and acid detergent fibers were decreased by 7 and 8%, respectively in lambs fed 30% sesame residue inclusion than those fed the control diet. Also, cost/kg (₦) of diet decreased by 17.30 and 24.16% in diets containing 20% and 30% sesame residue,

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

AUTHORS CONTRIBUTION

Emmanuel A. Adeola: Execution of experiment, data collection, data entry, data analysis, results interpretation, and preparation of draft manuscript. Yusuf Garba: Design and conceptualization of experiment, outline of methodology, data cleaning, data analysis, editing of discussion component, final proof reading of manuscript. Mohammed Baba: Outline of methodology, data analysis, editing and proof reading of manuscript.

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