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STUDIES ON BIOLOGICAL TREATMENT OF SALT PLANTS: II – FATTENING TRIAL

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ABSTRACT

Twenty four male Barki growing lambs (5 months age) were used to study the effect of feeding biologically treated halophyte mixtures(mixture 1 consisted of dried *Acacia saligna* treated with *P.florida* + dried *Tamarix mannifera* treated with *P.ostriatus* ; whereas, mixture 2 consisted of dried *Acacia saligna* treated with *P. ostriatus* + dried *Tamarix mannifera* treated with *P. florida*) and controlling with berseem hay for 140 days on feed intake, growth rate, feed efficiency, rumen liquor parameters, blood profile and economic efficiency. Lambs fed the control ration had the highest body weight with no significant differences among treatments. Lambs fed the control ration had significantly the highest daily gain followed by those fed mixture 1 and those fed mixture 2, respectively. DM intake / Kg BW / day was lower for lambs fed the biological treated mixtures than the control; so, the feed efficiency of the control diet had the lowest value comparing with the control. Roughage cost (LE) and total cost (LE) for the biological treated mixtures were lower than those of the control, reflected that economic efficiency of feeding biological treated mixtures were higher than that of berseem hay. Ruminal values of pH, TVFA's and ammonia-N of lambs fed the control diet were higher than those fed the biological treated mixtures. The hematological parameters reflected nearly similar values with no significant effect of the tested rations. Feeding biologically treated halophytes mixtures to lambs didn't cause any abnormal conditions in liver and kidney functions.
Key words: Halophytes – Fungal treatment – Sheep fattening.

INTRODUCTION

The rangelands in the Southern Sinai are generally identified as an open shrub vegetation characterized by spare, slightly stands and semi-shrubs. The *Chenopodiaceae* family is the most widespread family as it has an interesting geographical distribution in Egypt as well as numerous countries all over the world. The native natural vegetation varies greatly in their species, varieties, productivity, chemical composition and nutritive value from location to another location due to many environmental factors, especially the amount of rain fall and its distribution (Kandil, 1997). The salt contents in both halophytic plants and the underground water, as the main source of drinking water in the Egyptian deserts, considerably limit the utilization of such forages and affect the performance of animal (Fahmy, 1998). Moreover, the high levels of NDF, ADF, ADL and hemicellulose in ranges appeared to limit their utilization by sheep and goats (Kandil and El-Shaer, 1990). Hence, poor intake of the fresh and air-dried halophytic species could be attributed to their high Na, Ca and silica contents; high levels of ADL and NDF; and many of shrubs contain high level of plant secondary metabolites, i.e. alkaloids, tannins, oxalates, glycosides and nitrates (Abd-El-Rahman, 1996). During microbial processes for conversion of lignocellulosic wastes into foods, at least one of three objectives must be reached: an increase in the protein level, an increase in the digestibility of the lignocellulosic material and an improvement in the dry product palatability, although this last factor can be easily improved by ensiling or mixing the substrate with other more palatable foods (Kamra and Zadrazil, 1988). Wilson *et al.* (1994) reported that feed intake of halophytic plant species is low when fed as a sole ration, so that its value is limited to provide maintenance forage during the dry season when alternative forage is scare for its low quality. They added that, livestock performance is improved when the shrubs are fed as a mixture with grass. Baldrian *et al.* (2005) said that, *Pleurotus ostreatus* produces the cellulolytic and hemicellulolytic enzymes endo-1,4-β-glucanase, exo-1,4-β-glucanase, endo-1,4-β-glucosidase, endo-1,4-β-mannosidase, endo-β-1-4 mannanase and 1,4- β-mannosidase and ligninolytic enzymes during growth on wheat straw. Schmidt *et al.* (2003) observed that, the biological treatment increased CP, ADF, lignin, and cellulose proportions in cell walls and decreased NDF and hemicellulose when treated *Brachiaria decumbens* hay with *P. ostreatus* plus urea. Therefore, Kandil (2006) mentioned that some halophytes could be used as fodder plants. The objective of this experiment was to study the effect of using two biologically treated mixtures and controlling with berseem hay for 140 days on feed intake, growth rate and feed efficiency of Barki sheep.

MATERIALS AND METHODS

All materials and methods used herein are the same as mentioned in Abdelhamid *et al.* (2006). Twenty four male Barki growing lambs (5 month age) were used in this study, all sheep were well examined clinically for parasitic infestation during the preliminary period of three days. All groups were fed at maintenance and growth requirements according to the recommendation of Kearl (1982). The animals were divided into three groups (8 animals in each) to be fed as follow: Group (1) fed on a diet containing 70% barley grains + 30% mixture-1[consisted of *Acacia saligna* (As) treated with *Pleurotus forida* and *Tamarix mannifera* (Tm) treated with *Pleurotus ostreatus*, 1:1 (Af + To)], as treatment (1). Group (2) fed on a diet containing 70% of barley grains + 30% mixture-2 [consisted of As treated with *P. ostreatus* and Tm treated with *P. florida*, 1:1 (Ao + Tf)], as treatment (2). Group (3) fed on a diet containing 70% barley grains + 30% berseem hay [BH], as a control treatment (3). The average initial live body weights [LBW] were 23.94 + 1.65, 22.86 + 1.68 and 23.74 + 1.84 Kg for T_1, T_2 and T_3, respectively. Each treatment was fed daily at 9 a.m. Refusals were collected just before offering the next day's feed. Daily intake was recorded for each group and fresh drinking water was available at all times the day. The animals were weighed at the beginning of the experiment then every two weeks and average live body weight changes were recorded for each animal. The offered diets were adjusted according to the changes of live animal. The offered diets were adjusted according to the changes of live body lambs weight. At the end of the experiment, rumen liquor samples were obtained by using a stomach tube and filtered through two layers of mesh cloth. The samples were taken before feeding (0 hr) and at 2, 4 and 6 hrs post-feeding. Also, at the end of the experiment, blood samples were taken from the jugular vein using heparinized blood cell counter, another samples were collected and immediately centrifuged to separate the plasma, which stored at -20°C for subsequent analysis. Blood hematological parameters (WBC, Lym, Mid, Gran., RBC, HGB, HCT, MCV, MCH, MCHC, RDW, PLT, PCT, MPV, and PDW) were determined by blood cell counter, Hycel Diagnostics (made in France). Total protein (Gomal *et al.*, 1949), albumin (Doumas *et al.*, 1971), urea-nitrogen (Fawcett and Scott, 1960), creatinine (Schirmeister *et al.*, 1964) and liver function [aspartate transaminase (AST), and alanin transaminase (ALT), Reitman and Frankel (1957)] were determined in blood plasma by using commercial kits. Rumen pH was determined by using digital pH meter. The concentration of ruminal ammonia-N was determined by the procedure of A.O.A.C. (1990). Total volatile fatty acids (TVFA's) in rumen liquor were determined according to Warner (1964). Statistical analysis of the collected data was carried out using SAS (1998) system for ANOVA procedure (one way analysis of variance, except for the rumen liquor evaluations and blood analyses were analyzed as factorial design, then Duncan's (1955) multiple range test was calculated when F was significant.

RESULTS AND DISCUSSION

Live body weight and daily gain:

Live body weights of lambs did not differ significantly ($P \geq 0.05$) as affected by ration type during the whole experimental period (Table 1). The data concerning body weight changes expressed as average daily gain (Kg) of the experimental lambs are presented in Table 2. Generally, lambs fed the control ration had the highest body weight followed by lambs fed mixture 1 and then those fed mixture 2. Average of daily gains differed significantly ($P \leq 0.05$) at the second period ($W_1 - W_2$) reflected that animals fed the control (berseem hay) ration had significantly the highest daily gain, being 0.201 Kg, comparing with those of mixture 1, but did not differ ($P \geq 0.05$) than mixture 2 being 0.119 and 0.166 Kg, respectively. The control group recorded the highest significant ($P \leq 0.05$) increase in daily gain, being 0.225 Kg, followed by those fed mixture 1 then those fed mixture 2, being 0.131 and 0.117 Kg, respectively at the third period ($W_2 - W_3$). Generally, at the whole experimental period ($W_0 - W_5$), lambs fed the control diet had significantly ($P \leq 0.05$) highest daily gain (0.190 Kg) with no differences between both the experimental mixtures 1 and 2, being 0.150 and 0.146 Kg, respectively. However, the average daily gain was not affected significantly by the experimental rations at the periods $W_0 - W_1$, $W_3 - W_4$ and $W_4 - W_5$. In this respect, Swingle *et al.* (1996) concluded that halophytes could become important feed resources at moderate inclusion levels. Also, Degen used as a sole feed for small ruminants because of low intakes and negative N balance. Yet, Degen *et al.* (2000) reported that offering *A. saligna* as a supplement had a positive effect on body mass change. Loss of body weight was reported by Youssef (1999), so, he suggested that saltbush can be added to goats up to 20% only of DM intake. He found that body gain decreased by 11.69% in kids fed air dried halophytic plants mixture when compared with those fed the traditional diet berseem hay. On the other hand, Godinez and Sanchez (2002) reported that live weight gain was higher in sheep fed diets containing spent maize straw treated with *P. ostreatus* than untreated maize straw, being 213 and 161 g, respectively. In this respect also, Hamza *et al.* (2005) concluded that biological treatment (*P. astreatus*) could be used successfully to enrich poor quality roughages and to improve digestibility coefficients and feeding values of cotton stalks and rice straw as well as it is helpful to eliminate environmental pollution.

Table 1: Monthly body weight (Kg) for lambs as affected by biological treatments (means ± SE).

Items	Mixture 1	Mixture 2	Control
No. of animals	8	8	8
Initial body weight	23.94 ± 1.65	22.86 ± 1.68	23.74 ± 1.84
W_1	29.49 ± 1.95	27.29 ± 2.06	28.56 ± 2.23
W_2	32.83 ± 1.66	31.94 ± 2.26	34.19 ± 2.42
W_3	36.19 ± 1.38	35.21 ± 2.03	40.48 ± 2.52
W_4	39.96 ± 1.83	39.18 ± 2.56	45.75 ± 2.47
W_5	44.88 ± 2.10	43.25 ± 2.27	50.31 ± 2.63

W = weight 1-5 = months

Table 2: Average daily gain (Kg) at monthly intervals for lambs as effected by the experimental diets (means ± SE).

Items	Mixture 1	Mixture 2	Control
No. of animals	8	8	8
1st month	0.198 ± 0.02	0.158 ± 0.02	0.172 ± 0.02
2nd month	0.119^{b} ± 0.02	0.166^{ab} ± 0.03	0.201^{a} ± 0.01
3rd month	0.131^{b} ± 0.03	0.117^{b} ± 0.03	0.225^{a} ± 0.02
4th month	0.135 ± 0.04	0.142 ± 0.02	0.188 ± 0.02
5th month	0.175 ± 0.02	0.146 ± 0.02	0.163 ± 0.02
Average W_0 - W_5	0.150^{b} ± 0.02	0.146^{b} ± 0.01	0.190^{a} ± 0.01

a – b: Means in the same row with different letters are significantly ($P \leq 0.05$) different.
W = weight. 0-5 = months

DM intake and feed conversion:

The averages of dry matter intakes of lambs given rations of biologically treated mixtures as compared to those of the control are presented in Table 3. The DM intakes (Kg / head / day) were 0.995, 0.992 and 1.183 for lambs fed mixtures 1, 2 and the control; TDN intake (g / head / day) and DCP intake (g / head / day) had the same trend of DMI (Kg / head / day). However, TDN intake/Kg gain was 4.65, 4.74 and 4.17 Kg for those day). However, TDN intake/Kg gain was 4.65, 4.74 and 4.17 Kg for those fed mixtures 1, 2 and the control, respectively. Also, DCP/Kg gain were 0.52, 0.52 and 0.46 Kg for mixtures 1, 2 and the control, respectively. Feed efficiency were 0.151, 0.147 and 0.161 for mixtures 1, 2 and the control. In this respect, Bakshi *et al.* (1985) reported that daily consumption of spent wheat straw (SWS) increased in DMI by 2.58% in buffalo feeding. Due to its soft texture, the daily consumption of SWS fed alone was between 10 and 11 Kg (9.0 Kg DM) indicating its acceptability by the animals. Also, they suggested that an increase in daily feed intake could probably be caused by the higher palatability. Animal's feed intake from halophytic plants is depending on the form or treatment of the plants (Youssef, 1999); yet, the supplementary feeding improves the intake and performance of the animals (Eid, 2003). On the other hand, some biological treatments improve the chemical structure and composition of the treated wastes and by-products (El-Ashry *et al.*, 2001). Therefore, these treatments improve also the intake, digestibility, feeding value and N-balance (Hamza *et al.*, 2006). Additionally, Godinez and Sanchez (2002) found that daily voluntary feed intake was higher in sheep fed spent maize straw (SMS) treated with *P. ostreatus* than those fed untreated, while feed conversion was lower with SMS diet comparing with those fed the untreated diet. Recently, Abdelhamid *et al.* (2006) reported that biological treatment of the used (in the present trial) halophytes led to improving the animal feed intake from these plants as a consequence of the improvements in their palatability as well as in their nutrients digestibility coefficients and utilization.

Table 3: Effect of feeding the experimental diets on average daily gain, DM intake and feed efficiency throughout the fattening period.

Items	Mixture 1	Mixture 2	Control
No. of animals	8	8	8
Initial body weight, Kg	23.94	22.86	23.74
Final body weight, Kg	44.88	43.25	50.31
Total body gain, Kg	20.94	20.39	26.58
Average daily gain, Kg	0.150	0.146	0.190
Feed efficiency, kg gain/kg DM	0.151	0.147	0.161
DM intake, Kg/h/day	0.995	0.992	1.183
Feed conversion ratio	6.633	6.795	6.226
TDN intake, g/h/day	698.22	691.67	791.87
TDN/Kg gain, Kg	4.65	4.74	4.17
DCP intake, g/h/day	78.11	76.56	87.77
DCP/Kg gain, Kg	0.52	0.52	0.46

Rumen liquor parameters:

Ruminal pH values of lambs fed the experimental diets are presented in Table 4. Ruminal pH values were not significantly ($P \geq 0.05$) affected by rations used; yet, the highest value of pH was recorded by the control group (6.83) followed by group fed mixture 1 (6.75) and group fed mixture 2 (6.73), respectively. Ruminal pH values tended to decrease with increasing time of sampling up to 4 hrs, thereafter tended to increase again at 6 hrs. Similar fed on treated rice straw and corn stalks with *Penicillium funculisms*, the minimum pH values were observed at 3 hrs post-feeding and tended to increase again at 6 hrs. On the other hand, Khorshed (2000) found that the rumen pH values of all biological treatments significantly ($P \leq 0.01$) decreased than those of the control.

concentrations of ruminal total volatile fatty acids (TVFA's) of lambs fed the experimental diets are presented in Table 5. The TVFA's concentrations were not affected significantly ($P \geq 0.05$) by dietary treatments; yet, animals fed the control ration had the highest TVFA value (9.64 meq/100 ml) followed by those fed mixture 1 (9.15 m eq / 100 ml) and mixture 2 (8.72 m eq / 100 ml), respectively. Increasing the sampling time decreased significantly the TVFA's values till 4 hrs and tended to increase again at 6 hrs. In this respect, Chandra *et al.* (1991) treated paddy straw with different fungal strains and found that TVFA's in rumen liquor of sheep was reduced comparing with untreated straw. Also, Deraz (1996) reported that TVFA's for animals fed biologically treated ration reached its maximum at 3 hrs post-feeding and started to decrease afterwards. Yet, Abd-El-Aziz (2002) concluded that TVFA's values were higher significantly at 3 hrs after feeding biological treated rations, then declined.

Table 4: Ruminal pH values of sheep fed the experimental diets.

Time (h)	Mixture 1	Mixture 2	Control	Overall mean ± SE
Zero hr	6.84 ± 0.09	6.80 ± 0.09	6.98 ± 0.06	6.87[a] ± 0.05
2 hrs	6.74 ± 0.07	6.71 ± 0.05	6.81 ± 0.07	6.75[b] ± 0.04
4 hrs	6.66 ± 0.04	6.65 ± 0.03	6.59 ± 0.03	6.63[c] ± 0.02
6 hrs	6.78 ± 0.09	6.76 ± 0.04	6.95 ± 0.05	6.83[ab] ± 0.04
Overall mean ± SE	6.75 ± 0.04	6.73 ± 0.03	6.83 ± 0.04	

A, b, c: Overall means in the same column with different letters are significantly ($P \leq 0.05$) different.

Table 5: Ruminal total volatile fatty acids concentration (m eq /100 ml) of sheep fed the experimental diets.

Time (h)	Mixture 1	Mixture 2	Control	Overall mean ± SE
Zero hr	10.44 ± 0.98	10.19 ± 0.60	8.81 ± 0.91	9.81[a] ± 0.49
2 hrs	9.22 ± 0.59	9.22 ± 0.57	10.76 ± 0.39	9.73[a] ± 0.32
4 hrs	7.92 ± 0.25	7.48 ± 0.62	8.81 ± 0.57	8.07[b] ± 0.30
6 hrs	9.01 ± 0.71	8.00 ± 0.44	10.16 ± 0.56	9.06[a] ± 0.36
Overall mean ± SE	9.15 ± 0.36	8.72 ± 0.32	9.64 ± 0.34	

A, b: Overall means in the same column with different letters are significantly ($P \leq 0.05$) different.

Ruminal ammonia nitrogen concentrations of lambs fed the experimental diets are presented in Table 6. Data showed that feeding lambs on biological treated mixtures significantly ($P \leq 0.01$) decreased the ammonia-N concentration from 33.27 mg/100 ml for the control, to 28.80 mg/100 ml for mixture 1 till 25.67 mg/100 ml for the animal group fed mixture 2, with no significant ($P \geq 0.05$) effect of sampling time. Similar results were

2, with no significant ($P \geq 0.05$) effect of sampling time. Similar results were obtained by Bader (1993) who reported that NH_3-N values of Ossimi rams fed biological treated ration were lower than those fed berseem hay plus molasses (control). In this respect, Wiedmeier *et al.* (1987) found that ruminal parameters were nearly unaffected by biological treatments of cattle feed. However, Ibrahim (2002) reported that the maximum concentrations of NH_3-N and VFA's were observed at 3 hours post-feeding. Moreover, he indicated that fungal treatment of agricultural by-products increased NH_3-N and total VFA's concentrations. In addition, El-Wakeel (2004) reported that there were large increases in VFA concentrations in response to enzyme treatment. She added that VFA concentrations were often inversely related to DM disappearance, a response that she cannot explain.

Table 6: Ruminal ammonia nitrogen concentration (mg/100 ml) of sheep fed the experimental diets.

Time (h)	Mixture 1	Mixture 2	Control	Overall mean ± SE
Zero hr	31.37 ± 2.49	29.25 ± 2.10	27.96 ± 2.88	29.53^a ±1.42
2 hrs	28.05 ± 2.17	25.00 ± 2.90	38.68 ± 3.99	30.58^a ±2.05
4 hrs	27.40 ± 2.49	22.90 ± 2.31	32.97 ± 3.67	27.76^a ±1.78
6 hrs	28.41 ± 0.81	25.54 ± 1.86	33.47 ± 2.33	29.14^a ±1.17
Overall mean± SE	28.80^b ±1.04	25.67^c ± 1.18	33.27^a±1.69	

A, b, c: Overall means in the same row or column with different letters are significantly ($P \leq 0.05$) different.

Hematology:

Data of the hematological parameters of the lamb groups fed the 3 tested diets are illustrated in Table 7. Data showed that most of the tested criteria reflected nearly similar values with no significant ($P \geq 0.05$) effect of the tested rations. However, HCT and MCV differed significantly ($P \leq 0.05$), being 44.43, 35.70 and 41.74% HCT for mixtures 1, 2 and the control; whereas MCV values were 34.94, 34.46 and 38.79 FL for mixtures 1, 2 and the control, respectively. On the other hand, RDW values significantly increased ($P \leq 0.05$) in groups fed mixtures 1 and 2 (14.67 and 14.34%) as comparing with the control group (13.70%), while, MPV values were significantly ($P \leq 0.05$) lower for animal groups fed mixtures 1 and 2 (7.68 and 7.69 FL) comparing with the control group (7.94 FL). Sampling time had a significant effect on PLT, PCT and MPV values, which decreased with increasing sampling time up to 6 hours. In this respect, many authors reported positive effect of biological treated roughages on the blood picture of small ruminants, particularly on blood proteins (Khorshed, 2000). Yet, Ibrahim (2002) found no significant differences regarding the effect of biological treatment of roughages on the blood criteria measured in sheep. Also, Abdelhamid *et al.* (2006) came to the same conclusion in the present study. However, it well known that some of macro (gill, fruit or flesh)-fungi produce secondary metabolites which destroy the red blood cells or negatively affect liver, kidney and heart's functions (Abdelhamid, 2000).

Table 7: Hematology of sheep fed the experimental diets (mean ± SE).

Items	Time	Treatments			Overall mean
		Mixture 1	Mixture 2	Control	
WBCS, Kμl	0	131.55±13.20	134.13±17.89	121.79±15.55	129.16± 8.78
	6	131.80±18.05	143.34±14.18	129.33±16.94	134.82± 9.25
Overall mean		131.68±10.89	138.74±11.61	125.56±11.22	
Lym. Kμl	0	3.29 ± 0.37	3.94 ± 0.61	3.09 ± 0.37	3.44 ± 0.27
	6	3.62 ± 0.51	3.99 ± 0.46	3.22 ± 1.99	3.61 ± 0.27
Overall mean		3.46 ± 0.31	3.97 ± 0.37	3.16 ± 0.27	
Mid. Kμl	0	7.41 ± 0.85	8.45 ± 1.78	7.92 ± 1.17	7.93 ± 0.74
	6	7.08 ± 1.26	8.75 ± 1.12	9.03 ± 1.30	8.29 ± 0.70
Overall mean		7.25 ± 0.74	8.60 ± 1.02	8.48 ± 0.86	
Grn. Kμl	0	120.85±12.30	120.97±15.93	110.78±14.26	117.53 ±7.98
	6	121.10±16.69	131.10±13.31	117.08±15.30	123.09 ±8.52
Overall mean		120.98±10.09	126.04±10.17	113.93±10.20	
RBCS, M/μl	0	13.69 ± 1.43	13.10 ± 2.57	11.63 ± 1.11	12.81 ± 1.02
	6	11.75 ± 0.32	10.63 ± 0.57	10.99 ± 0.85	11.12 ± 0.36
Overall mean		12.72 ± 0.75	11.86 ± 1.31	11.31 ± 0.68	
HCP, 221	0	33.17 ± 3.38	27.40 ± 1.17	28.40 ± 1.49	29.66 ± 1.33
	6	28.69 ± 0.57	27.62 ± 0.99	26.71 ± 2.04	27.67 ± 0.77
Overall mean		30.93 ± 1.75	27.51 ± 0.75	27.56 ± 1.24	
HCT, %	0	48.74 ± 5.19	35.26 ± 3.33	43.13 ± 2.81	42.38 ± 2.41
	6	40.12 ± 0.93	36.13 ± 2.04	40.35 ± 1.89	38.87 ± 1.01
Overall mean		44.43^{a} ± 2.75	35.70^{b} ± 1.90	41.74^{a} ± 1.68	
MCV, Fl	0	35.65 ± 0.57	34.94 ± 0.61	39.20 ± 3.14	36.60 ± 1.01
	6	34.22 ± 0.71	33.98 ± 0.54	38.38 ± 2.53	35.53 ± 0.94
Overall mean		34.94^{b} ± 0.47	34.46^{b} ± 0.41	38.79^{a} ± 1.96	
MCH, Pg	0	24.37 ± 0.62	26.37 ± 3.52	25.86 ± 1.74	25.53 ± 1.29
	6	24.47 ± 0.35	24.99 ± 0.64	26.82 ± 1.24	25.43 ± 0.50
Overall mean		24.42 ± 0.35	25.68 ± 1.75	26.34 ± 1.04	
MCHC, g/dl	0	68.45 ± 1.33	75.82 ± 1.50	66.55 ± 2.42	70.27 ± 3.57
	6	71.64 ± 1.72	73.49 ± 1.19	70.56 ± 1.60	71.90 ± 0.79
Overall mean		70.05 ± 0.97	74.66 ± 5.15	68.56 ± 1.48	
RDW, %	0	14.79 ± 0.31	14.37 ± 0.23	13.65 ± 0.28	14.27 ± 0.18
	6	14.54 ± 0.26	14.31 ± 0.22	13.75 ± 0.29	14.20 ± 0.16
Overall mean		14.67^{a} ± 0.20	14.34^{a} ± 0.16	13.70^{b} ± 0.20	
PLT, Kμl	0	1519.30±228.47	1547.20±114.51	1645.20±379.61	1570.57^{a} ±147.53
	6	1233.50±199.99	890.80 ± 104.66	923.10 ± 65.61	1015.80^{b} ±80.86
Overall mean		1376.40±151.36	1219.00±106.63	1284.15±204.96	
PCT, %	0	1.19 ± 0.19	1.21 ± 0.11	1.41 ± 0.39	1.27^{a} ± 0.14
	6	0.82 ± 0.01	0.68 ± 0.08	0.72 ± 0.05	0.74^{b} ± 0.05
Overall mean		1.01 ± 0.11	0.94 ± 0.09	1.07 ± 0.21	
MPV, FL	0	7.77 ± 0.14	7.75 ± 0.16	8.07 ± 0.28	7.86^{a} ± 0.12
	6	7.59 ± 0.13	7.62 ± 0.11	7.80 ± 0.09	7.67^{b} ± 0.06
Overall mean		7.68^{b} ± 0.10	7.69^{b} ± 0.09	7.94^{a} ± 0.15	
PDW, %	0	55.63 ± 2.03	52.69 ± 0.63	52.79 ± 1.32	53.70 ± 0.84
	6	54.22 ± 1.73	54.51 ± 2.10	52.79 ± 1.52	53.84 ± 1.01
Overall mean		54.93 ± 1.31	53.60 ± 1.09	52.79 ± 0.98	

A, b: Overall means in the same row or column with different letters are significantly ($P \leq 0.05$) different.

Blood proteins:

Values of total protein, albumin, globulin and A/G ratio for lambs are presented in Table 8. Blood proteins of lambs were not affected significantly with the dietary treatments nor with increasing sampling time up to 6 hrs. It indicated that animals did not suffer from any health problems that might affect the performance of the experimental animals. Similar results were obtained by El-Ashry *et al.* (2001). However, Khorshed (2000) reported that serum protein fractions and urea-N concentration of animals fed biologically treated ration were significantly higher than those fed untreated ration. It is important to note that all values of A/G ratio were higher than 1.00, which indicated that animals did not suffer from any health problems that might affect the performance of the experimental animals (El-Sayed *et al.*, 2002). The last authors studied the effect of feeding goats *T. viride* and *S. cerevisiae* treated roughages. They found that serum proteins (total protein, albumin, globulin and A/G ratio) and urea-N concentrations were significantly ($P \leq 0.05$) higher for goats fed biologically treated ration than those fed the untreated ration.

Table 8: Effect of biological treatment of halophytes on blood proteins level of sheep fed the experimental diets.

Items	Time	Treatments			Overall mean
		Mixture 1	Mixture 2	Control	
Total protein (g/dl)	0	6.68 ± 0.34	7.19 ± 0.34	6.75 ± 0.16	6.88 ± 0.17
	6	6.82 ± 0.31	6.58 ± 0.26	6.88 ± 0.26	6.76 ± 0.16
Overall mean		6.75 ± 0.23	6.89 ± 0.22	6.82 ± 0.15	
Albumin (g/dl)	0	3.81 ± 0.11	3.78 ± 0.20	3.93 ± 0.17	3.84 ± 0.09
	6	3.78 ± 0.16	3.77 ± 0.24	3.89 ± 0.21	3.81 ± 0.12
Overall mean		3.79 ± 0.10	3.78 ± 0.15	3.91 ± 0.13	
Globulin (g/dl)	0	2.88 ± 0.29	3.41 ± 0.39	2.82 ± 0.20	3.04 ± 0.18
	6	3.03 ± 0.34	2.81 ± 0.33	3.00 ± 0.27	2.95 ± 0.18
Overall mean		2.96 ± 0.22	3.11 ± 0.26	2.91 ± 0.17	
A/G ratio	0	1.41 ± 0.10	1.26 ± 0.16	1.50 ± 0.17	1.39 ± 0.08
	6	1.41 ± 0.16	1.59 ± 0.29	1.44 ± 0.20	1.48 ± 0.12
Overall mean		1.41 ± 0.09	1.43 ± 0.16	1.47 ± 0.13	

Kidney and liver functions parameters:

Data presented in Table 9 reflected the effect of treatments on kidney and liver functions of lambs. Values of urea-N were affected significantly ($P \leq 0.01$) by dietary treatments, the highest value was recorded by the control group, being 23.79 mg/100 ml, followed by the animals group fed mixture 1 (13.58 mg/100 ml), then the group fed mixture 2 (11.06 mg/100 ml). The increased blood creatinine by feeding biologically treated mixtures may be due to lower kidney function, being 0.3123 and 0.219 vs. 5.0880 for mixtures 1 and 2 comparing with the control, where Kidney function (Sarre, 1967) = 2.2 x urine volume (L) x specific gravity of urine. Since the dense urine is due to low water intake and hence low urine excretion, but concentrated (Zilva and Pannall, 1983 and Abdelhamid, 1996). However, there is a positive and strong correlation between water and feed intakes, water intake and dry matter digestibility and water intake and body weight gain (Najjoke *et al.*, 2004).

The AST activity differed but not significantly ($P \geq 0.05$), where the highest level was recorded by the animals group fed the control diet, being 45.48 u/L, 43.17 u/L for the group fed mixture 1, and 41.86 u/L for the group fed mixture 2. Sampling time had no significant effect on kidney or liver functions. In this respect, Fouad *et al.* (1998) reported that serum AST and ALT activities were higher for animals fed biologically treated rations comparing with the untreated one. However, El-Ashry *et al.* (2001) reported that, the use of biological treatments in feeding gouts is useful and did not cause any abnormal conditions in liver and kidney functions.

Table 9: Kidney and liver functions of sheep fed the experimental diets.

Items	Time	Treatments			Overall mean
		Mixture 1	Mixture 2	Control	
Urea-N (mg/dl)	0	13.72 ± 0.76	11.68 ± 0.89	22.28 ± 1.22	15.89 ± 1.01
	6	13.44 ± 1.38	10.45 ± 0.95	25.31 ± 1.80	16.40 ± 1.43
Overall mean		13.58^{b} ±0.77	11.06^{c} ±0.65	23.79^{a} ±1.11	
Creatinine (mg/dl)	0	1.34 ± 0.09	1.37 ± 0.05	1.39 ± 0.03	1.37 ± 0.03
	6	1.42 ± 0.06	1.39 ± 0.02	1.32 ± 0.03	1.38 ± 0.03
Overall mean		1.38 ± 0.05	1.38 ± 0.03	1.36 ± 0.02	
AST (µ/L)	0	40.79 ± 1.89	41.27 ± 2.00	44.89± 0.52	42.32 ± 0.96
	6	45.55 ± 0.92	42.46± 1.83	46.06 ± 1.55	44.69 ± 0.88
Overall mean		43.17 ± 1.16	41.86 ± 1.33	45.48 ± 0.81	
ALT (µ/L)	0	21.26 ± 1.56	20.49 ± 1.38	23.37 ± 1.50	21.71 ± 0.86
	6	21.73 ± 1.73	22.66 ± 1.90	20.96 ± 1.20	21.78 ± 0.92
Overall mean		21.50 ± 1.13	21.57 ± 1.17	22.16 ± 0.98	

A, b, c: Overall means in the treatments with different letters are significantly ($P \leq 0.05$) different.

Economical efficiency:

Data presented in Table 10 show that the return from body gain (LE) was 335.04, 326.24 and 425.28 from the animals fed mixtures 1, 2 and the control ration. While roughage costs (LE) for biological treated mixtures were lower than that of the control, where the roughage costs of mixture 1 were lower about 81.59% than the cost of roughage of the control ration. Also, mixture 2 roughage cost was lower than that of the control by 80.82%. Total feed cost (LE) for mixture 1 was lower than that of the control by 20.04%, while for mixture 2 was lower by 21.19% than that of the control group. However, total costs (LE) for the control group recorded the highest value, being 239.63 LE comparing with mixture 1 (202.48 LE) and mixture 2 (200.54 LE). Finally, it could be concluded that the economic efficiency of feeding biological treated mixtures consisted of halophytic plants treated with *P. ostreatus* or *P. florida* for lambs was higher than that of berseem hay and being 2.53 for mixture 1, 2.60 for mixture 2 and 2.29 for berseem hay groups. In this respect, Swingle *et al.* (1994) reported that incorporation into mixed diets would minimize potential adverse effects of the high salt content, low energy concentration, and content of antinutritional factors in halophytes on ruminant livestock production, and may provide higher economic returns than would be possible from direct grazing of halophytes. Deraz (1996) found that chemical and biological treatments of rice straw and corn stalks decreased the cost of feeds used to produce one Kg live body gain, also fungal treatment decreased the cost of TDN unit by 6.56 and 12.5% and of DCP by 27.74 and 31.26% for rice straw and corn stalks, respectively. Recently, Belewu and Ademilola (2002) fed goats on cotton waste treated with fungus (*Volvariella volvacea*) and found that the overall cost of feeds was reduced by as much as 36%. However, Allam *et al.* (2006) fed male desert goats a mixture of fodder shrubs (FS) consisted of 30% *Acacia saligna* and *Atriplex nummularia* as a roughage compared with berseem hay (BH) as a control. The roughage/ concentrate ratio was 40/60. They found that FS caused lower value of N-balance than BH; yet, they concluded that using feed blocks consisting of 60% concentrate feed mixture and 40% FS seems to be a good, practical and economical for feeding system for goats in the desert area.

Table 10: Economical efficiency of the experimental diets (dry matter basis).

Items	Mixture 1	Mixture 2	Control
Total body gain (Kg)	20.94	20.39	26.58
Return from body gain (LE)	335.04	326.24	425.28
Roughage dry matter intake (Kg)	33.23	34.65	64.50
Roughage cost (LE)	8.31	8.66	51.31
Barley grains intake (Kg)	106.13	104.17	101.13
Barley grains cost (LE)	124.17	121.88	118.32
Total feed intake (Kg)	139.36	138.82	165.63
Other cost (LE)	70.00	70.00	70.00
Total feed cost (LE)	132.48	130.54	169.63
Total cost (LE)	202.48	200.54	239.63
Feed cost LE/Kg. gain.	6.33	6.40	6.38
Final margin (LE)	132.56	125.70	185.65
Economic efficiency	2.53	2.60	2.29

These data were calculated according to the current local prices of one Kg body weight and feed ingredients used as follows: 16 LE/1 Kg and 795.45, 1170.21, 250, 250 LE./Ton of berseem hay, barley grains, mixtures 1 and 2, respectively.

CONCLUSION

Biological treatment of some salt plants (e.g. *Acacia saligna* and *Tamarix mannifera*) with white fungi (*Pleruotus ostreatus* and *Pleruotus florida*) can improve their chemical and structural compositions leading to better consumption, digestibility and feeding value. Therefore, these treated plants could be offered (with concentrates) for ruminants in desert near shores without negatively affecting animal's health and performance.

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دراسات على المعاملة البيولوجية للنباتات الملحية:
٢ – تجربة تسمين.

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أجرى هذا البحث بمحطة بحوث رأس سدر (بمحافظة جنوب سيناء) التابعة لمركز بحوث الصحراء بالتعاون مع قسم إنتاج الحيوان بكلية الزراعة – جامعة المنصورة بهدف دراسة تأثير استخدام المعاملة البيولوجية بفطريات العفن الأبيض لبعض النباتات الملحية(المخلوط الأول مكون من نباتات الأكاسيا المعاملة بسلالة الفلوريدا مع نباتات الطرفة المعاملة بفطر أوستريادس، أما المخلوط الثاني فيتكون من نباتات الأكاسيا المعاملة بفطر الأوستريادس مع نباتات الطرفة المعاملة بفطر الفلوريدا) لى تسمين الحملان البرقى. ويمكن تلخيص أهم النتائج المتحصل عليها كما يلي:-

الحملان المغذاة على دريس البرسيم حازت على أعلى وزن حي (غير معنوي) مقارنة بالمعاملات المعالجة بيولوجيا، الحملان المغذاة على دريس البرسيم أعطت أعلى زيادة معنوية في معدل الزيادة اليومية للوزن، أدت التغذية على المخلوطين ١، ٢ إلى أقل مادة جافة مأكولة / كجم وزن جسم/اليوم وأقل كفاءة غذائية مقارنة بالتغذية على دريس البرسيم، أوضحت التغذية على المخاليط من النباتات الملحية المعالجة بيولوجيا أعلى كفاءة اقتصادية مقارنة بدريس البرسيم، قيم قياسات سائل كرش الحملان المغذاة على دريس البرسيم كانت أعلى مقارنة بالمخاليط المعاملة بيولوجيا، لم تظهر أي فروق معنوية بين المعاملات عند تقدير صورة الدم في الحملان، لم تظهر التغذية على المعاملات المعالجة بيولوجيا أي حالات غير طبيعية في وظائف الكلى والكبد. وعليه فقد أفادت المعالجة الفطرية في تحسين استهلاك الحيوانات من هذه النباتات (نتيجة تحسين طعمها وهضميا والاستفادة منها) دون الإضرار بصحة وأداء الحيوانات. وعليه ينصح بتقديم بعض النباتات الملحية المعالجة بيولوجيا (مع المركزات) لحيوانات المناطق الصحراوية والساحلية دون خطورة.