NUTRITIONAL PERFORMANCE OF GROWING SHEEP FED SILAGE OF SALT TOLERANT PLANTS UNDER SOUTH SINAI CONDITIONS

S. Abo Bakr, H.G. Helal, E.Y. Eid and H.M. El Shaer

Animal and Poultry Nutrition Department, Animal and Poultry Production Division, Desert Research Center, Cairo, Egypt.

(Received 20/1/2020, accepted 1/3/2020)

SUMMARY

This experiment was conducted at Ras Sudr Research Station belonging to Desert Research Center to elucidate the effect of feeding salt tolerant plants (*Atriplex nummularia*, Fodder beet, Pearl millet) silage (STPS) on productive performance of male Barki sheep under arid and salinity conditions of Southern Sinai, Egypt. Sixteen male Barki sheep (31.42 ±1.79 kg and 4 months age) were randomly divided into two equal groups (8 each). The first group (control) was fed 40% berseem hay (BH) from total ration and served as control. The second group (STPS) was fed ad liptum salt tolerant plants silage (Atriplex nummularia 50%, Fodder beet 35% and Pearl millet 10%) and the final mixture was sprayed with 5% molasses. All experimental lambs were fed concentrate feed mixture (CFM) as 60% percentage for total rations according to nutrient requirements. Results revealed that wide variations in chemical composition of the experimental roughages. It can be seen that STPS have lower contents of Dry matter (DM), Organic matter (OM), Crude protein (CP), Natural detergent fiber (NDF), Acid detergent fiber (ADF), than BH. However, STPS was higher than BH in ash content. Voluntary feed intake showed not significant differences between the two experimental groups of total and CFM intake. However, STPS group had lower ($P< 0.05$) roughage intake than control group. Animals fed STPS had higher ($P<0.05$) crude protein digestibility than the control group. Moreover, there were not significant differences between the two experimental groups of DM, CF, NDF and ADF digestibility. Feeding STPS lowered ($P<0.05$) free drinking, fecal, urinary and total water execration than control group. Ruminal parameters declared that, there were no significant ($P< 0.05$) differences in pH values, ammonia nitrogen concentration and total volatile fatty acids concentrations. Commonly, all ruminal parameters in the present study were within normal range of sheep. Blood biochemistry parameters showed significant ($P<0.05$) increase only for total proteins in control group compared to STPS group. Vastly, all values of blood biochemistry were within the normal ranges. Results of blood picture parameters except for WBC's (significantly decreased for STPS group) were not affected ($P< 0.05$) by the experimental rations fed to lambs. Weights of fattened lambs are didn't appear any significant ($P<0.05$) differences between groups. On the other hand, the cheapest price of roughage for STPS group reflected positively on economical evaluation than that resulted by BH. It could be concluded that feeding salt tolerant plants silage without serious nutritional hazards, would be an avenue to overcome the problem of feedstuff shortage prevailed under arid and salinity conditions of Sinai, Egypt.

Keywords; *Barki lambs, Productive performance, Salt tolerant plants, Rumen and blood parameters.*

INTRODUCTION

In desert area of Egypt, the shortage of ruminant feeds especially in summer and early autumn seasons is the main challenge to increase indigenous animal production and improve livestock productivity (Mansour and Al-Zahar, 2018). In arid and semi-arid regions such as South Sinai, animal husbandry, as the main income resource for pastoralists, is mostly based on the natural vegetation for rearing small ruminates (Squires and El Shaer, 2016). Degradation of the rangeland is evident in many parts of desert Egypt as a result of overgrazing, low erratic rainfall and long drought periods (El-Shesheny *et al*., 2014). So, in late years, the International Center for Bio saline Agriculture (ICBA), UAE, and Desert Research

Center, Egypt, collaborated to improve livelihood and income of the local poor people in marginal lands by cultivating salt-tolerant plants as fodders for their livestock (El Shaer, 2010). Natural fodder shrubs such as *Atriplex nummularia* and some common cultivated salt-tolerant fodder plants e.g. pearl millet and fodder beet, might be used to fill the gap in feed production in saline and dry areas (Helal *et al*., 2018a).

Oldman saltbush (*Atriplex nummularia Lindl*.) has received increasing interest as livestock forage especially in arid zones because it's adapted to drought and water and soil salinity. Oldman saltbush produces important consumable biomass in areas where other crops cannot grow (Ben Salem *et al*., 2010).

Pearl millet (*Pennisetum glaucum, L. R. Br*.) is considered as potential salt-tolerant grass species and good quality fodders for sheep in Egypt (Anon, 2009).

Fodder beet is not a sensitive crop; it can tolerant the unfavorable conditions of reclaimed soils, and high water irrigation salinity (Heuzw *et al*., 2015). Moreover, it is typically high in total digestible nutrient (75.94%) as reported by Gabra and Gad (1999) but low with crude protein values of 6% (El-Eissawy *et al.,* 2011), high yielding in terms of nutritive value and low input utilizing farm resources (Mansour and Al-Zahar, 2018).

Many procedures have been used to utilize and enhance desert feed resource (e. g. ensiling). Ensiling salt-tolerant plants (STP) with other feed ingredients appeared to be the most convenient processing method under the prevailing conditions of aridity in Egypt. In addition, processing STP as silage form led to improve the quality of halophytes and enhanced their acceptability for small ruminants (El Shear, 2004).

In Egypt, there are about 5.6 million heads of different breeds of sheep (El-Far *et al*., 2014). Barki sheep is one of three main breeds in Egypt. About 470,000 heads of this breed are maintained along the desert rangeland areas of Egypt (El-Bassiony 2016), out of which 300-350 thousand weaned male lambs may be produced yearly (Ibrahim 2018). So, this study aimed to assess the effect of ensiling mixture of salt-tolerant plants on male lamb's performance during growing period.

MATERIALS AND METHODS

Experimental location: The present study was conducted in South Sinai Research Station which localized in Ras Sudr and belongs to Desert Research Center (DRC), Ministry of Agriculture and Land Reclamation, Egypt.

***Silage preparation and making*:** Three salt tolerant plants (STP), *Atriplex nummularia* (AN), fodder beet (FB) and Pearl millet (PM) were used for processing the experimental silage mixture. Both of AN and PM were collected and chopped to 3-5 cm. The fodder beet roots were chopped using fodder beet chopping machine. The chopped parts were mixed where AN represented 50%, FB 35% and PM 10% and the final mixture was sprayed with 5% molasses and ensiled as described by Abou El Nasr *et al*., (1996). The salt tolerant plants silage (STPS) was fed to the experimental animals after 42 days of making silage

***Animals and rations*:** Sixteen male Barki sheep (31.42 ±1.79 kg and 4 months age) were used in this study. Animals were randomly divided into two equal groups (8 each). All experimental lambs were fed concentrate feed mixture (CFM) as 60% percentage for total rations. While, the roughage part was diffed where the 1st lambs group (T1) received 40 % Berseem hay (BH) and consider as a control group. The 2nd lambs group (T2) fed *ad liptum* salt tolerant plants silage (STPS).

All experimental animals were weighed at the starting of the experiment and then biweekly till the end. The amounts of offered rations were adjusted according to lamb's weight according to Kearl (1982). Clean fresh water was offered twice daily. The growing experiment lasted for 120 days.

***Digestibility trails*:** At the end of growing period, digestibility trail was assessed. Twelve animals (6 animals/ group) were placed individually in metabolism cages for 14 days as an adaptation period followed by 7 days as collection period. During the collection period, voluntary intake of each diet was determined and total feces weight and urine volume were recorded daily and samples represented one tenth of the voided feces and exerted urine were taken daily just after collection. Samples of feed, refusals and feces were dried at 65 ˚C for constant weight and ground to pass through a 1.0 mm mach screen and kept for analysis. Feces and urine samples were composited separately for each animal and stored for chemical analysis. Urine samples were stored in tight bottles containing sulfuric acid (1:1) to

capture NH_3-N. Drinking water was recorded and offered at 12.00 pm and feed intake was offered at 8.00 am. At the end of the collection period, samples of rumen liquor were taken at zero time, 3 and 6 hours post feeding through stomach tube, then filtered through two layers of mesh cloth and were stored at (-18 ˚C) to determine rumen ammonia nitrogen (NH_3-N), pH and total volatile fatty acid (VFA's). Also blood samples were withdrawn from jugular vein at zero time before feeding and were stored at (-18 ˚C) to determine total proteins (TP), albumin (AL), globulin (GL), urea-N and creaatinine. All parameters of blood picture (erythrocytes cell counts, RBCs; white blood cells, WBCs; hematocrit, Hct; hemoglobin, Hb; mean corpuscular volume, MCV; mean corpuscular hemoglobin, MCH and mean corpuscular hemoglobin concentration, MCHC) were measured in whole blood using blood counter apparatus model Rayto Product RT-7600 Auto Hematology Analyzer.

***Analytical methods*:** Proximate analysis of CFM, BH, STPS, fecal samples and Ammonia nitrogen in the rumen fluid were determined according to AOAC (2007) in Animal Nutrition Laboratory of Desert Research Center. Total volatile fatty acids (TVFA's) were determined according to Warner (1964).

***Statistical analysis*:** Data obtained in this study was statistically analyzed by one way of variances according to SAS (2004) and the statistical model was: - $Y_{ij} = \mu + T_i + e_{ij}$, Where: Y_{ij} = experimental observation, μ = overall mean, T_i = effect of treatment, e_{ij} = experimental error.

Differences between means were compared by Duncan's multiple range test of Duncan (1955).

RESULTS AND DISCUSSION

Chemical composition of the experimental roughages and CFM: The present results revealed wide variations in chemical composition of the experimental roughages. It can be seen that STPS had lower contents of DM, OM, CP, NDF and ADF than BH. However, STPS was higher than BH in ash content by 46.5% (Table 1). These results are in agreement with those obtained by Abd El-Rahman (2008) and El Shaer (2010) who reported that, most of halophytes are naturally characterized by high ash content as they tolerate high salt concentration in soil.

Calculated TDN for STPS was higher than BH which may be due to the existence fodder beet and molasses in STPS which features with high energy content (El-Eissawy *et al.*, 2011). Moreover, El Shaer (2010) concluded that some halophytes seemed to be nutritious based on their moderate nutritive value which can meet the maintenance nutritional requirements for ruminants (Kearl, 1982).

Chemical analysis of CFM had content 13.8% and 10.8% for crude protein and fiber, respectively. Also it had moderate nutritive value as TDN (%) according to chemical composition of its included traditional ingredients.

Table (1): Chemical composition of experimental roughages.

Item	Experimental roughages			
	Berseem hay (BH)	Silage (STPS)*	± SE	CFM
DM	90.2[a]	41.35[b]	0.79	92.0
OM	85.6[a]	78.9[b]	0.18	88.7
CP	12.3[a]	8.7[b]	1.5	13.8
CF	25.9[a]	21.9[b]	0.80	10.8
EE	1.8	1.8	0.89	2.1
NFE	45.6[b]	46.5[a]	0.03	62.0
Ash	14.4[b]	21.1[a]	0.21	11.3
NDF	62.2[a]	54.4[b]	1.49	39.6
ADF	47.0[a]	32.7[b]	1.74	19.7
TDN**	59.83	61.49	---	71.38

*[a, b] means at the same row with different superscript are significant at level (P<0.05). *silage formed from Atriplex nummularia 50%; fodder beet 35%; Pearl millet 10%) and molasses 5%., Dry matter (DM), OM: Organic matter, CP: Crude protein, EE: Ether extract, CF: Crude fiber, NFE: Nitrogen free extract, NDF: Natural detergent fiber, ADF: Acid detergent fiber, ADL, CFM: concentrate feed mixture. **TDN: Total digestible nutrient for BH and CFM were estimated according to Adams et al., 1964.*

***Voluntary feed intake and digestion coefficient*:** Data in Table (2) showed that roughage intake as g DM/ kg BW was lower (P<0.05) for STPS group than that of control group, with values being 13.61 *vs* 18.26 g/kg BW. The same trend was observed for roughage CP intake. These findings may be due to high ash content (Fayed *et al*., 2010 and Hassan, 2009). Also, Attia-Ismail (2015) reported that halophytes and salt tolerant fodders contain high ash, high fiber content and low protein, which may decrease roughage intake.

Table (2): Feed intake and digestion coefficient of experimental rations.

Item	Experimental groups		±SE
	Control	STPS	
DM intake g/kg BW			
Concentrate	14.91	15.85	0.28
Roughage	18.26[a]	13.61[b]	0.28
Total	33.17	29.46	2.14
CP intake g/kg B. W.			
Concentrate	2.06	2.15	0.03
Roughage	2.25[a]	1.18[b]	0.14
Total	4.31	3.33	0.13
Digestibility coefficient %			
DM	57.53	56.57	1.00
CP	60.15[b]	70.75[a]	0.13
CF	47.49	43.33	1.85
NDF	56.39	54.99	0.60
ADF	49.69	51.08	0.96

[a, b] means at the same row with different superscript are significant at level (P<0.05).

Animals fed STPS tended to consume comparable amount of total DMI but in general lower than that fed the control ration (Table 2). Commonly, this result indicated that the silage could replace the berseem hay in the fattening rations. This finding is in agreement with those obtained by Abdul-Aziz *et al*. (2001).

Digestion coefficient of DM, CP, CF, NDF and ADF are shown in Table (2). Crude protein digestibility was higher (P<0.05) for STPS group than BH group. This result may be owing to that STPS provided more readily available energy which improves protein utilization (Mansour and Al-Zahar, 2018).

In general, lambs fed on STPS recorded acceptable digestion coefficient compared to lambs fed control group (Table 2). These results may be attributed to that fodder beet ration had the highest value of NFE and the lowest CF value (Mansour and Al-Zahar 2018), as well as fodder beet is characterized by high sugar and starch contents resulting in high nutrient digestion and most likely supporting microbial growth (Helal *et al*., 2012 and De Brabander *et al*., 1999).

***Water utilization*:** Water utilization (free drinking, fecal, urinary and total water execration) as affected by type of experimental rations is shown in Table (3). There was a significant difference between the experimental groups in free water intake, being values 123.4 and 208.3 ml/kg $BW^{0.82}$ for control and STPS groups, in order. Obviously, the high moisture content led to the low water intake as shown in STPS group. Such trend is close to that obtained by Ben Salem *et al (*2010) who reported that sheep or goats receiving the mixture of saltbush and cactus (are low nitrogen and fiber but high in sugars) would need less drinking water as compared to those fed on saltbush alone or supplemented with dry feedstuffs (i.e. concentrate feeds) and the values ranged between 0.5 and 7 L/day.

Free water intake was higher (P<0.05) for control than STPS group with values being 3.24 and 2.20 ml/ g DMI, respectively. This result is in agreement with those obtained by Abou El-Nasr *et al*., (1996) who reported that values of free water intake ranged from 2.09 to 3.90 ml/g DMI for sheep fed different forms of saltbush plants

Urinary, fecal and total water execration showed the same trend of free drinking water, hens, control group had higher (P<0.05) for urinary, fecal and total water execration than STPS group (Table 3).

Lower water execration in STPS than control group may be due to low free water intake. The similar results was observed by Pearce *et al*. (2010) who reported that increasing water retention for sheep grazed

salt bush as a results of the highest concentrations of vitamin E in the muscle of the salt bush-grazed and aiding the retention of water.

Table (3): Effect of experimental rations on drinking and excretion water of lambs.

Item	Experimental groups		±SE
	Control	STPS	
Free water intake ml/kg $Bw^{0.82}$	208.3[a]	123.4[b]	14.39
ml/g. DMI	3.24[a]	2.20[b]	0.14
Urinary water ml/kg $Bw^{0.82}$	68.68[a]	48.45[b]	4.44
Fecal water ml/kg $Bw^{0.82}$	48.06[a]	24.40[b]	4.70
Total water excre.ml/kg $Bw^{0.82}$	116.74[a]	72.85[b]	8.75

[a, b] means at the same row with different superscript are significant at level (P<0.05).

***Ruminal parameters*:** Data in Table (4) declared that, there were no significant differences in pH values at 0, 3 and 6 hrs. post-feeding as a result of feeding STPS for lambs. In similar, Helal *et al*. (2018a) reported that ruminal pH levels didn't differ significantly between animals fed mixture of halophytes or control. Generally, the mean pH values of rumen liquor in the present study are within the ranges reported by Suharti *et al*. (2015) being 6.8- 7.0.

The degree of acidity of rumen fluid is the main variable of rumen fermentation as it can alter the type of fermentation Orskov and Ryle (1990). Moreover, Attia-Ismail (2015) reported that cellulolytic bacteria reduced when the pH begins to fall below 6.0.

Values of ruminal NH_3-N concentration (Table 4) were not affected (P< 0.05) by the experimental rations although the concentration increased with increasing the time before feeding up to 6 hrs after feeding for all animals.

Commonly, NH_3-N concentration of rumen fluid in the present study remained within the normal range under normal conditions from 8.5 to 30 mg/100ml of rumen fluid (McDonald *et al*., 2002).

Table (4): Effect of tested rations on some rumen parameters of lambs.

Item		Experimental group		±SE
		Control	STPS	
PH	0 hr.	7.49	7.61	0.03
	3 hr.	7.03	6.97	0.04
	6 hr.	6.99	6.80	0.07
	Overall mean	7.17	7.13	0.01
NH_3-N (mg/100ml RL	0 hr.	13.06	16.12	1.04
	3 hr .	31.29	33.60	1.68
	6 hr.	19.83	21.60	1.35
	Overall mean	21.40	23.27	0.78
TVFA´s (meq/100 ml RL)	0 hr.	3.08	3.89	0.29
	3 hr.	6.17	7.23	0.37
	6 hr.	5.44	5.48	0.21
	Overall mean	5.53	4.90	0.21

[a, b] means at the same row with different superscript are significant at level (P<0.05).

The concentrations of TVFA were not significantly affected by the experimental rations (Table 4). The results in the current study were in agreement with that of Eid (2003) who found that, values of TVFA were not significantly affected when sheep fed silage of halophytic plants mixture or control ration. On the other hand, Masters *et al*. (2009) reported that animals fed salt rations led to reduction of TVFA production.

Generally, ruminal TVFA values obtained in this study were within the normal levels (3.2 - 7.47 meq/100 ml RL), which reported by Yossef (1999).

***Blood biochemistry*:** Blood TP of lambs fed STPS was lower (P<0.05) (5.68 g/dl) than that of control ration (6.66 g/dl) (Table 5). This finding may be explained as lower crude protein content of STPS compared to BH as shown previously in Table (1). These results were in agreement with those reported by Ibrahim *et al*. (2018) who reported decreases (P<0.01) in TP in ewes and their lambs which fed STP could be assigned to lower crude protein percentage in ration of STPS than BH. Furthermore, El-Shaer *et*

al. (2005) and Fayed *et al*. (2010) attributed the lowest values of total proteins, albumin and globulin for lambs fed STPS to high salt content of STPS compared to BH.

In this respect, Abdel-Ghani *et al*. (2011) recorded a positive correlation between dietary protein and level of serum TP in sheep. Average values of blood TP of animals fed experimental rations were within the normal range (5.84 -7.31 g/dl) of small ruminates under salt plants feeding conditions according to Helal *et al*. (2018b). On the other hand, values of AL, GL and AL/GL ratio were not significantly affected by the experimental rations. These results were in agreement with results reported by El-Essawy *et al.* (2011) who found no significant differences in these parameters when rams fed the FB plus alfalfa or FB plus *Atriplex nummularia* .

Table (5): Effect of the experimental rations fed to lambs on some blood biochemical and kidney function indicators.

Item	Experimental group		±SE
	Control	STPS	
TP (g/dl)	6.66[a]	5.68[b]	0.25
AL (g/dl)	3.20	3.03	0.13
GL (g/dl)	3.46	2.65	0.23
AL:GL ratio	0.99	1.12	0.09
Kidney function indicators			
Urea (mg/dl)	41.81	41.65	1.00
Createnine (mg/dl)	1.19	1.27	0.07

[a, b] means at the same row with different superscript are significant at level (P<0.05).

Generally, blood biochemistry parameters such as TP, AL and GL has a great importance as good indicators of nutritional status (EL-Gohary *et al.*, 2017). The present results showed clearly that feeding STPS didn't cause any side effects and all values of blood biochemistry were within the normal ranges and the animals of the present investigation were in good nutritional status.

The results of blood urea and createnine concentrations clarified that feeding STPS did not affect the kidney function (Table 5). The present results are in accordance with Eid (2003) who reported insignificant differences between sheep fed different roughage (silage of halophytes plants mixture or BH). The obtained values of urea nitrogen concentration were within the normal levels and had no adverse effect of kidney function in all animals groups (Hanafy *et al*., 2007). Similar insignificant results were obtained with blood createnine concentration (Table5). On the other hand, Shaker *et al*. (2014) reported that goats fed STP mixture decreased (P< 0.05) blood createnine concentration.

In general, the revealed values for blood createnine concentration (1.19 - 1.27mg/dl) were within the values (1.1 – 1.9 mg/dl) reported by Abdul and Daniel (2013) and Amuda and Okunlola (2018).

***Blood picture*:** Results of blood picture parameters except for WBC's (Table 6) were not affected (P< 0.05) by the experimental rations. WBC's was decreased (P<0.05) for STPS group compared to control group. These results were in agreement with those reported by Bhatti *et al*. (2009) who found that WBC's was significantly decreased for buffalo heifers fed roughage contained 66.5 % (*Pennisetum purpurium* plus *Atriplex amnicola*) compared with BH.

Table (6): Mean values of the hematological parameters of Barki lambs as affected by the experimental rations.

Item	Experimental group		±SE
	Control	STPS	
RBC's ($\times 10^6$ cells/ul)	11.86	11.31	0.15
WBC's ($\times 10^3$ cells/ ul)	9,20[a]	7.28[b]	0.46
Ht (%)	40.64	36.74	1.10
Hb (g/ dl)	8.22	8.38	0.14
MCV (fl)	32.46	32.24	0.42
MCH (pg)	7.18	7.84	0.19
MCHC (%)	21.92	24.2	0.72

[a, b] means at the same row with different superscript are significant at level (P<0.05).

Feeding STPS or BH resulted in insignificant differences in RBC's (Table 6). This result agreed with that reported by Fayed (2009) who found no significant changes in RBC's for sheep fed halophyte plants.

The comparable values of Ht, Hb, MCV, MCH and MCHC resulted by feeding lambs on STPS compared with BH emphasis that STPS could be successfully incorporated in rations of sheep in the desert area without any adverse effects on lambs. All values recorded for the previous parameters are within the normal ranges as reported by Amuda and Okunlola (2018). In addition, these results were in agreement with those obtained by Khalasi *et al*. (2010). Also, Alhadrami and Dakheel (2005) reported that feeding Awassi sheep high STP has no signs of illness or loss of appetite.

***Lambs performance*:** Weights of fattened lambs are present in Table (7) and didn't appear any significant ($P<0.05$) differences between groups. Although there were no significant effects ($P>0.05$) on total or daily BW gain, there was a trend that animals fed BH grew slightly better than those fed STPS. Average daily gain for control group was higher by 15.6% than STPS group.

These findings are in line with the results reported by Abu-Zanat (2005) who observed a significant effect of forage type on growth rate of Awassi lambs. Where lambs were fed alfalfa hay diet showed higher growth rate than those lambs fed ration containing *Atriplex* alone or mixed with alfalfa hay.

Generally, the obtained average daily gain by STPS was lower than that obtained in earlier studies (Gabr, 2002 and Eid, 2003) while Ghandour *et al*. (2014) found that the average daily gain ranged from 67.22 to 144.22 gm for lambs fed CFM plus different roughage (Acacia hay or BH, respectively). Also, Al Khalasia *et al.* (2010) showed that average daily gain ranged from 68.2 to 96.3 for lambs fed rations containing sorghum fodder irrigated with water containing three different concentrations of salt (3, 6 or 9 dS/m).

Table (7): Effect of the experimental rations on live body weight gain, feed conversion and economical evaluation of fattened lambs.

Item	Experimental group		±SE
	Control	STPS	
Initial BW (kg)	31.50	31.33	1.79
Final BW (kg)	46.57	44.35	2.25
Total gain (kg)	15.07	13.01	0.69
ADG (g)	100.26	86.75	4.68
Economical evaluation of the experimental rations			
Feed conversion (Kg DMI/Kg gain)	11.46	12.63	
Price of feed intake (L.E /d)*			
Concentrate	2.88	2.79	
Berseem hay	1.78	0	
Silage	0	0.94	
Total	4.66	3.73	
Feed cost /kg gain (L. E)	46.48	43.19	
Return from selling kg gain (L.E)	13.51	16.80	
Economic efficiency**	1.29	1.39	
Net revenue as %	100	124	

**Based on market prices at the beginning of the experiment .The price 4500, 3500 and 2000 L.E./ton of CFM, BH and STPS, respectively. The price of one kg live body weight at selling time was 60 L.E. **Economic feed efficiency expressed as the ratio between the price of total live body weight gain and the price of feed consumed to that gain.*

***Economical evaluation*:** The obtained findings revealed that the feed conversion expressed as kg DMI/kg gain were 11.46 and 12.86 for control and STPS groups, respectively. This result was in agreement with those obtained by El Shaer (2004) who reported that feed conversion ranged from 14.0 and 14.2 kg feed/ kg gain for sheep fed BH or halophytes silage, respectively. Also, Abdou *et al*. (2011) reported that feed conversion was 12.16 kg feed/ kg gain for goats fed BH plus CFM and 15.27 kg feed/ kg gain for goats fed *Atriplex nummularia* plus different desert concentrate feeds or halophytes silage, respectively.

Besides, the obtained resulted demonstrated that the highest feed cost per kg gain was recorded for control group due to higher price of BH (3500 LE/ton), however, the ration of STPS had lower feed cost (2000 LE/ton).

In spite of the highest total gain in control group, the highest price of BH and highest cost of kg gain reflected negatively return from selling live weights. On the other hand, the lowest total gain and the cheapest price of roughage for STPS group reflected positively (higher by 24%) return from selling live weights. Also, STPS group resulted in high net revenue by 24% over than that resulted by BH.

CONCLUSION

From aforementioned results, it could be concluded that, ensilage mixture of salt tolerant plants such as *Atriplex nummularia, Pearl millet* with fodder beet could be used successfully and safely for feeding lambs with no health challenges to the animals. Utilization of STPS could be considered as an attempt to reduce feed shortage and feeding cost and to enhance the economical feed efficiency in the arid and saline conditions prevailed in Southern Sinai, Egypt.

REFERENCES

AOAC (2007). Association of Official Analytical Chemists. Official Methods of analysis, 19th Edition, Washington, USA.

Abd El-Rahman, H. H. (2008). Improvement of the nutritive value of some unpalatable desert plants by ensiling treatment with palatable plants and molasses additives. J. Agric. Sci. Mansoura Univ. (33): 8001– 8010.

Abdel-Ghani, A. A. ; G. M. A. Solouma; A. K. I. Abd-Elmoty; Kassab, A. Y. and E. B. Soliman (2011). Productive performance and blood metabolıtes as affected by protected protein in sheep. Open J. Anim. Sci., (1):24–32.

Abdou.Ahlam R.; E.Y. Eid; A. M. El-Essawy; A.M. Fayed; H.G. Helal and H.M. El Shaer (2011). Effect of Feeding Different Sources of Energy on Performance of Goats Fed Saltbush in Sinai Journal of American Science., 7(1): 1040-1050.

Abdu l-Aziz, G. M.; A. S. Shalaby; A. M. Abd El Gawad; H. M. El Shaer and A. A. Fahmy (2001). Carcass quality of fattened sheep fed halophytic silage with non -conventional energy supplements in Egypt. In : Rubin OR. (ed.), Moran d-Fehr P. (ed.). Production systems and product quality in sheep and goats . Zaragoza : p. 35-39

Abdul-Waheed, A. B. and N. T. Daniel (2013). Haematologicaland Biochemical Profile of Growing Yankassa Rams Fed Sorghum Stover Supplemented with Graded Levels of Dried Poultry Droppings Based Diets. Pakistan Journal of Biological Science,16 (24):1922-1928.

Abou El Nasr, H. M.; H. M. Kandil; A. El Kerdawy; H. S. Dawlat, Khamis and H. M. El Shaer (1996). Value of processed saltbush and acacia shrubs as sheep fodders under the arid conditions of Egypt. Small Rumin. Res., (24)15–20.

Abu-Zanat, M. M. W. (2005). Voluntary intake and digestibility of saltbush by sheep. Asian Austr. J. Anim. Sci., 18(2): 214-220.

Al Khalasi, S. S.; O. Mahgoub; I. T.; Kadim; W. Al-Marzouqi and S. Al-Rawahi (2010). Health and performance of Omani sheep fed salt-tolerant sorghum (Sorghum bicolor) forage or Rhodes grass (Chlorisgayana). Small Ruminant Research, (91):93–102.

Alhadrami, G. A. and A. J. Dakheel (2005). Effect of feeding long term Sporobolus grass hay on growth performance of Awassi sheep. In: Proc. 6thAnnual UAE University Research Conference, (3) 55.

Amuda, A. J. and D. O. Okunlola (2018). Haematological Parameters and Serum Biochemistry of West African Dwarf Sheep Fed Ensiled Maize Stover and Concentrate Supplements. Journal of Agriculture and Veterinary Science, 11(5):57-63.

Anon. (2009). Introduction of salt-tolerant forage production systems to salt-affected lands in Sinai Peninsula in Egypt: a pilot demonstration

Attia-Ismail, S. A. (2015). Nutritional and feed value of halophytes and salt tolerant plants. In: El Shaer and Squires, (Eds). Halophytic and Salt Tolerant Feedstuffs: Impacts on Nutrition, Physiology and Reproduction of Livestock. 126: Vol. 106. 2015. CRC Press; New York.

Ben Salem, H.; H. C. A., Nefzaoui; D. E.; K. L. Mayberry, Pearce and D. K. Revell, (2010). Potential use of oldman salt bush (Atriplex nummularia Lindl.) in sheep and goats feeding. Small Ruminant Research, (91):13-28.

Bhatti, J. A.; M. Younas; M. Abdullah; M. E. Babar and D, H. Nawaz (2009). Feed intake, weight gain and Hematology in Nili-Ravi bufflo heifers fed on mott grass and berseem fodder substituted with salibush (Atriplex Ammivola). Pakistan Vet. J., 29(3): 133-137.

De Brbander, D. L.; J. L. De Boever; A. M. De Smet; J. M. Vanacker and C. V. Boucque (1999). Evaluation of the physical structure of fodder beets, potatoes, pressed beet pulp, brewers grains and corn silage. J. Dairy Sci., 82(1):110-121.

Duncan, D.B. (1955). Multiple range and multiple F- test. Biometris; 11:

Eid, E. Y. A. (2003). Feed utilization and performance of animals fed the natural and cultivated fodder shrubs in Sinai. Ph. D Thesis, Fac. Agric., Cairo Univ., Egypt.

El-Bassiony, M. F. (2016). Impact of increasing twining rate in Barki ewes on milk yield, milk composition and lambs performance up to weaning. Australian J. of Basic and Applied Sci., 10(18): 365-376.

El-Essawy, A. M.; E.Y. Eid; A. M. Fayed; A. R. Abdou; H.G. Helal and H.M. El-Shaer (2011). Influence of feeding foder beet with different forage as nitrogen sources under saline conditions on Barki rams performance in Southern Sinai. Egyptian J. Nutrition and Feeds, 14 (2): 191-205.

El-Far, A. H.; E.K. Bazh and M. S. Moharam (2014). Antioxidant and Antinematodal Effects of Nigella Sativa and Zingiber Officinale Supplementations in Ewes. Int. J. Pharm. Sci. Rev. Res., 26(1): 222-227.

EL-Gohary, E. S. H.; M. M. Fathala; M. A. H. El-Rayes; R. M. Abou-Aiana and M. M. Eissa (2017). Effect of Using Tanniniferous Plants Shrubs in Feeding Barki Ewes on some Productive and Physiological Parameters. J. Animal and Poultry Prod., Mansoura Univ., 8 (12): 467- 476.

El Shaer, H. M. (2004). Potentiality of halophytes as animal fodder under arid conditions of Egypt. Rangeland and Pasture Rehabilitation in Mediterranean Areas. Cahiers Options Méditerranéennes 62, 369–374.

El Shaer, H. M. (2010). Halophytes and salt tolerant plants as potential forage for ruminants in the Near East region. Small Ruminant Research, 91(1): 3-12.

El-Shaer H. M.; F. T. Ali; N. Y.S. Morcos; S.S. Emam and A. M. El- Essawy (2005). Seasonal changes of some anti-nutritional factors contents of some halophytic shrubs and the effect of processing treatments on their utilization by sheep under desert conditions of Egypt. Egyptian J. Nutrition and feeds, 8 (1):417-431.

El-Shesheny, M.A.; S.H. Hendawy; and K.M. Ahmed (2014). Assessment of productivity, botanical composition and nutritive value of some plant communities at Sidi-Barrani in North Western Coast of Egypt. Annals of Agricultural Science, 59(2): 155–163.

Fayed, Afaf M. (2009). In vitro and In vivo Evaluation of Biological Treated Salt Plants. American-Eurasian J. Agric. & Environ. Sci., 6 (1): 108-118.

Fayed, A. M.; A. M. El-Essawy; E. Y. Eid; H. G. Helal; A. R. Abdou and H. M. El Shaer (2010). Utilization of berseem and *Atriplex nummularia* for feeding sheep under saline conditions of South Sinai, Egypt. Journal of American Science, 6(12):1447-1461.

Gabr, M.G. (2002). First experience of Matrouh Resource Management Project in salt bush utilization for animal feeding. Int'l Symp. Optimum Utilization in Salt Affected Ecosystems in Arid and Semi-Arid Regions, Cairo, Egypt, April 8–11, pp. 419–425.

Gabra, M. A. and S. M. Gad (1999). Physical characteristics and feeding values of roots of some fodder beet varieties (Beta Vulgaris l.) with references to chopping size. J. Agric. Mansoura Univ., 24:4881:389.

Ghandour, M. M. A.; A. M. Fayed; G. M. Abdul-Aziz and M.A. Hanafy (2014). Effect of Using Polyethylene Glycol or Sodium Bentonite on Performance of Sheep Fed Acacia saligna. World Applied Sciences Journal, 32 (11): 2309-2316.

Hanafy, M. A.; A. A. Fahmy; M. S. Farghaly and A. El Shrerf (2007). Effect of using some fodder plants in diets on goats performance under desert conditions of Sinai. Egypt. J. Nutr. and Feeds, 10(1): 151-163.

Hassan, A. A. (2009). Effect of some enrichment and biological treatments on ameliortation utilization of Atriplex nummularia fed by sheep. Egyptian J. Nutrition and feeds. 12, (3):553- 566.

Helal, H. G.; A. R. Abdou; E.Y. Eid; A. M. El-Essawy; A. M. Fayed and H. M. El Shaer (2012). Nutritional studies on sheep saltbush supplemented with different desert energy sources under slain conditions in southern Sinai. Egypt. J. Nutr. and Feeds, 15(1): 49-61.

Helal, H. G.; S. Abo Bakr; E. Y Eid and H.M. El Shaer (2018a). Productive performance of Barki ewes fed halophytes added with Propionibacteria freudenreichii under saline conditions. Res. J. Anim. and Vet. Sci., 10 (2):18-27.

Helal, H. G.; E.Y. Eid; M. S. Nassar; H. S. Badawy and H. M. El Shaer (2018b). Comparative nutritional studies of ewes and does fed salt tolerant plants under desert condition. Nature and Science, 16(6)62-77.

Heuze, V.; G.Tran; and D. Sauvant (2015). Fodder beet roots. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. Htts://www. feedipedia.org/node/534.

Ibrahim, N. H.; A. S. El-Hawy; M. F. El-Bassiony; F. E. Younis and Abo S. Bakr (2018). Effect of Feeding Salt Tolerant Plants Silage on Productive Performance and Biochemical Changes of Barki Ewes and their Lambs during the First Month Post-Partum. J. Anim. and Poultry Prod., Mansoura Univ., 9 (8): 337 – 344.

Kearl, L. C. (1982). Nutrients requirements in developing countries. International Feedstuffs Institute Utah Agric. Exp. Stat.; Utah State University, Logan; USA.

Mansour, A. M. and Hoda Al-Zahar (2018). Feeding fodder beet roots supplemented with urea for lactating buffalo, Egypt. J. Nutr. and Feeds, 21(1): 1-13.

Masters, D.G.; D. E. Mayberry, and P.E. Vercoe (2009). Saltbush (*Atriplex nummularia L.*) reduces efficiency of rumen fermentation in sheep. Options Méditerranéennes, A/no. 85. Nutritional and foraging ecology of sheep and goats.

McDonald, P, R. A.; Edwards; J. D. F. Greenhalgh and C.A. Morgan (2002). Animal Nutrition. Sixth Edition. Pretice Hall. Gosport,London, 543 p.

Orskov, E. R. and Ryle. (1990). Energy Nutrition in Ruminant. Elsevier Application. Jhon Willey and Sons, New York. Owen, F.N. and J. A.

Pearce, K.L.; H.C. Norman and D. L. Hopkins (2010). The role of saltbush-based pasture systems for the production of high quality sheep and goat meat. Small Ruminant Research,(91): 29–38.

SAS Institute, (2004). Statistical Analysis System; STAT/ user's guide; Release 9.1; SAS Institute; Cary NC. USA.

Shaker, Y. M.; N. H., Ibrahim; F. E. Younis and H. M. El Shaer (2014). Effect of Feeding Some Salt Tolerant Fodder Shrubs Mixtureon Physiological Performance of Shami Goatsin Southern Sinai, Egypt Journal of American Science10(2s).66-77.

Squires, V.R. and , H. M. El Shaer (2016). Global distribution and abundance of sources of halophytic and salt tolerant feedstuffs. pp3-20. In: V.R. Squires and H.M. El Shaer Halophytic and salt-tolerant feedstuffs: Impacts on nutrition, physiology and reproduction of livestock. CRC Press. pp415.

Suharti, S.; A. R., Nasution Nuraliyah and , N. Hidayah (2015). The potential of canola and flaxseed oil protected by calcium soap for optimizing in vitro rumen microbial fermentation of beef cattle. Pros Sem Nas Masy Biodiv Indon, (1):89-92.

Warner, A.C.I. (1964). Production of volatile fatty acids in the rumen, Method of measurement. Nutr. Abstract and Review, 34: 339.

Youssef, K. M. (1999). Improving the palatability and nutritive value of some range plants for goat feeding in Sinia. Ph.D. Thesis. Fac. of Agric. Ain Shams Univ., Egypt.

الأداء الغذائى للأغنام النامية المغذاة على سيلاج النباتات المتحملة للملوحة تحت ظروف جنوب سيناء

صلاح أبوبكر ، حسن جودة هلال ، إيهاب يحيى عيد و حسن محمد الشاعر

قسم تغذية الحيوان والدواجن- شعبة الإنتاج الحيوانى والدواجن- مركز بحوث الصحراء- المطرية- القاهرة- مصر.

نفذت هذه الدراسة بمحطة بحوث جنوب سيناء (رأس سدر) واشتملت على جزئين ،أولهما تجربة تسمين تم إجرائها من خلال 16 ذكر برقى نامى بمتوسط وزن 31,42 كجم قسموا الى مجموعتين متساويتين وغذوا معاملتين تجريبيتين، المعاملة الأولى: دريس برسيم (40% من العليقة الكلية) والمعاملة الثانية: سيلاج النباتات المتحملة للملوحة والذى تم تقديمه للشبع. تم تصنيع السيلاج من القطف الملحى 50%، بنجر العلف 35%، الدخن 10%، بالإضافة الى 5% مولاس. تم تقديم مخلوط العلف المركز لكلا المعاماتين بنسبة 60% طبقا للاحتياجات الغذائية والتغير فى الوزن. تلى ذلك الجزء الثانى والذى اشتمل على تجربة التقييم الغذائى وذلك باختيار 12 حيوان من الجزء الاول لوضعهم فى صناديق الهضم وتغذيتهم نفس العليقتين المختبرتين (المقارنة والسيلاج) لتقدير الماكول وماء الشرب ودراسة بعض مقاييس الكرش والدم.

أوضحت نتائج التحليل الكيماوى للعلف الخشن أن دريس البرسيم كان أعلى فى محتواه من المادة الغذائية (المادة الجافة، المادة العضوية، البروتين الخام ومكونات الالياف) ما عدا الرماد ومجموع المركبات الغذائية المهضومة الذى ارتفع فى سيلاج النباتات المتحملة للملوحة. سجلت حملان المجموعة الثانية انخفاضا معنويا فى كمية المأكول من العلف الخشن (السيلاج) مقارنة بالمجموعة المقارنة (الدريس) فى حين لم يكن هناك اختلافات معنوية فى كمية المأكول من مخلوط العلف المركز والمادة الجافة الكلية الماكولة . لم يكن هناك اختلافا معنويا فى معاملات هضم المادة الغذائية (المادة الجافة، الالياف الخام ومكوناتها) بين المجموعتين ماعد معامل هضم البروتين الخام الذى زاد معنويا فى مجموعة السيلاج مقارنة بمجموع دريس البرسيم. أظهرت نتائج ماء الشرب أن المجموعة المقارنة كانت أعلى معنويا مقارنة بمجموعة السيلاج، وعلى الجانب الاخر سجلت مجموعة السيلاج ارتفاعا معنويا فى كلا من ماء البول والروث وكمية الماء الكلى الخارج. لم يكن هناك اختلافات بين مجموعتى المقارنة والسيلاج فى قياسات الكرش (pH , تركيز الامونيا وتركيز الاحماض الكلية الدهنية الطيارة) سواء كان ذلك فى أوقات التغذية المختلفة (قبل التغذية وبعدها بثلاث أو ست ساعات) أو كمتوسط عام . كان من نتائج التغذية على سيلاج النباتات المتحملة للملوحة أنها أدت الى انخفاض معنوى فى قيم البروتينات الكلية لسيرم دم الحملان عند مقارنتها بمجموعة دريس البرسيم فى حين لم يكن هناك اختلافات بين المجموعتين فى قيم الالبيومين، الجلوبيولين وكذلك الكرياتنين واليوريا. الا أنه بصفة عامة كانت كل القيم داخل المدى الطبيعى. لم تؤدى التغذية على السيلاج الى ظهور اختلافات فى صورة الدم للمعاملتين ما عدا خلايا الدم البيضاء والتى انخفضت معنويا فى مجموعة السيلاج مقارنة بمجموعة دريس البرسيم أوضحت نتائج الأداء الإنتاجى للحملان أنه لم يكن هناك اختلافات معنوية فى كلا من الاوزان النهائية، الزيادة الوزنية الكلية والزيادة الوزنية اليومية الا أن الزيادة الوزنية اليومية كانت أعلى بمقدار 15,6% لصالح مجموعة دريس البرسيم مقارنة بمجموعة السيلاج . كان لانخفاض سعر السيلاج مقارنة بسعر دريس البرسيم أثرا ايجابا فى نتائج التقييم الاقتصادى حيث كانت تكلفة إنتاج كجم وزن حى أقل من مجموعة دريس البرسيم وكان الناتج من بيع كجم زيادة وزنية أعلى مما أدى الى تحسن فى صافى الدخل بمقدار 24% لصالح مجموعة السيلاج مقارنة بمجموعة دريس البرسيم. لذا توصى الدراسة بأنه يكون من المفيد جدا عمل مخاليط علفية (القطف ، الدخن وبنجر العلف) متزنة غذائيا وأجراء بعض المعاملات التصنيعية (السيلاج) لها لاستخدامها فى تغذية الحملان خلال مراحل نموها حيث أنها أظهرت نتائج ايجابية على الأداء الإنتاجى والاقتصادى للحيوانات بجانب أنه لم يكن لاستخدامها أى آثار ضارة على الحملان وكذلك فهى أقل تكلفة من العلائق التقليدية وبالتالى فان استخدامه تحت الظروف الملحية يعتبر حلا مناسبا للسيطرة على نقص الاعلاف وسد الفجوة الغذائية مما يؤدى الى تنمية قطاع الإنتاج الحيوانى فى هذه المناطق.