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PHYSIOLOGICAL PERFORMANCE OF BARKI MALE LAMBS FED HALOPHYTES UNDER SEMI- ARID CONDITIONS

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ABSTRACT

This research was achieved at Maryout Research Station, Desert Research Center to give an intensive physiological inspection of the liver and kidney functions, and weight changes in addition to the blood biochemical and electrolytes changes in growing Barki lambs fed on either fresh or silage forms of a mixture of *Atriplex halimus* and *Acacia saligna*. Three groups of lambs were fed as follows: the first group (G1, 5 lambs) was fed on Berseem hay and served as control group. While the second group (G2, 6 lambs) was fed on a fresh mixture of *Atriplex* and *Acacia*, the third group (G3, 6 lambs) was fed on silage form of *Atriplex halimus* and *Acacia saligna* mixture. The concentrations of total proteins (TP), albumin (A), globulin (G), total lipids (TL), total cholesterol (TC), alanine amino transferase (ALT), aspartate amino transferase (AST), alkaline phosphatase (ALP), urea, creatinine, triiodothyronine (T3), thyroxine (T4), aldosterone (AL), sodium (Na), potassium (K), calcium (Ca) and phosphorus (P) along with A/G, urea/ creatinine, Na/ K, Na/ Na+ K and Ca/ P ratios were determined. Body weight changes and average daily gain (ADG) were also recorded.

The obtained results demonstrated that animals fed on fresh mixture of *Atriplex halimus* and *Acacia saligna* exhibited the poorest physiological performance as the values of TP, G, TC and AL ($P<0.01$), ADG ($P<0.05$), A, TL, T_3, T_4, Ca, P and Na/ K ratio were lower than the other two groups. Additionally, the liver and kidney function parameters might indicate the harmful effects of feeding fresh desert shrubs since the fresh fed group animals had the highest values of ALT, creatinine and Na ($P<0.01$), AST ($P<0.05$) and K and the lowest values of ALP and urea ($P<0.01$) and urea/ creatinine ratio.

The results indicated that the silage fed and control groups nearly had non-significant differences in almost all the measured parameters, which emphasizes the great potentialities of using such combinations of the ensiled salty natural plants in the rations of sheep as a solution of the possible shortage in feed resources in desert conditions.

It could be concluded that applying ensiling form for such desert forages is an appropriate mean for feeding desert animals and reducing the physiological hazards which might come out from using fresh desert shrubs in animals' feeding.

Keywords: Barki lambs, *Atriplex*, *Acacia*, biochemical parameters, liver function, kidney function, electrolytes

INTRODUCTION

Drought remains the most important factor threatening the food security of livestock in the deserts. Considerable attention has been paid to introduce new types of fodder. Feeding halophytes is a feasible solution to minimize the problem of feed shortage in arid and semi- arid areas of Egypt. The suitable halophytic forage species that showed better adaptability are *Atriplex* and *Acacia* species (Kandil and El- Shaer, 1990). *Atriplex* (salt bush) and *Acacia* (leguminous) shrubs represent the incessant forage shrubs adapted to salt

and drought stresses along the northwestern coastal area of Egypt. Moreover, they were ranked as acceptable forages utilized by sheep and goats (Aboul- Nasr, 1998). So, they are capable of producing feeds in these areas especially those of a comparatively higher salinity where many other salt tolerant plants fail to produce sufficient grazable biomass.

On the other hand, Mohamed (1996) reported on the presence of tannins, flavonoids, alkaloids, saponins in *Atriplex halimus*. To avoid disadvantages of such antinutritional factors, the silage is considered a proper conservation method for plants that could improve their palatability and nutritive value so animals were able to cover their maintenance requirements (El- Shaer, 1997). Hanafy *et al.* (1996) observed that ensiling of desert plants sharply depressed the presence of some anti- nutritional factors. Moreover, high salt content of saltbushes limits intake and reduces digestibility by shortening rumen turnover rates (Warren and Casson, 1992). Mixing saltbushes with low salt forages (i.e. legumious tress) is desirable to improve its utilization and nutritive value (Shawket, 1999).

The scanty of information about the effect of feeding such desert forages on the physiological functions of growing Barki lambs for a long term was the motive of this work to focus on liver and kidney functions and body weight changes in addition to the metabolic state of lambs fed on a mixture of *Atriplex halimus* and *Acacia saligna* during the growing period of eight months.

MATERIALS AND METHODS

1- Location of study:

The present study was undertaken at Maryout Research Station; 35- km southwest of Alexandria, Desert Research Center.

2- Aim of the study:

This experiment aimed at studying some physiological and biochemical parameters of effects of feeding a mixture of *Atriplex halimus* and *Acacia saligna* on growing Barki male lambs for eight months.

3- Animals and experimental design:

Seventeen healthy growing Barki male lambs aged 4 months with average body weight of 25.79± 0.826 kg from weaning (4 months) up to twelve-month age were divided into three groups according to the ration of their dams. Each animal in the three experimental groups was daily offered with barley grains to cover the maintenance requirements of energy, as recommended by Kearl (1982). Concerning the roughage, which was offered *ad. lib.*, the first group (G1, 5 lambs) was fed on berseem hay (Control group). The second one (G2, 6 lambs) was fed on a fresh mixture of *Atriplex halimus* and *Acacia saligna* while the animals of third group (G3, 6 lambs) were fed on silage of the mixture of *Atriplex halimus* and *Acacia saligna*, prepared according to Khamis *et al.* (1992). Tape water was available twice daily. The experimental animals were housed indoors inside a semi-closed pen, roofed with metal and walled in four directions with concrete. All animals

The chemical composition of the experimental rations, halophytic forages (*Atriplex halimus* and *Acacia saligna*) and barely grains was determined according to AOAC (1985) (Table 1).

Table (1): Chemical composition of feed ingredients of the experimental halophytic diets fed to lambs (Dry matter basis, adopted from Abdelhameed *et al.*, 2006)

	DM	Ash	CP	CF	EE	NFE
Berseem hay	86.31	13.81	13.88	31.39	3.17	38.75
Atriplex halimus						
Silage	34.19	18.59	12.35	12.64	3.98	52.54
Fresh	27.50	22.90	16.28	15.85	3.96	42.54
Change*	**+6.69**	**-4.31**	**-3.93**	**-3.21**	**+0.02**	**+10**
(%)	**24.33**	**18.82**	**24.14**	**20.25**	**0.50**	**23.51**
Acacia saligna						
Silage	47.98	8.05	11.69	21.29	4.04	54.93
Fresh	39.67	12.15	13.77	22.22	2.72	49.14
Change*	**+8.31**	**-4.1**	**-2.08**	**-0.93**	**+1.32**	**+5.79**
(%)	**20.95**	**33.74**	**15.11**	**4.19**	**48.53**	**11.78**
Barely grain	90.54	3.15	11.1	4.42	3.48	77.85

Change*, change due to ensiling process. DM, dry matter CP, crude protein CF, crude fiber EE, ether extract N FE, nitrogen free extract

According to the methods of Hodgkinson (1971), Pharmacopia Europian (1978), Karawya and Aboutable (1982) and Egyptian Pharamacopia (1984), the antinutritional factors such as tannins, alkaloids, falvonoids and oxalate, were determined (Table 2).

Table (2): Percentages of some chemical compounds present in *Atriplex halimus* and *Acacia saligna* (On dry matter basis (mg/ 100mg), adopted from Abdelhameed *et al.*, 2006)

	Tannins	Alkaloids	Flavonoids	Oxalates
Berseem	5.82	0.00	0.63	5.70
Shrub mixture:				
Silage	8.11	0.153	0.68	4.20
Fresh	12.51	0.33	1.670	5.10
Change* (%)	**-4.40 (35.17)**	**-0.177 (53.64)**	**-0.99 (59.28)**	**-0.90 (17.65)**

Change*, change due to ensiling process.

4- Hematological parameters:

In the early morning just before offering ration and water, jugular blood samples were withdrawn from all animals into clean heparinized tubes and centrifuged for 30 minutes at a speed of 3000 r.p.m. for plasma separation. Assays of total proteins (TP) and albumin (A) were carried out according to Biuret method after Gornal *et al.* (1949) and Doumas *et al.* (1971),

Biuret method after Gornal *et al.* (1949) and Doumas *et al.* (1971), respectively. Values of globulin (G) were calculated by subtracting the value of A from the TP whereas albumin/ globulin (A/G) ratio was calculated according to results of A and G.

The plasma concentrations of total lipids (TL) and total cholesterol (TC) were determined according to Schmit (1964) and Roeschlau *et al.* (1974), respectively. Concentrations of both alanine amino transferase (ALT) and aspartate amino transferase (AST) were analyzed according to Reitman and Frankel (1957). While alkaline phosphatase (ALP), urea and creatinine concentrations were determined according to Belfield and Goldberg (1971), Fawcett and Soctt (1960) and Schirmeister *et al.* (1964), respectively. . Urea/ creatinine ratio was calculated. The blood electrolytes (sodium (Na), potassium (K), calcium (Ca) and phosphorus (P)) were determined according to Trinder (1951), Sunderman and Sunderman (1958), Gindler and King (1972) and El- Merzabani, *et al.* (1977), respectively. Na/ K, Na/ Na+ K and Ca/ P ratios were also calculated.

Direct radioimmunoassay technique (RIA) was performed for plasma triiodothyronine (T3), thyroxine (T4) and aldosterone (AL) hormones using ready antibody coated tubes kits manufactured by Immunotech, Beckman Counter Company, France.

5- Statistical analysis:

Data were analyzed using General Linear Model Procedure (SAS, 1998).

RESULTS AND DISCUSSION

1- Growth performance:

The body weight gain throughout the experimental period was positive for all groups (Figure 1) with significant ($P<0.05$) differences. Control group achieved the highest body weight gain (75.42%) followed by silage fed group (62.38%) and fresh fed group (58.43%), respectively (Table 3).

Moreover, Control group had the highest average daily gain values followed by silage and fresh groups, respictively (Table 3). This reduction in daily gain of animals fed on fresh or silage forms of *Atriplex halimus* and *Acacia saligna* mixture might be attributed to the tannins content (Table 1), which was found to reduce the digestibility of protein and dry matter (Priolo *et al.*, 2000). A combination of reduced intake and low true digestibility of protein caused the negative effect of tannins on growth rate (Tanner *et al.*, 1990). These results were in agreement with those reported by Azamel (1997), El- Hassanein *et al.* (2002) and Nasr *et al.* (2002). Badawy *et al.* (2002) found that lambs fed on fresh *Atriplex halimus* or *Acacia saligna* had lower average daily gain than the control group. On the other hand, the values of A/G ratio showed a reverse trend of TP, A, and G where the fresh group had the highest ($P< 0.01$) value followed by control and silage groups (Table 4). However, Badawy *et al.* (2002) and Coles (1986) revealed that the animals fed *Atriplex* or *Acacia* had lower A/G ratio but the differences were not significant.

Table (3): Growth performance of growing Barki male lambs as affected by feeding desert shrubs mixture

Item	G1	G2	G3	Overall mean
Duration (Day)	240	240	240	240
Initial body weight (kg)	29.30±2.034	24.51±2.034	23.58±2.034	25.79±0.836
Final body weight* (kg)	51.40±2.771a	38.83±2.771b	38.29±2.771b	42.84±1.174
Body total gain* (kg)	22.10±0.564a	14.32±0.564b	14.71±0.564ab	17.04±0.288
% of initial body weight*	75.42±1.383a	58.43±1.838b	62.38±1.838c	65.41±0.926
Daily gain* (gm)	92.08±2.584a	59.67±2.584b	61.29±2.584b	71.01±0.443

*, P<0.05 ns, non-significant G1, Control group.
G2, animals fed on a mixture of fresh *Atriplex* and *Acacia*.
G3, animals fed on the silage of a mixture of *Atriplex* and *Acacia*.
Means in each row in a certain item having the same letter do not differ significantly.

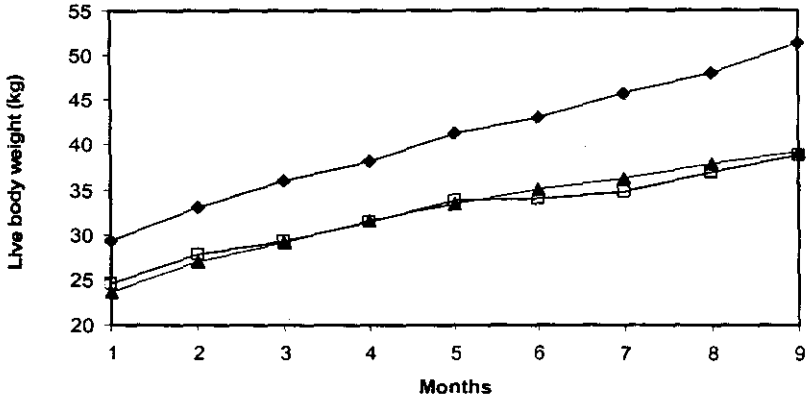

Figure (1): Changes in average live body weight of growing Barki male lambs fed desert shrubs

—◆— G1, Control group
—⊟— G2, animals fed on a mixture of fresh Atriplex and Acacia
—▲— G3, animals fed on the silage of a mixture of Atriplex and Acacia

Table (4): The mean values of total proteins, albumin and globulin concentrations and albumin/ globulin ratio of growing Barki male lambs as affected by feeding desert shrubs mixture

Item	G1	G2	G3	Overall mean
Total proteins** (g/dl)	8.57±0.298a	6.50±0.322b	7.84±0.298a	7.65±0.240
Albumin ns (g/dl)	3.92±0.165	3.15±0.178	3.54±0.165	3.53±0.096
Globulin** (g/dl)	4.65±0.283a	3.35±0.306b	4.30±0.283a	4.10±0.148
A/G ratio**	0.85±0.110a	0.94±0.113b	0.84±0.109a	0.88±0.076

**, p<0.01 ns, non significant G1, Control group.
G2, animals fed on a mixture of fresh *Atriplex* and *Acacia*.
G3, animals fed on the silage of a mixture of *Atriplex* and *Acacia*.
Means in a certain item having the same letter do not differ significantly.

2-2- Total lipids concentration:

The total lipids concentration (TL) of control group exceeded their counterparts of the fresh or silage diets fed groups by only 3.35 and 2.07%,

respectively (Table 5). The non-significant changes showed that feeding on either fresh or silage desert forages did not affect the TL level. These results could be attributed to that the halophytic plants like *Atriplex halimus* and *Acacia saligna* had low fat contents, therefore, feeding on these halophytes for long periods led the animals to utilize the stored body fats for energy supply (Abdel Halim, 2003 and Abdelhameed *et al.*, 2006).

2-3- Total Cholesterol concentration:

Lambs of fresh- fed group recorded the lowest ($P<0.01$) mean value of TC (Table 5) due to the anti- nutritional factors where tannins play a considerable role in lipids digestibility by complexing with fatty acids (Romero *et al.*, 2000), decreasing cholesterol absorption and increasing fat excretion (Bravo *et al.*, 1993). In accordance, Abdelhameed *et al.* (2006) found that fresh- fed group had the lowest cholesterol level as compared to the silage-fed and control groups.

Actually, it is worthy to declare that silage- fed group had non- significant higher TC concentration than that of control group (Table 5) referring to the reduction happened in the anti- nutritional factors as a result of ensiling process (2). In agreement, Abdel Halim (2003) reported that the TC values showed an increase ($P<0.01$) in animals fed on halophytes silage diet.

2- 4- Thyroid hormones:

Control group had highest mean values of triiodothyronine (T3), thyroxine (T4) followed by silage and fresh- fed groups (Table 5). This insignificant decrease might be attributed to the high content of salt. Metwally (2001) reported that saline water treatment in camels decreased both of T_3 and T_4 and attributed that to the decreased of feed intake, so that the metabolism process decreased. In addition, Ayyat *et al.* (1991) and Ahmed (1996) reported that drinking saline water depressed T_3 and T_4 levels of rabbits and found that the higher water salinity, the lower T_3 and T_4 levels.

Table (5): The mean values of total lipids and cholesterol concentrations of growing Barki male lambs as affected by feeding desert shrubs mixture

Item	G1	G2	G3	Overall mean
Total lipids^{ns} (g/l)	2.47±0.225	2.39±0.244	2.42±0.225	2.42±0.149
Cholesterol** (mg/dl)	59.67±3.155a	45.87±3.408b	61.55±3.155a	55.98±2.421
Triiodothyronine^{ns} (pg/ml)	2.36±0.242	1.91±0.230	1.96±0.280	2.07±0.135
Thyroxine^{ns} (ng/ml)	1.20±0.137	0.92±0.131	1.17±0.159	1.10±0.0753

****, p<0.01** **ns, non significant** **G1, Control group.**

G2, animals fed on a mixture of fresh *Atriplex* and *Acacia*.

G3, animals fed on the silage of a mixture of *Atriplex* and *Acacia*.

Means in a certain item having the same letter do not differ significantly.

From the abovementioned results, it was worthy to observe that there were no significant differences between control and silage- fed groups in the concentration of TP, A, G, A/g ratio, TL and TC indicating that ensiling of such halophytic plants might reduce the antinutritional factors (Table 2) which in turn increase the potentiality of feeding desert halophytes (Table 1). This theory was in agreement with those reported by Abdel- Halim (2003) and Younan (2006).

3- Liver function:

Fresh- fed lambs got higher (P<0.01) ALT concentration comparing with their counterparts of silage ration diet by 12.73% and control ration by 79.70% (Table 6). This increment of ALT concentrations might be attributed to the high tannins in these shrubs (Tripathy *et al.*, 1984) or to the high content of salt as reported by Hussein (1987) on sheep. Consistently, Badawy *et al.* (2002) noticed that feeding lambs on fresh *Atriplex* or *Acacia* increased significantly the level of ALT by 14.6 and 14.1 %, respectively.

Similarly, the mean concentration values of AST showed the same trend of ALT where the highest (P<0.05) concentration was observed in animals fed on the fresh mixture of forages plants, followed by those fed on silage ration. The lowest AST mean value was recorded for the control group (Table 6). The high contents of tannins in these shrubs would be the main reason of AST elevation (Tripathy *et al.*, 1984). In a harmony with the present results, Badawy *et al.* (2002) found a significant increase in activity of AST by 13.2% in lambs fed on shrubs as compared to their control group.

However, the mean concentration values of ALT and AST for the three groups were within the normal range reported by Lessard *et al.* (1986), being 5-20 IU/l and 10- 60 IU/l, respectively. On the other hand, the increase of ALT or AST concentration might be caused by high tannins (Tripathy *et al.*, 1984), oxalates (McIntosh, 1972), alkaloids (Craig *et al.*, 1991) and salt (Rodostitis *et al.*, 1994) in forages plants used.

Concerning the alkaline phosphatase concentration, animals fed on fresh or silage diets had lower ALP levels compared with control group. The utmost decline (P<0.01) of ALP was noticed in fresh forages diet group (Table 6). This reduction in ALP concentration might be due to the presence of tannins, which react with this enzyme, reducing its activity (Horigome *et al.*, 1988 and Abde- Halim, 2003). Additionally, excess of oxalate in such desert forages is an inhibitor for that liver enzyme (McComb *et al.*, 1979).

It is worthy to note that, there was no difference between silage diet and control groups. This might be attributed to the fact that the anti- nutritional factors were lowered (Table 2) as a result of ensiling process (Abdel- Halim, 2003 and Younan, 2006).

Table (6): The mean values of alanine amino treanferase, aspertate amino tranferase, alkaline phosphatase, urea, creatinine concentrations and urea/ creatinine ratio of growing Barki male lambs as affected by feeding desert shrubs mixture

Item		G1	G2	G3	Overall mean
ALT**	(IU/l)	7.49±1.195a	13.46±1.291b	11.94±1.195b	10.93±0.933
AST*	(IU/l)	48.75±2.843a	59.21±2.070b	56.50±2.843b	54.91±1.840
ALP**	(IU/l)	169.63±6.406a	130.03±6.919b	158.40±6.406a	153.46±4.864
Urea **	(mg/dl)	32.41±1.926a	25.70±0.794b	28.80±0.925a	28.99±.0.750
Creatinine**	(mg/dl)	4.40±0.139a	5.40±0.139b	4.70±0.139b	4.85±0.116
Urea: Creatinine ratio^{ns}		7.37±0.677	4.76±0.677	6.13±0.407	6.09±0.677

ALT, alanine amino tranferase **AST, aspertate amino tranferase**
ALP, Alkaline phosphatase
***, P<0.05** ****, p<0.01** **ns, non significant** **G1, Control group.**
G2, animals fed on a mixture of fresh *Atriplex* and *Acacia*.
G3, animals fed on the silage of a mixture of *Atriplex* and *Acacia*.
Means in a certain item having the same letter do not differ significantly.

4- Kidney function:

Regardless to the creatinine concentration, the present results revealed that the lowest ($P<0.01$) mean concentration of urea was observed in animals fed on fresh mixture of *Atriplex* and *Acacia* in comparison with the other two groups (Table 6). This result could be attributed to the presence of condensed tannins, which are known to reduce the degradation of dietary proteins in the rumen (Mashudi *et al.*, 1997).

Consistently, Waghorn *et al.* (1994) revealed that plasma urea nitrogen was lowered in sheep and goats fed on legumes that contain high tannins. Azamel (1997) noticed that the blood urea was significantly lowered in two groups of growing lambs fed on *Atriplex halimus* in comparison with control groups. On the contrary, Badawy *et al.* (2002) reported that animals fed on fresh *Atriplex halimus* had high urea values comparing with control group. While, in *Acacia* group it was lower than the control ones.

Remarkably, there was no significant difference between the control and silage groups in blood urea concentration, which might be in consequence of the ensiling process since it is reported to reduce the anti- nutritional factors (Abdel- Halim, 2003; Younan, 2006 and Abdelhameed *et al.*, 2006)

The obtained results declared that the pattern of the mean concentration values of creatinine was in reverse with that of urea results where the highest ($P<0.01$) mean value was observed for fresh *Atriplex* and *Acacia* fed group followed by silage fed group. The control group had the lowest value of creatinine (Table 6). In accordance, Badawy *et al.* (2002) observed that animals fed fresh *Atriplex* or *Acacia* had higher mean values of creatinine than their counterparts fed on control ration. Consistently, Zhu *et al.*, (1992) and Zhu and Filippich (1995) noticed that plasma creatinine was significantly increased in sheep dosed by 0.1 g tannic acid/ kg body weight intraperitoneally. However, El- Bashary (2000) reported that serum creatinine did not change in two groups of camels fed on *Atriplex halimus*.

Clark and Clark (1978) reported that feeding on *Atriplex* species caused destruction of renal nephrons since such plants contain high amounts of oxalates. Cheek (1995) reported that the common effect of oxalate is to cause kidney damage owing to blocking of tubules by crystals of calcium oxalate. This does not necessarily cause death, but the kidney damage remains and subsequently ingestion of oxalate- containing plants may have fatal results.

With reference to the high content of salt in such desert plants, it might be the clue to understand the increment observed in creatinine level of animals fed on fresh form of *Atriplex* and *Acacia* mixture. Receiving salt load resulted in alteration in kidney function of cattle (Nelson *et al.*, 1995 and Weeth and Lesperance, 1965). Hussein (1987) reported that drinking saline water caused highly significant increase in sheep plasma creatinine. Assad *et al.* (1989) noted a significant elevation of creatinine in serum of the ewes and their lambs received diluted seawater (1.3% TDS). Similarly, Abdel- Gawad (1993) demonstrated that drinking saline water by sheep, goats and camels increased plasma creatinine.

The results of urea/ creatinine ratio showed the same trend of urea but with non-significant differences with values being 7.37, 4.76, 6.13 for control,

fresh form and silage form groups, respectively. This might be due to the high presence of condensed tannins, which reduced the ruminal proteins degradation which in turn caused a reduction of urea nitrogen levels in sheep and goats fed on legumes that high in tannins (Mashudi *et al.*, 1997; Waghorn *et al.*, 1994 and Azamel, 1997).

5- Blood electrolytes:

Minerals play an important role in the regulation of body fluids, acid base balance and metabolic processes (Milne, 1996).

The mean values of calcium concentration in plasma showed that fresh form fed group had non-significant lower mean value as compared with silage form fed and control groups, respectively (Table 7) which might be attributed to the high content of tannins and oxalate. Tannins were found to disturb the absorption of minerals through the gastrointestinal tract and/ or increase the endogenous losses of minerals such as calcium, magnesium, and phosphorus (Mansoori and Acamovic, 1997). The results reported by Abdel-Halim (2003) and El- Hassanein *et al.* (2002) demonstrated that concentrations of Ca exhibited non- significant differences in animals fed halophytes in fresh or silage form and their control ones. On the other hand, pervious investigations demonstrated that high salt content in salt desert bushes didn't affect the Ca concentration. In similar, Amer (1990) found that in goats Ca and Mg were not affected by drinking saline water. Moreover, Jaster *et al.* (1978) reported that Ca and P in blood were unchanged and remained relatively constant in cows drinking saline water (2500 p.p.m. NaCl).

Table (7): The mean values of calcium, phosphorus, sodium, potassium and aldosterone concentrations and their ratios of growing Barki male lambs as affected by feeding desert shrubs mixture

Item	G1	G2	G3	Overall mean
Calcium^{ns} (mmol/l)	28.32±0.311	27.55±0.336	32.36±0.336	29.62±0.082
Phosphorus^{ns} (mmol/l)	5.08±0.220	4.89±0.238	5.48±0.238	5.14±0.133
Ca/ P ratio^{ns}	5.65±0.666	5.69±0.720	6.04±0.720	5.84±0.388
Sodium** (mmol/l)	143.00±1.119a	64.00±1.119b	153.79±1.119c	153.59±0.803
Potassium* (mmol/l)	4.37±0.256a	5.42±0.277b	4.43±0.277a	4.71±0.172
Na^+/K^+ ratio^{ns}	32.89±0.736	30.86±0.876	35.30±0.876	33.16±0.104
$Na^+ / Na^+ + K^{+\,ns}$	0.97±0.001	0.96±0.001	0.97±0.001	0.97±0.0006
Aldosterone (pg/ ml)	550.75±10.585a	33.33±12.646	803.75±10.080b	714.35±6.253

*, P<0.05 **, p<0.01 ns, non significant G1, Control group.
G2, animals fed on a mixture of fresh *Atriplex* and *Acacia*.
G3, animals fed on the silage of a mixture of *Atriplex* and *Acacia*.
Means in a certain item having the same letter do not differ significantly.

It is worthy adding that, there was an increase in blood insignificant Ca in silage fed animals as compared to their counterparts of the other two groups. This increase could be attributed to the elevated protein content of this fodder as a result of ensiling process. Abd El- Rahman (1996) and Abdel-Halim (2003) reported on enriching the ensiled materials with available energy and protein resources which enhanced animal acceptability. Total

blood Ca concentration is found to be affected by total plasma protein concentration. An increase in blood protein increases the amount of protein bound Ca and subsequently the total blood Ca concentration (Coles, 1986).

With non- significant differences, the results of phosphorus exhibited the same pattern of calcium (Table 7). The fresh *Atriplex* and *Acacia* fed animals had the lowest plasma P concentration. These results were in agreement with those reported by Abdel- Halim (2003) observing that the animals fed on halophytic plants had non- significant lower mean P concentration. The obtained results declared that there was a disturbance in the values of calcium/ phosphorus ratio for the three experimental groups, exhibiting a different pattern from those of calcium and phosphorus (Table 7) which might be referred to the presence of oxalate in such desert halophytic desert plants. Blaney *et al.* (1981) reported that oxalate reacts with calcium forming insoluble calcium oxalate, which decrease calcium absorption leading to disturbance in the absorbed calcium: phosphorus ratio.

The plasma sodium level values demonstrated that the animals fed fresh form of *Atriplex* and *Acacia* had the highest ($P<0.01$) value followed by the silage form. The control group had the lowest mean value of sodium concentration (Table 7). The increase in sodium concentration might be due to *Atriplex*, which contains high content of sodium (6.45%) and chloride (7.03%) as reported by Mohamed (1996). Similar results were obtained by Rasool *et al.* (1996) in sheep. Badawy *et al.* (2002) and Nasr *et al.* (2002) reported that serum Na^+ levels increased significantly in animals fed *Atriplex*.

In respect of potassium concentration, lambs fed fresh *Atriplex* and *Acacia* had the highest ($P<0.05$) plasma potassium concentration (5.42 mmol) followed by lambs fed the silage form (4.43 mmol/l) which were insignificantly higher than the control group (4.37 mmol/l). Similarly, Badawy *et al.* (2002) found that animals fed on *Atriplex* had higher K^+ concentration. This pattern of potassium was in complete harmony with that of sodium. Wenger and Schuh (1974) and Wichell (1976) noted a relationship between increasing Na^+ intake; which is already high in such forages, and high concentration of K^+ in plasma.

Na and K are known to be found in high concentrations in halophytes (NRC, 1975; Kearl, 1982 and El- Shaer, 1981), however, excess intake of these electrolytes is accompanied by their excess excretion through the kidneys (Neathery, 1980).

The values of Na/ K ratio and Na, K index values showed that there were no significant differences among the three experimental groups. However, silage fed group had the highest value of Na/ K ratio followed by the control group while the fresh fed group had the lowest value, which might be attributed to the highest level of potassium (Table 7). Consistently, Mohamed (1997) noted that the ratios of Na^+/K^+ as well as $Na^+ / Na^+ + K^+$ had no marked differences among groups but increased as the level of water salinity increase.

The mean values of aldosterone demonstrated that animals fed on fresh or silage diets of *Atriplex* and *Acacia* mixture had higher ($P<0.05$) aldosterone level than that of control group (Table 7). This increment in aldosterone concentration might be attributed to hyper- kalemia and the high content of

salt in such desert shrubs. Hamdi *et al.* (1982) clarified the association of aldosterone and $Na^+/ Na^+ + K^+$ index in the blood suggesting that it might be attributed to an increase in the aldosterone release in response to drinking the diluted sea water. In addition, Aboulnaga (1987) demonstrated that the aldosterone secretion and concentration of sodium and potassium in urine and blood plasma would be changed when the ratio of sodium and potassium intake changed.

CONCLUSIONS

Based on the aforementioned results, the following conclusions and recommendations could be achieved:

1- The prolonged feeding on fresh desert shrubs (*Atriplex halimus* and *Acacia saligna*) might negatively affect the physiological performance of lambs.
2- Ensiling would be an avenue for using such desert forages in animals feeding.

These results are of great importance and an attempt to minimize feed shortage for livestock in the deserts by increasing utilization of the available unpalatable desert shrubs, containing antinutritional factors as animals feeds specially for sheep and goats.

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الأداء الفسيولوجى لذكور الحملان الأغنام البرقى المغذاه على النباتات الملحية تحت الظروف شبه الجافة

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أنجز هذا البحث فى محطة بحوث مربوط التابعة لمركز بحوث الصحراء (٣٢كم جنوب غرب الأسكندرية) لإجراء دراسة فسيولوجية عن التغيرات البيوكيمياتية والكترولات الدم وكذلك التغيرات الوزنية بالإضافة إلى وظائف كل من الكبد والكلى لذكور الاغنام البرقى النامية نتيجة التغذية لفترات طويلة على مخلوط من نبات الاكاسيا (*Acacia saligna*) ونبات القطف (*Atriplex halimus*) فى صورة خضراء أو سيلاج. بعد الفطام (عند عمر أربعة شهور) تم تقسيم ذكور الأغنام البرقى النامية وذلك تبعا للعليقة التى كانت تقدم لأمهات تلك الحملان أثناء فترات التلقيح والحمل والرضاعة إلى ثلاثة مجموعات كالآتى: المجموعة الاولى: (٥ حملان) غذيت حيوانات هذة المجموعة على دريس برسيم وأستخدمت كمجموعة ضابطة. المجموعة الثانية: (٦ حملان) غذيت حيوانات هذة المجموعة على مخلوط أخضر من نباتى الأكاسيا والقطف بينما غذيت حيوانات المجموعة الثالثة (٦ حملان) على مخلوط من نباتى الأكاسيا والقطف فى صورة سيلاج.

تم تقدير كل من تركيز البروتينات الكلية (TP)، الألبيومين (A)، الجلوبيولين (G)، الليبيدات الكلية (TL)، الكوليستيرول الكلى (TC)، إنزيمات الكبد (ALT, AST & ALP)، اليوريا، الكرياتين، كما تم تقدير هرمونى الغدة الدرقية هرمون ثلاثي اليود (T_3) وهرمون رباعي اليود (T_4) وهرمون الألدستيرون (AL) بالإضافة إلى تقدير مستوى أملاح الصوديوم (Na)، البوتاسيوم (K)، الكالسيوم (Ca)، الفوسفور (P). تم حساب نسبة كل من الألبيومين إلى الجلوبيولين (A/G)، اليوريا الى الكرياتين، الصوديوم إلى البوتاسيوم (Na/K)، الكالسيوم إلى الفوسفور (Ca/P) وكذلك الصوديوم إلى الصوديوم والبوتاسيوم (Na/Na+K)، التغيرات الوزنية كما تم تقدير معدل الزيادة الوزنية اليومية (ADG).

أوضحت النتائج أن:

الحملان البرقى النامية المغذاة على المخلوط الأخضر من نباتى القطف والأكاسيا أظهرت أقل أداء فسيولوجى حيث أن مستوى تركيز كل من TP (P<0.01)، A، G (P<0.01)،TL، TC (P<0.01)، T3، T4، Ca، P، Na/ K ratio، AL (P<0.05)، ومستوى الزيادة الوزنية اليومية (P<0.05) كان أقل من المجموعتين الأخرتين.

أظهرت النتائج الخاصة بوظائف الكبد والكلى إحتمال تأثر كل من الكبد والكلى للحملان المغذاه على الخليط الأخضر من الأكاسيا والقطف حيث أن هذه الحيوانات سجلت أعلى مستوى من ALT (P<0.01)، AST (P<0.05)، الكرياتين (P<0.01)، الصوديوم (P<0.01)، البوتاسيوم، وأقل مستوى من ALP (P<0.01)، اليوريا (P<0.01)، نسبة اليوريا إلى الكرياتين.

أوضحت النتائج أن:

الأداء الفسيولوجى لمجموعة الحملان البرقى المغذاة على نباتى القطف والأكاسيا فى صورة سيلاج كان تقريبا مسويا فى معظم الصفات للأداء الفسيولوجى للمجموعة الضابطة مما يؤكد على أهمية تحويل تلك النباتات الملحية من الصورة الخضراء إلى سيلاج كأحد الحلول الممكنة لسد الفجوة فى مصادر التغذية تحت الظروف الصحراروية الجافة وشبة الجافة.

الخلاصة: من النتائج السابقة يمكن استخلاص ما يلى:

- إن التغذية لمدد طويلة على مخلوط النباتات الملحية الأخضر من الممكن أن يؤثر بشكل على الأداء الفسيولوجى والانتاجى لتلك الحيوانات.
- إن تحويل تلك النباتات الملحية من الصورة الخضراء إلى سيلاج من الممكن أن يكون أحد الوسائل للإستفادة من تلك النباتات الملحية الصحراية والغير مستساغة والذى يؤدى إلى تحسين القيمة الغذائية من خلال التخلص من مضادات التغذية أثناء عملية السيلجة حيث أن الأداء الفسيولوجى للمجموعة المغذاة على النباتات الملحية فى صورة سيلاج لم يختلف بشكل معنوى عن الأداء الفسيولوجى للمجموعة الكنترول فى معظم الصفات المدروسة.
- هذه النتائج تعتبر ذات أهمية كبيرة ومحاولة لتقليل النقص الحاد فى الأعلاف فى المناطق الصحراوية وزيادة إستساغة تلك النباتات الصحراوية الملحية فى علائق القطعان الحيوانية الصحراوية.