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Performance of Sudanese Desert Lambs Fed Graded Levels of Water Melon (*Citrullus lanatus*) Seed Cake Instead of Groundnut Cake

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Abstract: The present study was conducted to evaluate water melon (*Citrullus Lanatus*) seed cake as a possible protein supplement for growing lamb in comparison to groundnut cake. Graded proportion of water melon seed cake (WMSC) (0, 25, 50, 75, 100%) which replace groundnut cake (GNC) were incorporated in five diets iso-caloric, iso-nitrogenous diets for lamb. Diet A contained 0% proportion of MWSC, diet B, C, D and E contained 25, 50, 75 and 100% WMSC proportions, respectively. Forty five yearling male lambs of Sudan desert sheep ecotype Kabashi with average body weight of 31.5kg were used for feeding trial. There was a significant ($P < 0.01$) linear decrease in feed intake and average daily live weight gain with increasing WMSC level in the diet, but dietary treatments had no significant effect on feed conversion efficiency and final body weight. However, lambs fed diet A (0% WMSC) was found to be superior over the other treatment groups in previous parameters.

Key words: Performance, sudanese desert lambs, water melon seed cake

INTRODUCTION

Livestock industry is of great importance to Sudanese economy as it is one of the main sources of food, employment and foreign currency. Sheep population is estimated at 48136 million heads (Ministry of Animal Resources, 2002). In recent years, Sudanese sheep namely Sudan desert type, has receive great interest as an export commodity to the Arab countries. In, 2000-2001 for example, sheep exports has contributed $ 261.34 million to the national exchange earnings at an annual off take rate of 2l.778 million heads (Ministry of Animal Resources, 2002)

Protein is an expensive component in animal rations and one that may be in short supply especially in developing countries. This shortage is very critical in both human and animal nutrition. One of the critical pressing problems today' is how to augment the shortage of protein in diets (Oyenuga and Fetuga, 1975). Recently a new strategy for alleviating food shortages is now being actively developed. This strategy aimed primarily at reducing or eliminating man-animal competition for the already in adequate agricultural products, through the development of novel feed material unsuitable for human use and fed exclusively to livestock. The resulting sparing effect on traditional agricultural products routinely eaten by man should alleviate the present food scarcity experienced by many developing countries.

Oil seeds, cereal grains and pulses are the three groups of plants which supply most of the protein in the world.

Conventional oil seeds cakes in the Sudan include groundnut, sesame, cotton and sunflowers seed cakes. The relative abundance of these by-products offers a unique opportunity for fast improvement of animal production in the country. Unfortunately, there are constraints facing their efficient utilization, these include export of these products, human nutrition, food industry and poultry nutrition. These facts necessitate seeking other potential feed stuffs that can replace conventional oil seed cakes.

Water melon (*Citrulus Vulgaris*, Schrad) is a creeping annual cash crop which belongs to the family cucurbitaceae. It grows successfully in the tropics and sub-tropics (Mohr, 1986). In Sudan water melon is locally known as "*Batteikh*" and is cultivated every where, particularly in the western parts of the country.

Water melon is extensively utilized in many parts of the country especially in Darfur and Kordofan regions. The melon watery juice is considered in many dry areas as a water substitute. Whole melon seeds are roasted and consumed as a popular snack "*Tassali*". Melon seeds have been exported to some Middle Eastern and Arab countries. Water melon seeds are rich in oil and protein (Mustafa *et al*., 1972; Oyenuga and Fetuga, 1975 and Al-Khalifa, 1996). The seeds are mechanically pressed for oil extraction. Melon seed oil proved to be a good source of high quality edible oil characterized by low free fatty acid content (Mustafa *et al*., 1972). The seed cake which is the byproduct of the extracted seeds is used as a protein supplement for livestock (Pal and Mahadevan, 1968).

The experience with water melon seed cake or meal in rations for fattening livestock showed that water melon seed cake is a good source of digestible protein, which is comparable to other oil seed cakes like cotton, linseed, etc. (Sen, 1925). It can be safely incorporated in the animal feeds (Sastry *et al*., 1974).

The objective of this study is to: Evaluate water melon seed cake as a possible protein supplement for growing and finishing lambs in comparison to groundnut cake.

MATERIALS AND METHODS

Source of the cake: The cake was brought from El-Mursala oil presser Khartoum North Factories Area.

Experimental animals: Forty five male lambs of Sudan desert sheep ecotype Kabashi were utilized. Animals were selected according to their age (9-12 months) and weight which was approximately 31.5kg lambs, ear tagged and given an adaptation period of two weeks.

Adaptation period: During this period animals were fed groundnut halum and a mixture containing equal percentages of the assigned experimental rations *ad libitum*. The halum was gradually withdrawn during the first 7 days, while the ration mixture feeding continued till the end of the adaptation period.

Spraying with an acaricide solution against ecto-parasites and deworming with Thiabenzole as a drench solution was performed. The Thiabenzole treatment was repeated after 15 days.

Experimental procedure: Immediately after the adaptation period the animals were individually weighed and then randomly divided in to five groups (A, B, C, D and E) of similar number and weight. The five groups were separately penned. Each pen was provided with watering and feeding facilities.

Feeds and feeding: Five iso-caloric, iso-nitrogenous diets containing graded levels of water melon seed cake (0, 25, 50, 75 and 100), which replace groundnut cake were used. The other ration ingredients were sorghum grain, groundnut cake, wheat bran, and groundnut hulls, salt and lime stone. The chemical analysis, ingredient proportion and calculated chemical analysis of water melon seed cake and experimental diets are given in Tables 1 and 2. The diets were then randomly assigned to each animal group.

During the feeding period, animals were fed the assigned diets *ad libitum*. The diets were offered in one meal at 8.00 a.m. throughout the study period which extended for 45 days. Green fodder (*Medicago sativa*) was also offered at a rate of one kg/head/week to avoid vitamin A deficiency. Clean water and salt lick were available throughout the experimental period.

Table 1: Chemical analysis of water melon seed cake

Composition	Percentage
Crude protein	29.42
Moisture	4.27
Crude fibre	29.9
Fat	7.39
Ash	11.17
Nitrogen free extract	17.85
Metabolizable energy (ME) (Mj/kg)	9.82*

*Calculated according to Ministry of Agric., Fisheries and Food, London, U. K., (1976).

Data recorded:

Feed intake: Total feed offered and residual for each pen were recorded daily to calculate group and individual feed intake by difference.

Live weight gain: The animals were weighed weekly using a spring balance. Animals were fasted overnight except for water before weighing to reduce error due to variations in gut fill. The average weekly weight gain of each animals and feed conversion efficiency were calculated.

Statistical analysis: All experimental data were analyzed using simple randomized design and Duncan Multiple Range Test was used to detect difference between means (Snedecor and Cochran, 1980).

RESULTS

Feedlot performance: Feedlot performance data of experimental lambs fed diets containing different proportions of water melon seed cake (WMSC) are shown in Table 3.

Dry matter intake: Feed intake as given in Table 3 indicated that average daily feed intake different significantly ($P < 0.01$) among dietary treatment groups. It decreased as the proportion of dietary WMSC increased. Group A (0% WMSC) consumed significantly ($P < 0.01$) more feed per day (1.26kg), followed by group B (25% WMSC), then group C (50% WMSC), group D (75% WMSC) and group E (100% WMSC) which had the least daily feed intake (0.98kg).

Live weight: As seen in Table 3 the average initial live weight was not significantly different among the treatment groups. The average final body weight was also not significantly different among the treatment groups. Group A (0% WMSC) (control) had the highest final live weight (40.13kg) followed by group B (38.38kg), group C (37.19kg), group D (36.79kg) and group E which had the least final body weight (36.31kg), respectively.

Daily live weight gain: Average daily live weight gain was significantly different ($P < 0.01$) among the treatment groups. The average daily gain decreased as water

Table 2: Ingredient proportions and chemical composition of experimental diets

	Diets				
Item	A (control)	B	C	D	E
i)Physical composition (As fed)					
Water melon seed cake	0.0	3.8	7.7	11.5	15.3
Groundnut cake	10.0	7.5	5.0	2.5	0.0
Sorghum grains	35.0	35.0	30.0	30.0	27.0
Wheat bran	30.0	35.0	40.0	45.0	50.0
Groundnut hulls	23.0	16.7	15.3	9.0	5.7
Limestone	1.0	1.0	1.0	1.0	1.0
Salt	1.0	1.0	1.0	1.0	1.0
ii) Chemical composition(DM)					
Moisture	5.84	5.46	5.51	5.64	5.21
Crude protein	16.45	16.58	16.9	16.2	16.9
Crude fibre	17.63	16.5	16.73	14.9	13.14
Ether extract	4.16	4.35	4.85	5.36	5.46
Ash	8.86	7.50	8.03	6.68	6.41
Calculated metabolizable energy(Mj/kg DM)	11.03	11.24	11.14	11.07	11.40

Table 3: Performance of lambs fed diets containing graded proportion of water melon seed cake (WMSC)

	Proportion GNC protein replaced by WMSC protein (%)						
Item	A (0)	B (25)	C (50)	D (75)	E(100)	S.E	L.S
Number of animals	9	9	9	9	9	-	-
Feedlot period	45	45	45	45	45	-	-
Initial body weight(kg)	31.38	31.61	31.50	31.61	31.56	.092	N.S
Final body weight (kg)	40.13	38.38	37.19	36.79	36.31	1.11	N.S
Total live weight gain (kg)	8.50^{a}	7.10^{ab}	7.07^{ab}	6.07^{ab}	5.30^{b}	0.58	*
Daily weight gain (g/head/day)	197.67^{a}	165.12^{ab}	164.73^{ab}	141.20^{ab}	110.47^{b}	13.05	**
Total DMI (kg/head/day)	1.26^{a}	1.16^{ab}	1.09^{b}	1.07^{b}	0.98^{b}	0.04	**
Feed conversion efficiency (kg DMI/kg gain)	6.53	7.37	7.52	8.41	8.95	0.64	N.S

Means in the same row having different subscripts are significantly different, * = P < 0.05, ** = P < 0.01, N.S: Not significant, S.E.: Standard error and S.L.: Significant level. GNC = Groundnut cake, DMI = Dry matter intake.

melon seed cake proportion increased in the diet. Group A showed the highest daily gain (197.67g) while group E showed the least daily gain (110.47g).

Feed conversion efficiency: Feed conversion efficiency (F.C.E) is also shown in Table 3. The feed conversion efficiency was not significantly different among the treatment groups, however, lambs fed diet A had better feed efficiency (6.53) followed by lambs on group B (7.37), group C (7.52), group D (8.41) and then group E which had the least F.C.E (8.95).

DISCUSSION

Feed intake: It is clear from performance data Table 3 that feed intake tended to decrease significantly ($P < 0.01$) with the increase in the dietary proportion of water melon seed cake. This inverse relationship might be referred to increased crude fibre content of the diet 3. Madaan and Lal (1984) and Oyenuga (1968) also reported higher crude fibre content in WMSC. Feed intake in this study was 1.26, 1.16, 1.09, 1.07 and 0.98kg for group A, B, C, D and E, respectively, in these diets WMSC progressively increased from diet A-E. These values obtained here were in agreement with those reported by Gabbani (1999), who found a drop in feed intake of desert sheep fed WMSC (0.89kg). She attributed this drop to the fibrous nature of water melon seed hulls and furthermore, to imbalances in nutrients contents. Similarly El-Hag (1993) also found a drop in feed intake reached (0.121kg) when WMSC was fed to desert sheep compared with a value of control group that fed a diet containing zero WMSC.

On the other hand Ahmed (1998) reported that broilers fed increasing levels of dietary water melon seed meal progressively and significantly consumed more feed. He explained these findings on the basis of the essential amino acids profiles of the tested dietary proteins. Moreover, the positive correlation between feed intake and the increasing level of WMSC in diets could possibly be related to the capability of WMSC in improving the palatability of poultry rations.

This variation in feed intake between ruminants and monogastric species could be due to differences in species, WMSC level in the diet and processing conditions.

Body weight gain: The overall live weight gain from an initial weight of about 31.61kg to a slaughter weight of about 37.76 was not significantly different among the treatment groups. Final body weights linearly decrease

with increased WMSC inclusion in the diet. This could be explained by low feed consumption associated with increasing level of WMSC inclusion in the diet.

The average daily live weight gain was significantly ($P < 0.01$) different among the treatment groups. It tended to decrease with increasing dietary inclusion of WMSC. This reduction in growth rate reported was possibly due to decreased dry matter intake. The findings obtained in these studies were in agreement with those reported by El-Hag (1993) and Gabbani (1999) who reported negative body gain for Sudan desert lambs fed WMSC. However, these findings were in disagreement with those reported by Ahmed (1998) who revealed an improvement in average daily gain in monogastric species with increased level of WMSC in broiler diets.

Feed conversion efficiency: In the present study Sudan desert lambs fed on different diets containing 0, 25, 50, 75 and 100% proportion of water melon seed cake, ate 6.53, 7.37, 7.52, 8.41, 8.95kg of dry matter of feed to gain 1kg of live weight, respectively. These values obtained in this study were superior to those reported by El-Hag (1993) for desert lambs (-0.07) and Gabbani also for desert lambs (-85.16). Ahmed (1998) reported significant improvement in F.C.E of the birds consuming 10% WMSC. He attributed it to better amino acids profile of WMSC.

The recorded feed conversion efficiency of sheep received diets containing up to 50% WMSC was comparable to that of 6.66, 7.69 and 7.77 reported by Lutfi (1983) for Sudan desert sheep fed on GNC, SSC and CSC, respectively. These FCE values were also similar to the findings obtained by Mansour *et al.* (1993) for sheep fed varying ratios of groundnut hulls to dura, El-Khidir (1989) for Sudan desert sheep fed on high energy diet, Beshir (1996) for sheep fed graded levels of karkadeh seeds and Suleiman (1999) for sheep fed different protein sources. The decline in FCE value as the inclusion level of WMSC increased above 50% coincided with the lowering ratio digestibility which might be explained by dietary crude fibre level increase.

The values for F.C.E reported here in were inferior than the respective values (6.7 and 5.8) reported by Ahmed and Suleiman (1988) for Sudan desert sheep (Shugor ecotypes) fed on two rations containing either cotton seed cake or blood meal, that of Gaili and Ali (1985) for Sudan desert sheep (5.9) and that reported by Suleiman (1976) (4.5) for Gezira weaned lambs.

Ration composition differences as well as age and ecotype differences might be the reasons for these wide differences.

The F.C.E values obtained in the present study indicated that WMSC can be utilized to the same extent or even better by growing lambs compared to other protein sources utilized in the previous studies.

Summary and Conclusions: Forty five entire male Sudan desert lambs (9-12 months of age and averaging 31.5kg) were utilized in a growth trial to evaluate five levels (A 0%, B 25%, C 50%, D 75% and E 100%) of water melon seed cake (WMSC) in their diets. Diets were iso-caloric and iso-nitrogenous. The diets were offered *ad libitum* (after an adaptation period of two weeks) for 45 days. Green fodder (Medicago saliva) forage was given weekly.

Performance of the lambs was influenced by dietary levels of WMSC. Average daily gain (g), daily feed intake (kg) and feed conversion efficiency for the lambs fed diets A, B, C, D and E were 197.67, 165.12, 164.73, 141.20, 110.47, 1.26, 1.16, 1.9, had no significant effect on feed conversion efficiency and final body weight. However, lambs fed diet A (0% WMSC) was found to be superior over the other treatment groups in previous parameters.

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