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Carcass quality of fattened sheep fed halophytic silage with non-conventional energy supplements in Egypt

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SUMMARY – Due to the high expenses of conventional fattening diets, interest has been directed towards the utilization of alternative feed resources. This study aimed to determine the carcass traits and quality of growing sheep fed fattening diets of halophytic silage with non-conventional energy supplements. Silage of halophytic shrubs was fed as a basal diet supplemented with 3 energy sources: concentrate feed mixtures (CFM) (T2), ground date seeds (T3) and barley grains (T4). Berseem hay and CFM were given as a control diet (T1). 36 growing male sheep were divided randomly into four equal groups and offered one of the fattening diets for 6 months. At the end of the fattening trial, 3 animals from each group were slaughtered. All carcass traits and composition, i.e. carcass weight, wholesale-cuts, dressing percentage, etc. were determined. Feed efficiency and costs were determined. Slaughter and hot carcass weights were significantly affected by fattening diets. The highest values were recorded for animals in T4. Dressing percentage was insignificantly improved with the inclusion of halophytic silage in the fattening diets. Wholesale-cuts and eye muscle area were not significantly affected among fattening diets. Neck and flank % varied ($P<0.05$) among animal groups. Supplementation with barley or date seed led to increase carcass weight, kg carcass/cm^2 LD, total fatty tissue and gm fat/cm^2 LD indicating to producing marbling meat. Feed efficiency appeared to be relatively comparable. Halophytic silage supplemented with barley grains or ground date seeds, may be recommended for fattening sheep since the production costs of one kg gain in carcass was reduced by 47.5% compared to the conventional diets.

Key words: Fattening, carcass traits, sheep, halophytes, supplementary feeding, energy.

RESUME – *"Qualité de la carcasse d'ovins engraissés avec de l'ensilage d'halophytes avec une supplémentation énergétique non conventionnelle en Egypte". Dû aux coûts élevés des régimes d'engraissement conventionnels, on s'est tourné vers l'utilisation de ressources alimentaires alternatives. Cette étude vise à déterminer les caractères et la qualité de la carcasse chez des ovins en croissance recevant des régimes d'engraissement d'ensilage d'halophytes avec une supplémentation énergétique non conventionnelle. Un ensilage d'arbustes halophytes a été distribué comme régime de base supplémenté avec 3 sources énergétiques : mélange d'aliment concentré (CFM) (T2), résidus de dattes (T3) et grains d'orge (T4). Du foin de bersim et CFM ont été distribués comme régime témoin (T1). 36 ovins mâles en croissance ont été divisés au hasard en quatre groupes égaux recevant l'un des régimes d'engraissement pendant 6 mois. A la fin de l'essai d'engraissement, 3 animaux de chaque groupe ont été abattus. Tous les caractères de carcasse ainsi que la composition, soit le poids de la carcasse, les morceaux, le pourcentage de parage, ont été déterminés. L'efficacité alimentaire et les coûts ont également été déterminés. Le poids à l'abattage et le poids de la carcasse chaude ont été significativement affectés par les régimes d'engraissement. Les valeurs les plus élevées ont été enregistrées pour les animaux en T4. Le pourcentage de parage a été amélioré de façon non significative par l'inclusion d'ensilage d'halophytes dans le régime d'engraissement. Les morceaux et la surface de muscle dorsal n'étaient pas significativement affectées par le régime d'engraissement. Les pourcentages de cou et de flanc variaient ($P<0,05$) parmi les groupes d'animaux. La supplémentation avec de l'orge ou des résidus de dattes menaient à une augmentation du poids de la carcasse, kg carcasse/cm^2 LD, tissu gras total et g gras/cm^2 LD, indiquant la production de viandes marbrées. L'efficacité alimentaire semblait être relativement comparable. L'ensilage d'halophytes supplémenté avec des grains d'orge ou des résidus de dattes, peut être recommandé pour des ovins à l'engraissement car les coûts de production d'un kg de gain de carcasse étaient réduits de 47,5% en comparaison avec les régimes conventionnels.*

Mots-clés : *Engraissement, caractères de carcasse, ovins, halophytes, supplémentation alimentaire, énergie.*

Introduction

Shortage of feeds and water are the main limiting factors for sufficient animal production under the arid conditions of South Sinai in Egypt. The native ranges are characterized by the dominance of numerous less palatable and unpalatable shrubs. The palatable ones are always overgrazed by

sheep, goats and camels. To improve the palatability of such range plants, some processing methods have been applied such as ensiling to provide alternative feed resources (El Shaer *et al.,* 1991). Also, some agro-industrial by-products (date seeds and sunflower meal) along with barley grains being abundant in this region may be used as concentrate diets (Eid, 1998). This study was carried out to evaluate the effect of using a halophytic plants silage along with some energy sources, as fattening diets, on carcass traits and quality of fattened sheep.

Materials and methods

Silage making

The experimental silage used in this experiment, was approved previously as a good silage by Fahmy *et al.* (1999). It was made from the lush parts (leaves and stems) of some halophytic plants grown naturally or cultivated in South Sinai. The natural shrubs were *Tamarix mannifera, Zygophylum album, Halocnemum strobiloceum* while the cultivated ones were *Atriplex* spp*. and Acacia saligna* in a ratio of 10:10:10:12:18, respectively. The mixture of these plants were mixed, also, with broiler litter and molasses in a ratio 60:30:10, respectively. The ensiling procedures and the physical and fermentative traits of the silage were described and reported by Fahmy *et al.* (1999).

Animal and diets

Total number of 36 Barki growing male sheep (21.6±0.60 kg) were used in this study and randomly divided into 4 groups. Berseem hay (3 rd cut *Trifolium alexandrinum)* as a basal diet and concentrate feed mixture (CFM) were offered as a control diet (T1). The halophytic silage was fed as a basal diet and supplemented with 3 energy sources to the other three groups: CFM (T2), ground date seeds (T3) and barley grains (T4). They were given the experimental diets at 40:60 (roughage: concentrate ratio) to cover their maintenance requirements and allow 150 g gain according to the nutritional requirements of Kearl (1982). Sunflower meal was added to adjust the protein content in diets of T3 and T4. The four experimental diets were iso-coloric (1.93 Mcal/kg diet) and iso-nitrogenous (2.19% nitrogen). Three animals from each group were slaughtered after fasting for 12 hours. The carcass and internal organs and offals were recorded. The dressing percentage was calculated. The physical components of the whole sale cut were determined and the *Longissimus dorsi (LD*) muscle was measured between the 9th and 10th ribs using polar parameter. The price of one kg DM of the experimental diet was calculated according to marketing price of materials in 1997. Also, the production cost of kg of carcass weight gain was calculated.

Analytical methods

The proximate analysis of the experimental diets and silages was determined according to AOAC (1990). Fibre constituents (NDF, ADF and ADL) were determined (Goering and Van Soest, 1970). Data were statistically analysed as a complete random design according to Snedecor and Cochran (1980). Duncan multiple range test was also used.

Results and discussion

The silage was moist with pleasant aroma, golden yellow colour as previously reported by Fahmy *et al.* (1999) on the same silage. It was, also, acidic (3-4.5) and showed optimum levels of ammonia-nitrogen (0.35% of DM) and TVFAs (7.1 meq/100 ml) indicating good quality silage.

Data on chemical composition of fattening diets (Table 1) indicated that the basal diets (berseem hay and the halophytic silage) contained comparable crude protein (11.9 vs. 12.8%) while ash and lignin contents were about 65 and 105% higher in the silage than those of berseem hay. It could be attributed to high ash and ADL contents in the halophytic shrubs used in making the silage (EL Shaer *et al*., 1991). Barely grains attained high energy content compared to those of ground date seeds (GDS) and CFM. The highest NDF and ADF values were, also, recorded for GDS compared to other

energy sources. Similar results were found by El Shaer *et al.* (1986) and Allam *et al.* (1997). Such high fibre constituents could limit the utilization of GDS (Van Soest, 1982). Results in Table 2 showed that animals given fattened diets based on the silage (T2, T3 and T4) tended to consume comparable amount of TDN but in general lower than that fed the control ration (T1). However, the total dry matter intakes were almost similar to fattened animals in T1 and T2 indicating that the silage with CFM could replace the berseem hay in the fattening diets.

Table 1. Chemical composition (% on DM basis) of the fattening diets

Criteria	Basal diets		Energy supplement		
	Silage	Berseem hay	Ground date seeds	Barley grains	Concentrate feed mixture
DM	48.0	87.0	90.0	90.0	90.0
CP	11.9	12.8	7.60	11.5	14.4
EE	2.70	2.70	8.20	1.60	3.60
NFE	46.1	40.9	72.0	77.4	60.5
Ash	22.1	13.4	2.50	3.30	10.3
NDF	47.3	55.8	73.7	68.4	48.0
ADF	31.5	38.5	48.3	9.00	16.0
ADL	15.0	7.40	12.7	2.00	6.00

Table 2. Performance, feed efficiency and production cost of sheep fed the fattening diets

Criteria		T1	T2	T3	T4	±SE	F-test
Initial body weight	(kg)	21.6	21.7	22.1	22.3	0.62	ns
Average daily gain	(g/day)	162 a	140 ab	127 b	143 ab	10.2	*
Total feed intake	(kg DM)	236.4	234.9	207.5	211		
	(kg TDN)	132.6	118.2	118.3	112.7		
Feed efficiency	(kg DMI/kg gain)	8.30	9.50	9.30	8.40		
	(kg TDNI/kg gain)	4.60	4.80	5.30	4.50		
Feed cost	(LE/kg, DM diet)	0.54	0.48	0.33	0.65		
Production cost	(LE/kg total carcass gain)	7.47	7.53	3.99	6.43		

[a,b,c]Values with different letters on the same raw differ at P<0.05; ns = not significant; * = P<0.05.

There was no clear differences in feed efficiency among animal groups (in terms of kg DMI or TDN Feed/kg gain). These results are in harmony with those obtained by Abou El-Naser (1985) and Abdou (1998). The cost of one kg fattening diet was reduced in T3 by about 39% than the control ration. Also, the production of one kg gain in carcass weight gain was approximately 48% less than that of the control group. Such results confirm previous results obtained by Abdou (1998) and Eid (1998). Concerning the carcass traits, data in Table 3 revealed that the hot carcass weight was varied ($p<0.001$) among animal groups where the fattened sheep in T4 showed the highest value (26.3 kg). On the other hand, dressing percentage (based on slaughter weight) in animals fed the silage (T2, T3 and T4) were insignificantly greater than that in T1. Shoulder, rack and loin percentages were not affected significantly by the treatments. Meanwhile, neck % of sheep in T3 and T4 was decreased and lower by about 20 and 24%, respectively than that of the control group (T1). These results agree with those obtained by Abdou (1998). The percent of total internal fat (omental and kidney) of sheep fed diet T3 was significantly ($p<0.05$) highest (2.69%) as shown in Table 3. Meanwhile, the eye muscle area (cm^2) of sheep in (T4) insignificantly exceeded by 13% than those in the control group which agree with results obtained by El Bedawy *et al.* (1989). The total fatty tissues in carcass of sheep in T4 were significantly the highest (2.6 kg) while the lowest value was recorded in T2. When total fatty tissues were related to eye muscle area, the highest value was noticed in sheep of T3 and

T4.

Table 3. Dressing percentage and wholesale-cuts (%) and other carcass traits of sheep fed the fattening diets

Criteria	T1	T2	T3	T4	±SE	F-test
Slaughter weight (kg)	49.7 ab	42.0 c	45.7 bc	53.3 a	1.41	***
Hot carcass weight (kg)	22.3 b	20.3 b	22.3 b	26.3 a	0.73	***
Dressing percentages/ wholesale cuts (%)						
Neck	8.25 a	6.86 b	6.88 b	6.68 b	0.25	*
Shoulder	9.21	9.00	9.26	9.23	0.17	ns
Rack	12.9	14.4	11.5	12.6	0.49	ns
Loin	3.43	3.02	2.98	2.67	0.13	ns
Flank	3.21 b	2.47 b	3.89 ab	4.86 a	0.34	*
Total edible offals (%)	1.96	1.99	1.84	2.10	0.06	ns
Total internal fat (%)	1.59 b	1.06 b	2.69 a	1.90 ab	0.23	*
Eye muscle-area (cm^2)	20.7	18.9	18.0	23.4	1.13	ns
Total fatty tissue (kg)	1.727 bc	1.080 c	2.297 ab	2.600 a	0.20	**
Gram fat per cm^2 LD	83.4	57.1c	127.6	111.1 ab	10.9	**

[a,b,c]Values with different letters on the same raw differ at P<0.05; ns = not significant; * = P<0.05; ** = P<0.01; *** = P<0.001.

Data on chemical composition of prime cuts (Table 4) indicated that lean % in shoulder and rack was significantly increased in T3 and T4 compared to those in T1 and T2. Opposite trend was found for fat % in shoulder and rack which was significantly decreased in T3 and T4 in comparison with those in T1 and T2. It means that the type of fattening diets has a pronounced effect on the carcass quality of fattened sheep.

Table 4. Physical composition of prime cuts of sheep fed the fattening diets

Criteria	T1	T2	T3	T4	±SE	F-test
Shoulder						
Lean (%)	70.0 b	69.7 b	71.2 ab	73.3 a	0.84	*
Fat (%)	9.8a	9.00 b	7.90 c	8.30 c	0.84 c	***
Bone (%)	20.2	21.3	20.9	18.4	0.47	ns
Rack						
Lean (%)	55.4 b	53.0 c	58.4 a	56.9 ab	0.56	**
Fat (%)	15.5 a	15.0 a	12.2 b	13.0 b	0.44	***
Bone (%)	29.1 b	32.0 a	29.4 b	30.1 b	0.38	**
Loin						
Lean (%)	56.6	51.7	52.6	53.7	1.22	ns
Fat (%)	15.3 b	12.7 b	17.7 ab	23.9a	1.49	**
Bone (%)	28.1 ab	35.6 a	29.7 ab	22.4 b	1.76	*

[a,b,c]Values with different letters on the same raw differ at P<0.05; ns = not significant; * = P< 0.05; ** = P<0.01; *** = P<0.001.

In conclusion, fattening growing male sheep on a diet of a halophytic silage supplemented with ground date seeds or barley grain (as non conventional energy sources) led to produce high quality carcass being marble meat. Using such available fattening feed ingredients, in Sinai region, could reduce the production costs and encourage more investments in fattening sheep practices among Bedouins in Sinai.

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