Small Ruminant Research 91 (2010) 225–230

Contents lists available at ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

Short communication

Using sesame hulls in Awassi lambs diets: Its effect on growth performance and carcass characteristics and meat quality

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ARTICLE INFO

Article history:
Received 10 January 2010
Received in revised form 4 March 2010
Accepted 8 March 2010
Available online 2 April 2010

Keywords:
Awassi lambs
Sesame hulls
Digestibility
Carcass characteristics

ABSTRACT

This study was conducted to evaluate the effect of feeding sesame hulls (SH) on growth performance and carcass characteristics of Awassi lambs. Twenty-one Awassi lambs (age of 70 ± 4.53 days and initial body weight 18.6 ± 0.53 kg) were randomly allocated to 3 diets. Diet 1 served as a control and contained no SH (CON); diet 2 (low sesame hulls; LSH) and 3 (high sesame hulls; HSH) consisted of 12.5% and 25% SH, respectively. Lambs were housed in individual pens and consumed isonitrogenous diets *ad libitum*. At the end of the study all lambs were slaughtered to evaluate their carcass and meat characteristics. Lambs fed SH had higher ($P < 0.05$) intakes of DM and OM than the CON diet. Intakes of NDF and EE were greater ($P < 0.05$) for the HSH diet than for the CON and LSH diets. Average daily gain and ADG:DMI were comparable among all diets. Cost of gain was lower ($P < 0.05$) for the SH diet than for the CON diet. Digestibility of DM, OM and CP was similar among all diets. However, digestibility of NDF tended to be greater ($P = 0.09$) for the HSH than the CON and the LSH diets. Digestibility of EE was greater ($P < 0.05$) for the HSH diet than the CON diet while the LSH diet was not different from the other 2 diets. *Longissimus* muscle weight was greater ($P < 0.05$) for the LSH diet than for the CON diet while the HSH diet was not different from the other 2 diets. Rib fat depth tended to be greater ($P < 0.10$) for the LSH when compared to the CON diet, whereas rib fat depth was not different from the other 2 diets. *Musculus longissimus* area was greater ($P < 0.05$) in lambs fed the LSH diet than the CON diet. Whiteness (L^*) of *longissimus* muscle was greater ($P < 0.05$) for lambs fed LSH than CON. In conclusion, using the sesame hulls could be beneficial because it decreased the cost of gain with no negative effects on performance or carcass characteristics. Therefore, sesame hulls could be considered as an alternative inexpensive feedstuff for fattening lambs.

1. Introduction

Sesame (*Sesamum Indicum* L.) is a herbaceous annual plant belonging to the Pedaliaceae family. Sesame plays an important role in human nutrition. Sesame hulls are by-products of the sesame seed industry for oil extraction. Most of the sesame hulls in Jordan result from production of oil paste (tehineh) or food formulation such as Halaweh (sweetened tehineh) (Abou-Gharbia et al., 2000). The chemical composition of sesame hulls varies and is influenced by the processing method (i.e., mechanical vs. solvent extraction). In a recent report prepared by Ministry of Agriculture in Jordan (2007), crude protein ranges between 23% and 31%. Consequently, sesame hulls could be used as a feedstuff for sheep feeding to provide both protein and energy. In Jordan, a total of 3250 tonnes of sesame by-products is produced annually (Ministry of Agriculture, 2007).

Recently, Obeidat et al. (2009) found that when soybean meal was replaced by sesame meal (CP = 46%, DM basis),

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doi:10.1016/j.smallrumres.2010.03.004

Table 1
Ingredients and chemical composition of diets fed to Awassi lambs.

Item	Diets			Sesame hulls
	CON	LSH	HSH	
Ingredients (% DM)				
Barley	61.4	56.0	50.6	
Soybean meal	15.0	7.5	0.0	
Sesame hulls	0.0	12.5	25.0	
Wheat hay	21.0	21.0	21.0	
Urea	0.0	0.4	0.8	
Salt	1.5	1.5	1.5	
Limestone	1.0	1.0	1.0	
Mineral and vitamins[a]	0.1	0.1	0.1	
Feed cost/tonnes (US$)	531	450	368	
Nutrients				
Dry matter (%)	91.4	93.3	93.9	93.3
Organic matter (% DM)	86.1	91.0	87.6	88.0
Crude protein (% DM)	16.7	16.6	16.5	25.8
Neutral detergent fiber (% DM)	25.5	26.1	27.2	23.0
Acid detergent fiber (% DM)	11.9	12.4	13.0	15.8
Ether extract (% DM)	2.6	5.0	6.3	17.6
Metabolizable energy (Mcal/kg)[b]	2.7	2.9	3.0	3.92

[a] Composition per 1 kg contained (vitamin A, 450,000 IU; vitamin D_3, 1,100,000 IU; vitamin E, 3.18 g; Mn, 10.9 g; I, 1.09 g; Zn, 22.73 g; Fe, 22.73 g; Cu, 2.73 g; Co, 0.635; Mg, 100 g; Se, 0.1 g).
[b] Metabolizable energy: calculated using NRC (1985).

finishing performance improved and cost of production diminished without any detrimental effect on carcass characteristics or meat quality of Awassi lambs. Similarly, using sesame oil cake (i.e., sesame meal), Omar (2002) reported that the sesame oil cake addition at 10% and 20% improved growth performance (i.e., average daily gain, ADG:DMI, and cost of feed/kg gain) of lambs.

The objective of this study was to investigate the effect of replacing part of the barley grain and soybean meal with sesame hulls on growth performance, nutrient intake, digestibility, and carcass characteristics of Awassi lambs fed fattening diets.

2. Materials and methods

This study was conducted at the Agriculture Center for Research and Production at Jordan University of Science and Technology. The study area is classified as semi-arid area with a latitude 32°30′N and elevation of 510 m above sea level. The Jordan University of Science and Technology Institutional Animal Care and Use Committee approved all procedures used in this study.

2.1. Design, animals and diets

Twenty-one intact Awassi lambs averaging 70 ± 4.53 days of age and 18.6 ± 0.53 kg body weight were assigned randomly to 1 of 3 diets. Diet 1 was served as the control (CON) while groups 2 (LSH) and 3 (HSH) contained 12.5% and 25% (on DM basis) sesame hulls (SH), respectively, to replace soybean meal and part of barley grain as indicated in Table 1. Lambs were purchased from a local farm. Upon arrival at the study location, lambs were individually weighed, ear tagged, dipped and treated against internal and external parasites. Sesame hulls were obtained from local seed industry company for oil extraction. Sesame hulls were extracted mechanically according to the procedure described by Elleuch et al. (2007). All diets were isonitrogenous (by adding urea to SH diet) and formulated to have 16.6% CP (DM basis) and to meet the CP requirement of fattening Awassi lambs (NRC, 1985). Lambs were housed individually in shaded pens (1.5 m × 0.75 m) and fed twice daily (two equal meals at 0900 and 1500 h) for 63 days. A 1-week adaptation period was allowed prior to the experiment.

A total mixed ration diet was offered *ad libitum* (110% of the previous day's intake) to all animals with free access to fresh water for the duration of the study. For each lamb, individual refusals of feed were weighed daily and stored (−20 °C) until analyzed for dry matter and other nutrients to evaluate daily nutrients intake. Lambs were weighed at the beginning of the study and weekly, thereafter, before the morning feeding throughout the study. During the study period, one lamb from each group was removed from the study due to health problems not related to the experiment conditions. Therefore, their data were removed from the statistical analysis. These lambs exhibited symptoms including depression, emaciation and low feed intake during the experiment.

2.2. Laboratory procedures

Diets and refusal samples were dried at 55 °C in a forced-air oven to reach a constant weight, air equilibrated, and then ground to pass 1 mm screen (Brabender OHG, Kulturstrase 51-55, type 880845, Nr 958084, Duisburg, Germany) and kept for further analysis. Sesame hulls, diets, and refusals were analyzed for dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), neutral detergent fiber (NDF), and acid detergent fiber (ADF). Following AOAC (1990) procedures, samples were analyzed for DM (100 °C in air-forced oven for 24 h), OM (550 °C in ashing furnace for 6 h), CP (Kjeldahl procedure) and EE (Soxtec procedure, SXTEC SYSTEM HT 1043 Extraction Unit, TECATOR, Box 70, Hoganas, Sweden). The NDF and ADF were analyzed according to procedures described by Van Soest et al. (1991) with modifications for use in the ANKOM^{2000} fiber analyzer apparatus (ANKOM Technology Cooperation, Fairport, NY). Neutral detergent fiber analysis was conducted using sodium sulfite and alpha amylase (heat stable) and expressed with residual ash content.

2.3. Digestibility trial

On day 50 of the fattening period, 6 animals from each dietary group were selected randomly and housed individually in metabolism crates (1.05 m × 0.80 m) to evaluate nutrient digestibility. Animals were allowed a period of 7 days to adapt the metabolism crates. In subsequent collection period of 5 days, feed intake and refusals were recorded and sampled. Daily fecal output was collected, weighed, and recorded, and then 10% was kept for subsequent analyses.

Fecal samples were dried at 55 °C in a forced-air oven to reach a constant weight, air equilibrated, and then ground to pass 1 mm screen and kept for further analysis. Diets, refusals, and feces were analyzed for DM, OM, CP, EE, NDF, and ADF as described previously.