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IMPACT OF PROLONGED FEEDING HALOPHYTIC PLANTS ON EWE'S REPRODUCTIVE AND PRODUCTIVE PERFORMANCE

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ABSTRACT

Sixty Barki ewes (3-4 years old and 37.62±6.46 Kg body weight) in the breeding season were used to the end of the weaning season. Ewes were allocated randomly to three equal groups. First group (control) was fed *ad libitum* berseem hay; second and third groups were fed *ad lib* fresh and silage *Atriplex+Acacia*, respectively. All groups were supplemented with crushed barley grains. Results indicated that ewes fed silage diet recorded the higher dry matter intake (Kg/head/day) during early and late gestation and suckling periods. *Atriplex+Acacia* diets either fresh or silage decreased (P<0.05) ewes body weight at lambing comparing with control (48.63 and 47.55 *vs.* 51.23 Kg, respectively). Ewes fed *Atriplex+Acacia* diet either silage or fresh lost (P<0.05) less body weight during suckling period comparing with control group (2.95 and 4.59 *vs.* 5.14 Kg, respectively). The apparent digestibility of DM, OM, CP, EE, and NFE for fresh and silage *Atriplex+Acacia* diets decreased (P<0.05) comparing with control diet. CF digestibility of silage diets was comparable to the control diet and both were higher (P<0.05) than the fresh halophytic diets. TDN and DCP values were decreased (P<0.05) related to consumption of halophytic diets either fresh or silage. Ewes group fed silage recorded higher daily milk production and lower fertility index (lambing rate: 100, 95 and 85 for control, fresh and silage groups, respectively). Some illness symptoms appeared on lambs at the first week of lambing of ewes in groups fed *Atriplex+Acacia* diets either fresh or silage especially silage group (tremors and convulsion of limbs so they were unable to suck their dams). Silage ewes group showed higher lamb mortality (11.1, 16.7 and 35.3% of born alive for control, fresh and silage groups, respectively). Offspring birth weight did not significantly affect. Lambs daily BW gain was 190.22, 165.05 and 159.67 g/day for control, fresh and silage *Atriplex+Acacia* groups, respectively. Blood minerals concentration were significantly affected (P<0.05) by the dietary treatments being mostly lower with halophytic forages groups than those of control. The same trend was noticed on milk yield. We can conclude that feeding Barki ewes halophytic plants especially as silage for long-term during breeding, pregnancy and lactation seasons could cause illness problem to their offspring and increase the mortality rate which may be due to deficiency in some important and necessary minerals for fetus growth during gestation.

***Keywords**: Atriplex+Acacia*, dry matter intake, nitrogen balance, gestation, suckling, milk production, daily gain, blood parameters.

INTRODUCTION

Livestock production is facing several major constrains mainly: drought, and environmental changes and stresses. The most critical environmental constrains affecting livestock productivity are erratic and short duration of rain precipitation lead to long drought periods, salinity stress, erosion stress, diurnal variation in ambient temperature and heat and wind stress. These environmental constrains lead to shortage of feed resources (quantitative & qualitative) and feed supplementation on ranges and increasing salinity of the available feed and drinking water. So, *Atriplex spp., Slsola spp., Medicago spp., Stipa grostis spp., Nitraria retusa, Zygophylum spp., Acacia spp., Hamada scoparia and Plantago spp.*, are the most

common plants under these conditions (El-Shear, 1995).

Acacia sp. and Atriplex sp. plants are the most important introduced plants that can suite the environmental conditions of Egypt (El-Shaer and Gihad, 1992). These plants may be used as sources of green biomass during the dry season or when pasture availability is low. These plants are characterized by Deficiency of available carbohydrates, anti-nutritional as secondary metabolites (phenols, tannins, oxalates and salts) which reduce the utilization of these plants. Energy supplementation (Hassan *et, al.*, 1982), ensiling process (Abou El-Nasr *et al*., 1996), feeding in a mixture (Shawket, *et al*., 2001and Shawket *et al*., 2010) and physical and chemical treatments (Makkar and Singh, 1992 and Khazaal and Ørskov, 1994) are the most methods which are used to improve the utilization of these plants.

The aim of this study was to evaluate the effects of long-term feeding halophytic plants in fresh or silage form on the Barki ewe's productive and reproductive performance and lambs birth and weaning weight.

MATERIALS AND METHODS

Silage preparation and quality

Leaves and succulent stems of fresh *Atriplex halimus* (saltbush) and fresh *Acacia saligna* (leguminous trees) shrubs were collected and chopped at 2-3 cm length, then ensiled with adding molasses at rate of five percent (on DM basis). Ensiled materials were filled in special places ($3x2x2m^2$, each), stocked by trampling and finally covered with a plastic sheet and a 30 cm layer of sand to ensure anaerobic fermentation for at least one month before using for feeding the experimental animals.

For determination of silage quality, 25 gm of wet silage was extracted in a blender with 100 ml of distilled water for 10 minutes. The homogenate was filtrated through four layers of chess cloth. The filtrate was used for measuring PH, ammonia nitrogen (NH_3-N) and total and individual volatile fatty acids concentrations (VFAs).

Animals

Sixty Barki ewes (a desert breed in North Africa, 3-5years old and 37.62±6.46 kg body weight) were used. Trial started before breeding season and continued during pregnancy period till weaning lambs at 16 weeks age. Ewes were randomly divided into three groups, each of twenty ewes. Housed separately in shaded pens and fed according to the experimental allowances assigned during pregnancy and lactation periods. Ewes exposed to rams for two estrus cycle length.

During lactation, daily milk yield was measured biweekly starting from lambing until the end of 16^{th} week of lactation using the standard hand-milking procedure after separation of lambs from their dams. Milk samples were collected biweekly for chemical analysis. Standard reproductive parameters were recorded during breeding and up to lambing. Shrunken live body weight of ewes was recorded biweekly. Birth and weaning weights of lambs were also recorded.

Experimental diets

Three *ad libitum* basal diets were used; Berseem (*Trifolium alexandrium*) hay as control group, fresh Atriplex (*Atriplex halimus*) plus fresh Acacia (*Acacia saligna*) as group 2 and Atriplex silage plus Acacia silage for group 3. All animal groups were supplemented with crushed barley grains to cover their requirements of energy for pregnancy and lactation as recommended by NRC (1985). Experimental diets were offered daily to animals indoors. Each type of roughage offered in a separate feeder. Amounts of feed offered and refused were daily recorded to estimate the actual voluntary feed intake for the three experimental groups. Fresh tap water was made available for drinking once daily after the morning feeding.

Digestibility trials

At the end of lactation period the trial of nutrients digestibility and nitrogen balance were conducted using three ewes, chosen randomly for each experimental diet. The digestibility trials lasted two weeks, the first as a preliminary

period in metabolic cages, followed by 7 days as collection period. The animals were weighed at the beginning and end of the metabolism trials. Animals were housed in individual metabolic cages. During the metabolism trials, animals fed the same experimental allowances. Faeces and urine were quantitatively collected from each animal. Ten percent of each faecal sample was taken and dried at 65 °C for a constant weight. Urine samples were daily collected in containers of 100 ml size. 10%, v/v H_2SO_4 and 10% of daily urine collected were taken and composed. Experimental animals drank once daily and drinking water was recorded. At the end of the digestibility trial, composed samples of refused feeds and feces were separately mixed, finally ground and kept for chemical analysis.

Blood samples were collected at the end of the digestibility trials at times 0, 3 and 6 hours post feeding from the jugular vein.

Analytical methods

Proximate analyses of diets, residues, feces, urine and ammonia nitrogen concentration in silage were determined according to the procedure of A.O.A.C. (1995). PH was determined using Acumen PH meter. Total VFA's concentration was determined by steam distillation (Warner, 1964). Silage acids molar proportions were determined by gas chromatography (Jouany, 1982). Extractable total phenols and total tannins in feeds offered were determined as described by Makkar and Godchild (1996). Total oxalates were determined according to the method of Hodgkinson (1971). Sodium (Na), potassium (P) and calcium (Ca) were determined after digestion with sulphuric acid using flame photometric procedure (Jackson, 1958). Zinc (Zn), magnesium (Mg), copper (Cu) and selenium (Se) were also determined after digestion with sulphuric acid using atomic absorption trophotometer (Unicam 919).

Statistical analysis

Data were statistically analyzed using the method of least square analysis of variance using software SPSS 10.0 of windows (SPSS, 1999). Differences in mean values among experimental groups were compared by Duncan's Multiple Range Test (Duncan, 1955).

RESULTS

The physical and fermentative characteristics of silage

The silage physical characteristics were; moister with pleasant aroma, normal odor without any objection after smell, golden yellow in color and pleasing test without any mold sliminess or mushy root. The fermentative characteristics of the ensiled materials (Table 1) indicated that PH value of *Acacia* silage was higher than that of *Atriplex*. But, on the other hand, values of the total volatile fatty acids (TVFA's) and ammonia-nitrogen (NH_3-N) of *Acacia* silage were lower than that of *Atriplex* silage by 32 and 65%, respectively. Composition of VFA's (%) indicated that *Acacia* silage had higher lactic, butyric, isobutyric and valeric acids than *Atriplex* silage by about 17, 5, 50 and 7 times, respectively, while *Atriplex* silage had higher acetic, propionic and isovaleric acids than *Acacia* silage by about 32, 48 and 5%, respectively.

Table 1: The fermentation characteristics of *Atriplex* and *Acacia* silages

Item	*Atriplex* silage	*Acacia silage*
PH	3.50	4.24
TVFA,s .mol/100gm DM	0.56	0.38
NH_3-N, mg/100gm DM	7.74	2.70
Composition of acids %:		
Lactic acid	49.82	58.32
Acetic acid	32.67	24.71
Propionic acid	6.99	4.71
Butyric acid	9.81	10.31
Isobutyric acid	0.12	0.18
Valeric acid	0.18	1.38
Isovaleric acid	0.41	0.39

Chemical composition of feed ingredients

Data of the chemical composition of ingredients of experimental diets are presented in Table (2). Dry matter content of Berseem hay was higher than that of Fresh *Atriplex* and fresh Acacia by 3.1 and 2.9 times, respectively. *Atriplex* contain higher CP by about 1.2 times and ash by 1.7 and 1.9 times than B. hay and Acacia, respectively. However, *Atriplex* contain less CF and NFE than B. hay and Acacia (15.85 *vs*. 31.39 and 22.22 % and 41.01 *vs*. 42.25 and 49.14 %, respectively). It was noticeable that the chemical composition of fresh *Acacia* was comparable to B. hay except that B. hay had higher CF percentage content than fresh *Acacia. Atriplex* and *Acacia* as fresh forages had lower DM content compared to *Atriplex* and *Acacia* silages (27.50 and 39.67 *vs.* 30.19 and 41.98%, respectively).

On the other hand, *Atriplex* had higher content of oxalates than *Acacia* by about 9.1 times, while *Accacia* had higher content of phenols and tannins than *Atriplex* by about 3.6 and 149.3 times, respectively. It was noticeable that ensiling process of fresh *Atriplex* or *Acacia* decreased the anti-nutritional factors content in these halophytic plants like phenols, tannins and oxalates by 43.8, 67.0 and 27.5% in *Atriplex* and by 42.6, 56.0 and 34.0% in *Acacia*, respectively.

It was noticeable that *Atriplex,* fresh or silage contains higher concentrations of sodium (Na), potassium (K), magnesium (Mg), cupper (Cu) and selenium (Se) than Acacia, fresh or silage (Table 3). Generally, *Atriplex* and *Acacia* silages contain lower minerals concentration than fresh *Atriplex* and fresh *Acacia.*

Voluntary feed intake and body weight changes

Dry matter intake (DMI, kg/ewe/day) of ewe dams increased ascending from early to late gestation to suckling (Table 4). It averaged 1.33Kg, 1.57Kg and 1.80Kg, respectively, for control group versus 1.13, 1.48 and 1.73Kg for fresh *Atriplex+Acacia* group and 1.27, 1.68 and 1.91Kg, for *Atriplex+Acacia* silages group, respectively. Although there were no significant differences among the three dietary treatment groups, it was noticed that ewes group fed silage of both *Atriplex* and *Acacia* recorded higher DMI during most physiological periods compared with the other two groups.

Table 2: Chemical composition and anti-nutritional factors content (% on DM basis) of feed ingredients

Nutrients	Berseem hay	Barley grains	Atriplex		Acacia	
			fresh	silage	fresh	silage
DM	86.31	90.54	27.5	30.19	39.67	41.98
CP	13.88	11.1	16.28	12.35	13.77	11.69
EE	3.17	3.48	3.96	3.98	2.72	4.04
CF	31.39	4.42	15.85	12.64	22.22	21.29
Ash	10.31	3.15	22.9	18.59	12.15	8.05
NFE	42.25	77.85	41.01	52.44	49.14	54.93
Anti-nutritional factors						
Phenols	2.57	2.51	2.35	1.32	8.41	4.83
Tannins	0.28	1.3	0.03	0.01	4.48	1.97
Oxalates	3.88	0.26	4.29	3.11	0.47	0.31

Table 3: Minerals content of feed ingredients (on DM basis)

Minerals	Berseem hay	Barley grains	Fresh Atriplex	Fresh *Acacia*	*Atriplex silage*	*Acacia silage*
Na %	0.98	0.21	4.99	1.15	3.4	0.81
K %	1.21	0.18	2.99	1.05	1.44	0.71
Ca %	1.77	0.19	2.08	3.75	1.63	2.63
Mg g/kg	11.25	1.65	15.63	6.14	10.52	4.88
Zn mg/kg	156.2	170.6	133.5	140.5	112.3	119.6
Cu mg/kg	55.32	49.65	60.52	45.65	49.88	35.14
Se ppm	5.82	1.44	19.65	11.85	19.55	9.25

Table 4: Dry matter intake, changes in body weights and milk yield of ewes fed experimental diets

Items	Control	Fresh[1]	Silage[2]	Sig
Dry matter intake, Kg/head/day				
Early gestation	1.33	1.13	1.27	NS
Late gestation	1.57	1.48	1.68	NS
Suckling	1.8	1.73	1.91	NS
Body weight, Kg				
Initial	37.63 ± 1.55	37.77 ± 1.37	37.53 ± 1.49	-
At lambing	51.23^{a} ±1.76	48.63^{b} ±1.87	47.55^{b} ± 2.01	*
At weaning	45.09 ± 1.21	44.04 ± 2.06	44.60 ± 2.58	NS
Body weight changes, Kg				
Overall	7.46^{a} ± 0.85	6.27^{b} ± 0.44	7.07^{a} ± 0.37	*
Before lambing	13.60^{a} ± 0.67	10.86^{b} ± 0.79	10.02^{b}± 0.91	**
Lambing to weaning	-6.14^{b} ± 0.22	-4.59^{a} ± 0.44	-2.95^{a} ± 0.22	**
Daily milk production ml/ewe/day	300.49±3.95	296.85±1.86	332.89±3.29	NS

[1] Fresh *Atriplex+Acacia* diet [2] Silage *Atriplex+ Acacia* diet

Means in the same row not sharing a superscript were significantly *P<0.05, **P<0.01

Table 5: Digestibility coefficients and nutritive value of the experimental halophytic diets

Items	Control	Fresh *Atriplex+Acacia*	Silage *Atriplex+Acacia*
DM	71.55^{a} ± 0.45	67.24^{b} ± 0.59	63.96^{c} ± 0.63
OM	73.43^{a} ± 0.36	68.06^{b} ± 0.35	66.63^{c} ± 0.37
CP	71.28^{a} ± 0.22	65.75^{b} ± 0.50	66.48^{b} ± 1.27
EE	71.76^{a} ± 0.95	66.87^{b} ± 0.46	65.72^{b} ± 1.29
CF	68.81^{a} ± 0.93	65.38^{b} ± 0.85	68.10^{a} ± 0.48
NFE	75.62^{a} ± 0.61	64.21^{b} ± 0.61	66.44^{c} ± 0.24
Nutritive value %:			
TDN	69.73^{a} ± 0.20	63.84^{b} ± 0.21	64.18^{b} ± 0.23
DCP	9.01^{a} ± 0.02	8.60^{b} ± 0.10	7.68^{b} ± 0.1

a, b and c = means in the same column with different superscripts are differ significantly ($p< 0.05$).

Results of live body weights and weight changes during the production cycle of the ewes in the three treatment groups (Table, 4) indicated that at lambing ewes in the control group gained (P<0.01) 13.60 Kg while those fed *Atriplex+Acacia* either fresh or silage gained 10.86 and 10.02 Kg, respectively.

Nevertheless, the control ewes lost from lambing to weaning, 16 weeks, (P<0.01) average -6.14 Kg while the other two groups lost in average -4.54 and –2.95 Kg, respectively.

Nevertheless, the experimental dietary treatments had no significant effect on the means of body weights of ewes at weaning (45.09Kg, 44.04Kg and 44.60kg for dams received control, fresh and silage diets, respectively).

It is of interest that body weight increased during the stress stages of pregnancy and lactation, which refer to the poor body condition score of ewes at the start of experimentation. This means that this unexpected gain is a compensatory growth occurred as far as feeding efficiently managed during the experimental period.

Milk production

In general, ewe fed *Atriplex+Acacia* silage diet had higher daily milk production (332.89 ml), while dams fed control and fresh *Atriplex+Acacia* had lower daily milk production (Table 4) with no significant differences (300 and 297.85 ml, respectively). Milk production of ewes fed hay or fresh *Atriplex+Acacia* showed better persistency as compared to ewes fed the *Atriplex + Acacia* silage diets. Lactation was presumed to last 16 weeks.

Digestibility coefficient and nutritive value

The digestibility coefficients of the experimental diets are presented in Table (5). Results indicated that DM and OM digestibilities of control diet were higher (p<0.05) than *Atriplex+Acacia* silage and fresh diets (71.55 and 73.43 *vs*. 67.96, 68.06 and 63.96, 66.63 %, respectively).

In addition, CP and EE digestibility of control diet was higher (p<0.05) than that of *Atriplex+Acacia* silage or fresh *Atriplex+Acacia* diets (71.28 and 71.76 *vs.* 66.48, 65.72 and 65.75 and 66.87 %, respectively). The digestion coefficient of CF for control and *Atriplex+Acacia* silage diets were higher (p<0.05) than fresh *Atriplex+Acacia* diet (68.81 and 68.10 *vs.* 65.38%, respectively). The digestion coefficient of NFE was higher (p<0.05) for control diet (75.62%) followed by *Atriplex+Acacia* silage diet (66.44%) while the lowest value were obtained for fresh *Atriplex+Acacia* diet (64.21%). Results showed that, TDN and DCP values of the control were higher (p<0.05) than those of fresh and silage *Atriplex+Acacia* diets (69.73 and 9.01 *vs*. 63.84, 8.60 and 64.18, 7.68 %, respectively) with insignificant differences between the values of the two diets of *Atriplex+Acacia* neither fresh nor silage.

Nitrogen utilization:

Data of nitrogen utilization presented in Table (6) revealed that ewes fed control and fresh *Atriplex+Acacia* diets recorded higher (p<0.05) nitrogen intake (NI) 23.54 and 21.90 g/h/d, respectively with insignificant differences in between , while the lowest (P<0.05) NI values were recorded for ewes fed *Atriplex+Acacia* silage diet (19.81g/h/d). Nitrogen absorbed values indicated that control ewes recorded higher (p<0.05) value (16.78 g/h/d) followed by ewes fed fresh *Atriplex+Acacia* then *Atriplex+Acacia* silage diets (14.39 and 13.19 g/h/d, respectively). On the other hand, ewes fed control and fresh *Atriplex+Acacia* diets excrete more (p<0.05) urine than ewes fed *Atriplex+Acacia* silage diet. All experimental diets showed positive nitrogen balance (NB). Control ewes recorded the highest (P<0.05) value followed by the two groups fresh and silage (3.02 *vs*. 2.13 and 2.31g/day, respectively). Nitrogen balance as a percent of nitrogen intake (NB/NI) was significantly (P<0.05) higher for control group than the other two ewes groups, that fed *Atriplex+Acacia* silage diet (11.71%) then fresh (9.80%), respectively.

Table 6: Nitrogen utilization by ewes fed the experimental halophytic diets (mean ± SE).

Items	Control	Fresh *Atriplex+Acacia*	Silage *Atriplex+Acacia*
Nitrogen intake (g/day)	23.54 [a] ± 1.14	21.90 [ab] ± 1.38	19.81 [b] ± 0.75
Nitrogen absorbed (g/day)	16.78 [a] ± 0.84	14.39 [b] ± 0.88	13.19 [b] ± 0.72
Urine nitrogen (g/day)	13.76 [a] ± 0.96	12.26 [a] ± 0.85	10.87 [b] ± 0.73
Nitrogen balance (g/day)	3.02 [a] ± 0.12	2.13 [b] ± 0.05	2.31 [b] ± 0.08
Nitrogen balance as % of NI	12.93 [a] ± 1.14	9.80 [c] ± 0.48	11.71 [b] ± 0.61

a and b = means in the same column with different superscripts are differ significantly ($p< 0.05$).

Reproductive performance

Twenty ewes were used in each experimental feeding group from the beginning of pregnancy. At lambing two ewes of control group died due to delay parturition and death of fetus inside the uterus. Ewes lambed as % of ewe joined were 90, 90 and 85 for control, fresh and silage *Atriplex+Acacia* groups, respectively (Table 7). This indicates that dietary treatment of *Atriplex+Acacia* silage had a negative effect on the conception rate. Whereas, early embryonic mortality, defined as the number of ewes mated but neither lamb nor aborted and including undetected conception failure, were recorded only in the fresh and silage *Atriplex+Acacia* groups (2 and 3 of ewes joined, respectively). Consequently, total lambs born alive were 18 from control or fresh *Atriplex+Acacia* groups and only 17 from silage *Atriplex+Acacia* group. Lambs' mortality from birth to weaning was 11.1% in control group and increased to16.7% and 35.3% in lamb groups of fresh and silage *Atriplex+Acacia*, respectively. It is noteworthy that, lamb mortality number with silage diet was higher three and two times than that with control and fresh *Atriplex+Acacia*, respectively (recording 6, 2 and 3 lambs, respectively).

Ewe's Production index

Ewe's production index was calculated for the three groups as kilograms of lambs born or weaned per 100 ewes joined. (Table 8). Results indicate that control diet weaned more kilograms (2664 kg) than groups fed fresh *Atriplex+Acacia* (2356 kg) or silage *Atriplex+Acacia* (2296 Kg). These represent 88.4 and 86.2 %, respectively, of what control ewes produced. The decrease of weaned weight index for silage feeding group may be an indicator for decreasing the nutritional quality of *Atriplex+Acacia* silage diet. Lamb's birth weight did not show significant differences due to the three experimental groups. The average weaning weights of lambs were 26.64, 23.56 and 22.96 kg for the three dietary treatments, control, fresh and silage *Atriplex+Acacia*, respectively. This indicate that feeding *Atriplex+Acacia* either fresh or silage decreased lamb weaning weight by about 11.6 and 13.8 % than control group, respectively.

Blood metabolites

Average blood biochemical parameters of ewes fed the experimental diets during pregnancy are shown in Table (9). Blood urea concentration of ewes fed control and silage diets were significantly higher ($P<0.05$) than that of ewes fed fresh *Atriplex+Acacia* diet. Blood glucose concentration of ewes fed silage diet had the highest value ($P<0.05$) than ewes fed fresh *Atriplex+Acacia* or control diets. It was observed that dietary treatments had no significant effect on TP concentration. Blood creatinine content of ewes fed fresh *Atriplex+Acacia* diets was significantly higher ($P<0.05$) than that of control diet. Also, creatinine concentration for ewes fed silage diet showed higher values but with no significant difference.

Ewes fed fresh *Atriplex+Acacia* had higher ($P<0.01$) blood Na level than those fed control and silage diets, by 1.6 and 1.4 times, respectively. Also, blood of ewes fed fresh

Atriplex+Acacia diets recorded higher (P<0.05) K level than those fed control and silage diets by about 1.3 and 1.7 times, respectively. Blood selenium content of ewes fed *Atriplex+Acacia* diets either fresh or silage was higher (P<0.01) than those fed control diet. On other hand, blood of ewes fed control diet contained more (P< 0.05) Ca, Zn, Mg and Cu than the other two groups fed *Atriplex+Acacia* diets either fresh or silage with no significant differences between them.

Table 7: Reproductive performance of ewes fed fresh and silage *Atriplex+Acacia* diets

Items	Experimental diets		
	Control	Fresh Atriplex+Acacia	Silage Atriplex+Acacia
Ewes number	20	20	20
Ewes mated number	20	20	20
% of joined	100	100	100
Ewes lambing number	18	18	17
% of joined	90	90	85
Lambs born	18	18	17
Ewes mortality			
During pregnancy	-	-	-
After lambing	2	-	-
% of joined	10	-	-
Lambs mortality	2	3	6
% of born alive	11.1	16.7	35.3

Table 8: Lambs production, daily gain (gm/day) and ewe's production index

Items	Experimental diets		
	Control	Fresh *Atriplex+Acacia*	Silage *Atriplex+Acacia*
Live lambs born/100 ewes joined	90	90	85
Lambs weaned/100 ewes joined	80	70	55
Lambs mortality,% born alive	11.10	16.70	35.30
Birth weight of lambs/ Average	3.81	3.76	3.80
Weaning weight of lambs/ Average Kg	26.64	23.56	22.96
Daily gain from birth to weaning/ Average gm/day	190.22	165.05	159.67
Ewes production index			
Kg born/100 ewes joined	381	376	380
Kg weaned/ 100 ewes joined	2664	2356	2296
Weaned weight index, %	100	88.44	86.19

DISCUSSION

The fermentative characteristics of ensiled halophytic pasture plants indicated that both silages of *Atriplex halimus* (saltbush) and *Acacia saligna* (legume shrubs) had suitable pH values (3.5 and 4.24, respectively) which were within the desirable range of a good quality silage (Abou El-Nasr *et al*., 1996). Visual

appraisal and such fermentative traits indicated that the two tested silages were well preserved and had good quality. This was supported by their optimum pH values as well as VFA's and lactic acid concentrations and also a pleasant aroma and normal odor.

The concentrations of TVFAs and NH_3-N were lower in *Acacia* silage than in *Atriplex* silage, which might due to the less degradation rate of carbohydrates and nitrogen in *Acacia* that contain tannins (Khattab, 2007). *Acacia* silage had higher lactic acid than *Atriplex* silage. Earlier studies of many workers indicated that legume silage had tendency to be high in lactic acid as compared to other forage silages (Demarquilly and Dulphy, 1977 and Abou El-Nasr *et al*., 1996).

Many previous studies indicated that fresh *Atriplex* contains high amounts of salts (Malcom *et al.*, 1988) especially Na which ranged between 5.59 and 6.66% in *Atriplex* foliage DM at spring and fall seasons, respectively (Abu- Zanat *et al*., 2003) and its high levels of soluble N content equal about 4% of its total N (Kaitho *et al*., 1998a,b). The high levels of salt in *Atriplex* forced animals to increase water intake with consequential influences on rumen functions (Konig, 1993). Fresh *Acacia* contains high levels of condensed tannins (CT) which form insoluble complexes with proteins, those proved to be the major constraint for reducing the feeding value of acacia (Degen *et al*., 1995, 1997; Ben Salem, 1998). The negative effects of these secondary compounds decrease feed intake from *Atriplex* and *Acacia* when each fed alone. So, feeding ruminants on mixed saltbushes (*Atriplex sp.*) with low salt and high tannins content and legume forage (*Acacia sp.*) is desirable (Gihad and El-Shaer, 1994; Khattab, 2000; Hassan *et al*., 2001 and Shawket *et al*., 2001) because of combination of such shrubs lead to enhance their palatability, consumption and nutrients utilization.

In general and as confirmed previously by Farid *et al.* (2005a) the DMI of ewes increased progressively from breeding to pregnancy and lactation stages up to weaning time. They indicated that increasing DMI during lactation up to weaning may be due to increasing amounts of the experimental diets consumed by nursing lambs beyond 6 to 8 weeks old representing effective competition to their dams.

Table 9: Blood biochemical parameters of pregnancy ewes fed the experimental diets

Items	Experimental diets			
	Control	Fresh *Atriplex+Acacia*	Silage *Atriplex+Acacia*	
Chemical composition				
Urea, mg/dl	18.31 ^{a} ± 1.34	15.55 ^{b} ± 1.26	18.20 ^{a} ± 1.24	*
Glucose, mg/dl	34.05 ^{c} ± 1.05	38.82 ^{b} ± 1.35	48.41 ^{a} ± 1.68	*
Total protein, g/dl	6.31 ± 0.14	5.39 ± 0.38	5.85 ± 0.36	NS
Creatinine, mg/dl	1.20 ^{b} ± 0.04	1. 30 ^{a} ± 0.03	1. 22^{b} ± 0.05	*
Minerals content				
Na, mg/dl	168.68 ^{c} ± 11.5	273.15 ^{a} ± 4.03	197.85 ^{b} ± 2.38	**
K, mg/dl	165.68 ^{b} ± 6.79	212.30 ^{a} ± 5.43	127.31 ^{c} ± 12.0	**
Ca, mg/dl	11.57 ^{a} ± 0.31	9.70 ^{b} ± 0.57	9.01 ^{b} ± 0.39	*
Zn, mg/dl	0.61 ^{a} ± 0.04	0.35 ^{b} ± 0.05	0.28 ^{b} ± 0.05	*
Mg mg/dl	2.53 ^{a} ± 0.36	1.53 ^{b} ± 0.02	1.26 ^{b} ± 0.04	*
Cu, mg/dl	0.31 ^{a} ± 0.20	0.19 ^{b} ± 0.05	0.19 ^{b} ± 0.05	*
Se, ppm	11.58 ^{b} ± 4.01	22.60 ^{a} ± 6.50	19.87 ^{a} ± 5093	**

a, b and c, means in the same row with different superscripts are differ significantly *P<0.05, **P<0.01, NS = non-significant

Although there were no significant differences between ewes' feeding groups in respect of daily DMI, it was observed that ewes fed fresh *Atriplex+Acacia* diets recorded lower DMI than those fed the control or *Atriplex+Acacia* silage diets. This may be due to that ensiling process improve the quality of halophytic plants to be more nutritious by reducing their anti-nutritional factors concentration (Ngwa *et al*., 2002) and enhancing their acceptability for sheep and goats (Abou El Nasr *et al*., 1996). Although, lower ($P<0.05$) apparent digestibility of DM and OM were noticed with sheep fed *Atreplex+Acacia* silage compare with fresh diets and control which could attributed to the high amount of minerals squished out with the silage juice and its negative effect on rumen metabolism and nutrients digestion.

The other nutrient digestibilities (CP, CF and NFE) of silage diet were higher than those of fresh diet specially that of fiber which may be due to that ensiling halophytic plants reduce the concentration of anti-nutritional factors which lead to improve fibrolytic activity (Ngwa and Nsahlai, 2002). Nevertheless, there were no significant differences between nutritive value as TDN and DCP percentage of the two halophytic diets fresh or silage. All the dietary treatments show a positive nitrogen balance. The control diet had higher ($P<0.05$) NB value comparing with the other two groups fed the halophytic diets with insignificant differences in-between which led to adequate growth for ewe groups fed *Atriplex+Acacia* diets either fresh or silage.

It was noticed that the dietary treatments had no significant effect on ewes' BW at weaning. Nevertheless, changes in ewes BW were affected significantly ($P<0.05$) by the dietary treatments. Whereas, ewes fed *Atriplex+Acacia* diets either fresh or silage showed less ($P<0.01$) BW changes being 10.86 and 10.02 *vs.* 13.60 Kg and - 4.59 and -2.95 *vs.* -5.14 Kg compared to control, respectively during pregnancy to lambing and from lambing to weaning periods. These indicated that ewes in control group lost live body weight more than ewes of the other two groups by about twice (fresh *Atriplex+Acacia* group) and three and half times (silage *Atriplex+Acacia* group). This may be due to the competition on concentrate and possibly hay by the growing lambs beyond the age of eight weeks in control group in comparison to the other two groups fed *Atriplex+Acacia* diets either fresh or silage which was not palatable to newborn lambs. On the other hand, this may be illusory because of increasing water intake by animals fed these halophytic plants (Konig, 1993).

Although, the DMI of ewes fed *Atriplex+Acacia* silage diets was slightly higher than those fed either the control or fresh *Artiplex+Acacia* diets during late gestation and suckling, it was observed that the dietary treatments had no significant effect on ewe's milk yield. This could attributed to the negative effects of secondary chemical compounds (oxalates and tannins) presented in the browse of *Atriplex* and *Acacia* (Abu-Zanat and Tabbaa, 2005). Total milk production per 16 weeks was 33.65, 33.25 and 37.28 litters for ewes fed control, fresh and silage *Atriplex+Acacia* diets, respectively. These results were higher than those reported by Farid *et al.*, (2005b) being 24.07 and 20.02 litters / 16 weeks of lactation for Barki ewes fed their nutritional requirements according to NRC (1985) and *ad lib* Berseem hay, respectively. According to NRC (1985), the recommended requirements revealed that the computed CPI ($g/day/Kgw^{0.75}$) and MEI ($kcal/day/Kgw^{0.75}$) for ewes during the different experimental physiological stages were enough to cover their CP and ME requirements. These result indicated that all animals groups were in good nutritional status during late gestation and lactation which is the primary factor influencing total milk yield (Abu-Zanat and Tabbaa, 2005).

The most important factor determines profitability of a sheep enterprise is "production rate" which is an expression of "reproductive efficiency". Medvei (1982) and Farid *et al.*, (2005a) had stated that nutrition is the most important environmental factor controlling conception. Presently, we know that nutrition controls many physiological functions related to reproductive efficiency, directly or mediate by the effect of nutrition on several endocrine mechanisms. Sheep producers are well aware

that the next lamb crop is determined by the status of the ewe before and during the breeding season, and that condition of the offspring and their performance pre- and post-weaning are determined by the status of the ewe at lambing (Neary, 2005).

Feeding the control ewes according to NRC (1985) recommended allowances resulted in seemingly optimum performance. Using diets contain each *Atriplex+Acacia* either fresh or silage had adequate effect on the ewes reproductive performance comparing to control group. Although ewes fed on these halophytic diets starting from the flushing period, reared relatively long period on such forages. Ewes lambing as a percentage of ewes joined were the lowest for ewes fed *Atriplex+ Acacia* silage diets compared to the others. In control group, two ewes died at lambing due to over fatness of their fetus delays parturition and cause death of fetus inside the uterus. The low lambing rate of ewes fed halophytic diets either fresh or silage may be due to early embryonic mortality, which lead to less number of lambs born. Also, ewes fed *Atriplex+Acacia* silage recorded more lamb mortality as % of born alive compared to control and fresh *Atriplex+Acacia* groups (35.3 *vs.* 11.1 and 16.7%, respectively). Reproductive efficiency of ewes fed control or fresh *Atriplex+Acacia* diets were close to those recorded by Farid *et al.,* (2005b) for ewes fed according to NRC (1985) allowances. Ewe's production index indicated that ewes fed fresh or silage *Atriplex+Acacia* diets recieved adequate nutritional requirement for late pregnancy. The present reproductive performance of ewes fed fresh *Atriplex+Acacia* diet are almost equal to that indicated by Farid *et al.,* (2005b) for Barki ewes fed either NRC (1985) allowances or *ad lib* berseem hay plus concentrate mixture (4 parts ground corn grains and one part soybean meal offered at rate 200g /day/ewe). Whereas, 100 *vs.* 100% of ewes mated per ewe joined, 90.5 % of ewes lambed per ewes joined, 90 *vs.* 90.5 and 90.5; % of lambs born alive of ewes joined, 90 *vs.* 85.7 and 85.7 % of lamb mortality of born alive, 16.7 *vs.* 5.6 and 16.7 for ewes fed fresh *Atriplex+Acacia*, NRC allowances and *ad lib* B. hay plus concentrate mixture, respectively. While ewes fed silage *Atriplex+Acacia* diet recorded the lowest percentage of ewes lambed and higher lambs mortality (85% and 35.3%, respectively). Ewe production index as Kg born or weaned/100 ewes joined for groups fed *Atriplex+Acacia* diets either fresh or silage were higher than that recorded by Farid *et al.* (2005b) for NRC fed ewes or hay fed ewes (376 and 380 kg *vs.* 329.9 and 318.8 Kg born/100 ewes joined and 2356 and 2296 kg *vs.* 1765 and 1982.8 Kg weaned/ 100 ewes joined, respectively). These due to the higher weights of weaned lambs born from ewes fed *Atriplex+Acacia* diets either fresh or silage than those born from NRC ewes' group or hay ewes' group (23.56 and 22.96 Kg *vs*. 21.6 and 18.2 Kg, respectively). The present weaned weight index, based on control group, were 88.4 and 86.2% for ewes fed fresh and silage *Atriplex+Acacia* diets, respectively. So, it is appropriate to conclude that the ewe's status before breeding and its nutrition during breeding and early pregnancy are the most significant factors controlling reproductive efficiency and affecting the overall production rate expressed above as kilograms born and weaned per 100 ewes joined. In addition, the above results of higher production rate of ewes fed *Atriplex+Acacia* diets fresh or silage indicate that ewes were in optimum condition before breeding and were well nourished during breeding and the first 90 days of pregnancy. Whereas, ewes fed control and *Atriplex+Acacia* diets either fresh or silage produced lambs of similar birth weight (3.81, 3.76 and 3.80 Kg, respectively) which were comparable to the results indicated by Farid *et al.,* (2005c) for NRC fed ewes or hay fed ewes (3.85 and 3.72 Kg, respectively). While, the weaning weights of lambs born for ewes fed the fresh and silage *Atriplex+Acacia* diets were higher than those of NRC fed ewes (23.56 and 22.96 Kg *vs*. 21.79 Kg, respectively). Average growth rate from birth to weaning of control lambs group was higher than those of other two tested groups fed *Atriplex+Acacia* either fresh or silage (190.22gm/day *vs.* 165.05 and 159.67 gm/day, respectively). It was noticeable that the daily gain of halophytic fed lambs were comparable to the recorded average daily gain value (160 g/day) for NRC fed lambs (Farid *et al*., 2005c).

Blood urea content of ewes fed fresh *Atriplex+Acacia* was lower (P<0.05) than those fed control or silage diets which may be due to the high content of anti-nutritional factors in fresh forage which affect the utilization of protein in the rumen by binding feed proteins and converting them to indigestible form and reduce the digestive enzymatic activity causing a lower rumen ammonia production (Ramirez and Lara, 1998 and Ndluvo, 2000). The higher blood glucose content of ewes fed *Atriplex+Acacia* silage may be due to the higher VFA's production in the rumen, particularly propionate which formalize to glucose in the liver (Khattab, 2007).

The lower blood Ca, Zn, Mg and Cu in ewes fed *Atriplex+Acacia* diets either fresh or silage mainly due to their content of secondary metabolites mainly oxalic acid in *Atriplex spp.* and condensed tannins in *Acacia spp.* (Table, 2). Oxalic acid binds with Ca and Mg to form insoluble salts and non- digestible compounds (James, 1978 and Cheeke, 1995). Furthermore, binding Ca with oxalate led to an imbalanced Ca: P ratio in lactating Awassi ewes fed saltbush diets and they accentuated the need to amend the Ca: P ratio in the diet of ewes by supply good quality Ca and P sources during lactation period (Alazzeh and Abu-Zanat 2004). Also, oxalic acid and tannic acid as chelating agents interfere with Zn absorption (McDowell, 1992). On the other hand, the high level of Ca in *Atriplex* and *Acacia* basal diets may be negatively affecting Zn availability for animals. Excessive dietary Ca is known to negatively affect concentration of Zn in animal body tissues (Alfaro *et al*., 1988 and McDowell, 1992). Also, the higher levels of Mg and K content of *Atriplex+Acacia* diets might be responsible of decreasing Zn availability (McDowell, 1992). The higher Se content of *Atriplex* and *Acacia* than berseem hay may be responsible of the higher (P<0.01) blood Se of ewes fed *Atriplex+Acacia* diets either fresh or silage, compared with control diet which became over the maximum tolerable level of Se (5pmm).

So, the negative effect of long term feeding of these halophytic diets (2 months before mating season + 5 months for pregnancy + 4 months suckling) to ewes could be harmful effects on born lambs at the first week of birth with illness symptoms such as:

1-Lambs unable to move on the fore limbs and muscular deformity which may be due to the imbalanced ratio of Ca: P.

2-Tremors, convulsion, desalination of movement and paralysis of the lips, so lambs unable to suck their dams, and die during the first week after birth which may be due to the decreasing levels of each Ca and Mg.

3-Paralysis of the hide legs, in coordination of movement, tremors, convulsion, reluctant to move and aimless movement wandering, which may be due to decrease of Cu level.

These symptoms expressed in the higher mortality percentage of born alive lambs during the first week after birth, 16.7% and 35.3% for the two groups fed halophytic diets either fresh or silage, respectively. The higher mortality percentage of born lambs of silage diet group may be due to the high amount of minerals squished out with the silage juice.

The above symptoms might be attributed to defect in concentrations of effective minerals, like Ca, Zn, Mg and Cu, besides the high level of Se in the blood of ewes most fed silage of *Atriplex+Acacia*, followed by those fed them fresh, during early and late gestation, compare to ewes fed control diet, which produce healthy lambs without illness symptoms.

So, further studies are needed to investigate these minerals deficiency especially when pregnant ewes fed the halophytic forages ad lib for a long period and also during lactation period, whereas Alazzeh and Abu-Zanat (2004) accentuated the need to amend the Ca: P ratio in the diet of sheep and supply good quality Ca and P sources mainly when feeding saltbush (*Atriplex spp.*) to lactating ewes.

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تأثير تغذية النعاج لفترة طويلة على النباتات الملحية على أدائها الإنتاجى والتناسلى

سافيناز محمد شوكت ، إبراهيم محمد خطاب ، محمد حسن أحمد

تم استخدام ستون نعجة برقى (أعمارها من 3 - 4 سنوات ومتوسط وزن جسمها 37.62 ± 6.46 كيلو جرام) وذلك من بداية موسم التلقيح وحتى نهاية موسم فطام الحوالى. قسمت هذه النعاج عشوائيا إلى ثلاث مجاميع متماثله . غذيت المجموعة الأولى على دريس البرسيم للشبع بينما غذيت المجموعتين الثانية والثالثة على القطف والأكاسيا فى صورة طازجة (خضراء) أو فى صورة سيلاج للشبع على التوالى وقد تم إضافة حبوب الشعير المجروش لكل المجاميع الثلاثة . أوضحت نتائج الدراسة أن النعاج المغذاة على عليقه السيلاج قد سجلت أعلى قيمة للمادة الجافة المأكولة وذلك خلال فترات الحمل الأولى والمتأخرة وأثناء الرضاعة كما أدى تغذية النعاج على علائق القطف والأكاسيا طازجة أو سيلاج إلى انخفاض الفقد فى وزن الجسم مقارنة بالكنترول عند الولادة (2.95 ، 4.59 ، 5.14 كجم على التوالى وذلك خلال فترة الرضاعة .

انخفضت معاملات الهضم الظاهرى للمادة الجافة والمادة العضوية والبروتين الخام والدهن والمستخلص الخالى من النيتروجين وذلك للنعاج المغذاة على العلائق المحتوية على القطف والأكاسيا مقارنة بالعليقة الكنترول . معاملات هضم العناصر الغذائية ماعدا الألياف الخام لعليقه سيلاج القطف والأكاسيا كانت متطابقة مع معاملات هضم العليقة الكنترول . بينما المعاملات الهضم للعليقة الكنترول والسيلاج كانت أعلى من عليقة القطف والأكاسيا الطازجة . قيم مجموع العناصر الغذائية المهضومة والبروتين المهضوم انخفضت معنويا نتيجة للتغذية على العلائق المحتوية على نباتات ملحية فى صورة طازجة أو سيلاج . سجلت مجموعة نعاج السيلاج أعلى إنتاج يومى للبن وأقل دليل للخصوبة (معدل الولادة 100 ، 95 ، 85 %) للمجموعة الكنترول والنباتات الملحية طازجة أو سيلاج على التوالى .

ظهرت بعض الأعراض المرضية فى الأسبوع الأول بعد الولادة على الحملان المولودة من النعاج المغذاه على علائق القطف والأكاسيا فى صورة طازجة أو سيلاج (ارتعاشات وتشنجات بالأطراف بحيث لا تستطيع أن ترضع من أمهاتها) ولقد سجلت النعاج المغذاة على عليقة السيلاج أعلى معدل نفوق (1.1 ، 16.7 ، 35.3 % من المواليد أحياء وذلك لمجموعة الكنترول والنباتات الملحية طازجة والسيلاج على التوالى). لم يتأثر وزن الميلاد للحملان معنويا ، معدل الزيادة اليومية للحملان كان 190.22 ، 105.5 ، 159.67 جم / اليوم وذلك للمجموعة الكنترول والمجاميع المغذاة على القطف والأكاسيا طازجة و السيلاج على التوالي. تركيز العناصر المعدنية فى الدم تأثر معنويا بالمعاملات الغذائية وغالبا كان أقل فى المجاميع المغذاة على النباتات الملحية .

من نتائج هذه الدراسة يمكن أن نستنتج أن تغذية النعاج البرقى على النباتات الملحية خاصة فى صورة سيلاج لفترة طويلة (مواسم التلقيح والحمل والرضاعة) يمكن أن يسبب بعض الأعراض المرضية للحملان المولودة من هذه النعاج كما يرفع معدل النفوق والذى يمكن أن يرجع إلى النقص فى بعض المعادن الهامة والضرورية لنمو الجنين خلال فترة الحمل .