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SOME WOOL CHARACTERISTICS OF BARKI SHEEP FED ON SOME HALOPHYTES UNDER DESERT CONDITIONS.

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ABSTRACT

Thirty adult Barki ewes were randomly divided to three groups (n=10) and were used to study the effect of feeding different forms of halophytic plants on wool production and characteristics. The maintenance requirements of energy were totally covered by barely grains and water was available twice a day for each group. The first group (control) had a free choice to feed on berseem hay, the second group was allowed to feed on fresh mixture of halophytic plants (*Atriplex nummulria and Acacia saligna*) at the ratio of 1:1 while the third group was allowed to feed on silage form of the halophytic plants mixture (*ad lib.)*.

Dimensions of the primary and secondary wool follicles were lower ($p<0.05$) in animals fed on fresh halophytes mixture compared with those of the control group. The concentrations of general proteins in primary and secondary follicles structures showed a similar trend.

There was an obvious deterioration in wool production and most of the studied traits due to feeding halophytes mixture either in fresh or silage forms. However, the ensilage processing of the halophytes mixture seemed to decrease the negative effects on these traits where it occupied an intermediate position between the control and fresh halophytes groups. The concentration of wool sulfur was higher ($p<0.05$) in the ensilage halophytes group than that of the control ($p>0.05$) and the fresh halophytes mixture ($p<0.05$) groups.

Results revealed the importance of ensilage processing of the halophytic plants to decrease the negative effects of the fresh form of these plants on wool production and characteristics.

INTRODUCTION

Halophytes have been used as a forage source to solve the problem of food shortage especially in arid and semi-arid regions of Egypt (El-Shaer and Ismail, 2002). Most of these plants are less palatable and contain antinutritional substances which would affect palatability and intake (Hathcok, 1986).

Atriplex and Acacia species are readily browsed halophytic forages that can greatly contribute in animals feeding in arid and semi-arid regions. Atriplex species have extensively been used as forage for feeding sheep in the arid regions (Ben Salem *et al.*, 2000). Despite the high protein content and digestibility of *Atriplex nummularia*, it is characterized with moderate palatability and intake due to its high salt content (Wilson and Harrington, 1980). Furthermore, Khattab (2007) reported high oxalate and sodium contents in *Atriplex nummularia* which might neutralize *A. nummularia* oxalate and dilute its anti-nutritional effects. Depending on the findings of James *et al.*, (1968) sodium is the major cation neutralizing oxalate in lamb diets.

On the other hand, *Acacia saligna* is a rugged tree that widely adapted to arid conditions. It is of particular interest as forage for ruminants due to its drought tolerant, rapid growth and low water requirements. (Native, et al. 1999, NAS, 1980 and Degen et al. 1985). Acacia species are

characterized with the low protein digestibility (Wilson, 1977) due to the protection of protein by tannins (Gartner and Hurwood, 1967). In addition, they are characterized by high concentrations of phenolic components (lignin and tannin) in their leaves. The condensed tannin in Acacia species inhibits plant protein degradation in the rumen and decrease rumen availability of sulfur, which then depresses the digestibility of plant cell walls. Tannin may also inhibit microbial enzymes in the rumen and decrease the digestion of plant proteins in the intestines (Norton, 1994). Feeding sheep on *Acacia aneura* leaves was found to cause a reduction in wool yield and growth; and an obvious depression in sulfur absorption (Kumar, 2003). Barry (1985) and Krebs *et al.* (2003) reported negative effects of tannins on wool growth and fiber diameter.

Wool is an important natural coat for sheep especially under semi-arid conditions. Not only it protects animals from extremes of climatic and environmental conditions, it could be also utilized as a textile fiber.

The objectives of this study were to determine and evaluate the effects of feeding a ration containing a mixture of *Acacia saligna* and *Atriplex nummularia* in the fresh and silage forms on some wool and skin follicles characteristics of Barki sheep.

MATERIALS AND METHODS

This experiment was carried out at Mariout Research Station (35 Km of Alexandria) belonging to the Desert Research Center. Thirty adult Barki ewes with an average age of 38 months and an average body weight of 35.0 Kg were randomly selected and included in this study. Animals were divided into three groups (10 animals in each). The first group served as a control (group 1) and given berseem (*Trifolium alexandrinum*) hay, the other two groups were fed on a mixture of *Acacia saligna* and *Atriplex nummularia* (1:1) either in fresh (Group 2) or ensiled (Group 3) forms *(ad libtum)*. Animals were offered barley to cover 100% of the energy requirements of energy as recommended by Kearl (1982). The chemical composition of diets are shown in Table (1).

Animals were kept in semi open pens. Fresh water was available twice a day. Animals were healthy and free from internal and external parasites.

Samples of skin and wool were collected from the mid side region of five experimental animals randomly chosen from each group. For the histological study, skin samples were fixed in 10% formalin then embedded in paraffin wax, sectioned at 6-8 µm thickness and stained with Haematoxyline and Eosin (Drury and Wallington, 1980). Histological measurements included external and internal diameters, wall thickness and wool fiber diameter of both primary and secondary wool follicles using an image analyzer (LEIA Q 500).

For histochemical investigation of the wool follicles, the sections were stained according to Pearse (1968). Concentration of general proteins and general carbohydrates in primary and secondary follicle structures (outer root sheath and inner root sheath) were measured by an image analyzer (LEIAQ Q 500) as percentages of optical density values.

Table (1): Chemical composition (on dry matter basis) of feed ingredients of the experimental diets fed.*

Nutrients%	Berseem hay	Barley grain	Fresh halophytes	Ensiled halophytes
DM %	86.31	90.54	33.58	41.09
CP %	13.88	11.1	15.03	12.02
EE %	3.17	3.48	3.34	4.01
CF %	31.39	4.42	19.04	16.96
Ash %	13.81	3.15	17.53	13.32
NFE %	38.75	77.85	45.08	53.74
Anti-nutritional factors				
Total phenols %	2.57	2.51	5.38	3.08
Total tannins %	0.28	1.30	2.25	0.99
Total oxalates %	3.88	0.26	2.38	1.71
Minerals				
Na (%)	1.1	0.09	2.67	1.95
K (%)	2.12	0.45	1.51	0.86
Ca (%)	1.94	0.19	2.72	2.02
Mg (g/ kg)	9.45	1.79	10.36	8.64
Zn (ppm)	176.66	175.64	146.22	102.76
Cu (ppm)	62.46	52.17	52.62	30.59
Se (ppm)	0.21	0.12	7.35	6.30

* Khattab (2007). DM; dry matter. CP; crude protein. EE; ether extract. CF, crude fiber. NFE, nitrogen free extract

Wool samples from 10 cm^2 patch of mid-side position were taken from each animal adjacent to the skin surface using a fine scissor, and kept in plastic bags for further analysis. Ten staples were taken randomly from each wool sample to measure staple length to the nearest 0.5 cm using a ruler till the dense part of the staple. Clean scoured yield was calculated using the method suggested by Chapman (1960). Five hundred fibers from each sample were used to calculate the average fiber diameter and its standard deviation as well as medullated fiber percentage using optical fiber diameter image analyzer (LEICAQ 500 MC). Ten grams of clean scoured and hand carded wool were taken from each sample to determine bulk and resilience using loose wool bulkometer by the method suggested by Bedford *et al.*, (1977). Three greasy staples from each sample were used to measure staple strength using Agritest Staple Breaker as suggested by El-Gabbas *et al.*,(1999). The increase in length as a proportion of the original staple length (elongation) as well as the length and weight of top as a proportion of the length and weight in both top and base were calculated to measure the point of break by length and weight respectively at the time of measuring staple strength. Medullation index (MI) was calculated for each sample, according to the following equation of Pilkington and Purser (1958) and adopted by Guirgis (1973)

$$MI = \frac{1}{10} \sum_{i=1}^{4} Pi$$

Where, i = 1, 2 ,3 and 4 are scores for fine, coarse, hetrotype and kemp, respectively. Pi is the percentage of the i^{th} class.

Sub samples "not less than 300 fibers" were classified into kemp, medullated and fine categories; according to its coarseness and the percentage of medulla (kemp: very coarse fibers with medulla occupying more than 90% of the fiber, medullated: with about 30-70% medulla and fine: non medullated fibers). Fiber type percentages were also counted as described by Guirgis (1967). The crimp frequency/cm was counted along the fiber against a millimeter ruler.

Concentrations of sodium (Na), zinc (Zn), cadmium (Cad), cupper (Cu) and cobalt (Co) in wool samples were measured using UNICAN 929 Atomic Absorption Spectrometer. Sulfur (S) concentrations in wool samples were measured by turbid-metric method using the procedures of Rain Water and Thatcher (1979).

Data were analyzed using general linear model (GLM) of SAS (2000). The model included the fixed effect of treatment on the studied traits. Differences between means were tested by Duncan Multiple Range test (Steel and Torrie, 1980) with significant level of 0.05.

RESULTS AND DISCUSSION

Feeding fresh halophytes mixture (group 2) decreased ($p<0.05$) the external diameter, internal diameter, wall thickness, fiber diameter and medulla thickness of the primary wool follicle compared with the other groups (Table 2). In coincidence, the external diameter, internal diameter, wall thickness and fiber diameter of the secondary follicles showed a similar trend where they were lower ($p<0.05$) in group (2) than the other groups (Table 3 and plate 1). These results indicated a decline in the dimensions of the wool follicles in this group. This may be attributed to the effect of the anti-nutritional factors which were higher in group (2) diet as listed in Table (1) that might influence the availability the nutritional requirements of the wool follicles.

Offering halophytes silage (Group 3) improved the primary and secondary follicles dimensions to be higher in both external and internal diameter as well as wall thickness compared with the other groups (Tables 2, 3 and plate2). The previous result showed that silage treatment tended to decrease the effect of anti-nutritional factors of the halophytic plants on the wool follicles. In coincidence, Abd El-Halim (2003) and Khattab (2007) recommended offering *Atriplex nummilaria* and *Acacia saligna* in silage form to decrease the contents of anti-nutritional factors in sheep diets.

The distribution of general proteins in the wool follicle structures of the different groups (Table 4 and plate 3) showed that group (3) had higher protein contents in the outer root sheath, inner root sheath and fibers of the primary and secondary wool follicles than the other groups. In contrarily, group (2) had the lowest ($p<0.05$) protein contents in wool follicle sheaths compared with the other groups which might indicate a decline in follicle activity and cell proliferation in this group. According to Parmer *et al.* (1988), the higher protein contents in active wool follicle sheaths are associated with an increased protein synthesis during the cellular proliferation. This might explain the lowest wool follicle dimensions (external diameter, internal diameter, wall thickness and fiber diameter) of primary and secondary wool follicles of group (2) (Tables 2 and 3).

Table (2): Least squares means (± SE) of external diameter, internal diameter, wall thickness, fiber diameter and medulla thickness (µm) of the primary follicles of the different experimental groups.

Items	Group 1	Group 2	Group 3
External diameter	144.60 ± 2.970 ^{b}	106.96 ± 3.701 ^{c}	162.22 ± 3.99 ^{a}
Internal diameter	68.50 ± 1.780 ^{a}	57.06 ± 2.260 ^{b}	73.33 ± 2.44 ^{a}
Wall thickness	75.56 ± 2.450 ^{b}	49.89 ± 3.111 ^{c}	88.88 ± 3.35 ^{a}
Fiber diameter	72.91 ± 3.954 ^{a}	60.69 ± 4.100 ^{b}	69.80 ±3.865 ^{ab}
Medulla thickness	47.58 ± 3.510 ^{a}	33.53 ± 3.639 ^{b}	47.71 ±3.431 ^{a}

Means with different superscript letters in the same row differed significantly at P<0.05.
SE: Standard error

Table (3): Least squares means (± SE) of external diameter, internal diameter, wall thickness, fiber diameter and medulla thickness (µm) of the secondary follicles of the different experimental groups.

Items	Group 1	Group 2	Group 3
External diameter	79.06 ± 1.532 ^{b}	60.15 ± 1.534 ^{c}	93.25 ± 1.67 ^{a}
Internal diameter	38.54 ± 0.781 ^{a}	30.63 ± 0.782 ^{b}	39.93 ± 0.85 ^{a}
Wall thickness	40.51 ± 1.173 ^{b}	29.52 ± 1.181 ^{c}	53.32 ± 1.28 ^{a}
Fiber diameter	28.89 ± 1.193^{a}	27.38± 1.237^{a}	28.78 ± 1.167^{a}

Means with different letters in the same row differed significantly at P<0.05
SE: Standard error.

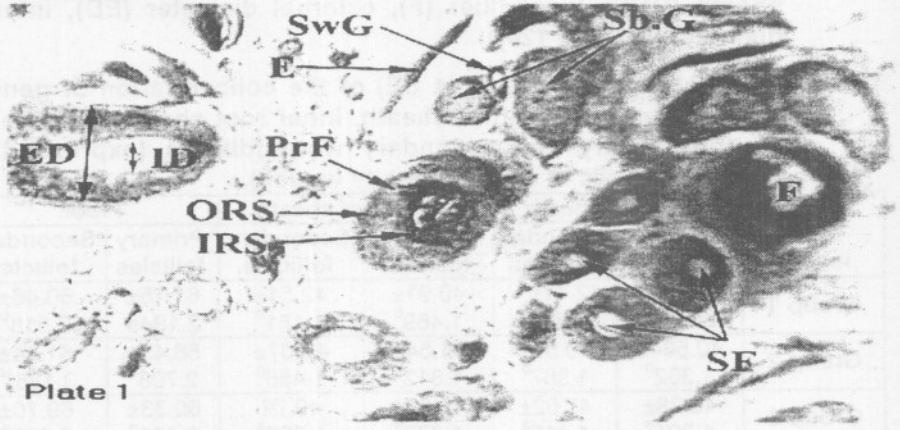

Plate 1

Plate (1): Cross section in the skin of Barki sheep in fresh group showing follicle group structure (sweat gland (SW), sebaceous gland (Sb), erector pili muscle (E), secondary follicles (SF), and the structures of follicle (inner root sheath (IRS), outer root sheath (ORS), wool fiber (F), external diameter (ED), internal diameter (ID),{H,X 120})

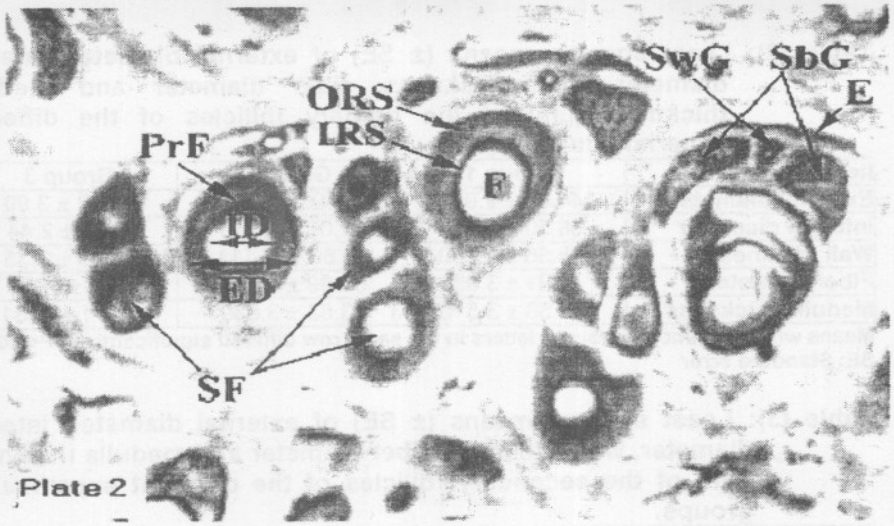

Plate (2): Cross section in the skin of Barki sheep in silage group showing follicle group structure (sweat gland (SW), sebaceous gland (Sb), erector pili muscle (E), secondary follicles (SF), and the structures of follicle (inner root sheath (IRS), outer root sheath (ORS), wool fiber (F), external diameter (ED), internal diameter (ID),{H,X 120})

Table (4): Least squares means (± SE) of the concentration of general proteins in outer root sheath, inner root sheath and fiber of the primary and secondary wool follicles (expressed as percentages of optical density values).

Treat-ments	Outer root sheath		Inner root sheath		Fiber	
	Primary follicles	Secondary follicles	Primary follicles	Secondary follicles	Primary follicles	Secondary follicles
Group 1	44.68± 1.055^{a}	42.41± 1.081^{b}	40.91± 1.469^{b}	42.51± 1.151^{b}	61.15± 2.194a	60.46± 2.518^{b}
Group 2	40.584± 1.302^{b}	40.52± 1.367^{b}	41.54± 1.812^{b}	42.07± 1.456^{b}	56.43± 2.708^{a}	61.44± 3.185^{ab}
Group 3	46.28± 1.201^{a}	47.02± 1.415^{a}	48.83± 1.673^{a}	49.72 1.507^{a}	60.33± 2.499^{a}	69.70± 3.297^{a}

Means with different letters in the same column differed significantly at P<0.05.
SE: Standard error.

The lowest protein contents of wool follicles structures of group (2) may be attributed to the high tannin content of the fresh halophytes mixture which was found to decrease the absorption of the important amino acids for wool growth such as lysine and cystine (Ashes *et al.* 1984) and as a consequence, decreased the contents of protein in wool follicle structures and the follicle cells proliferation.

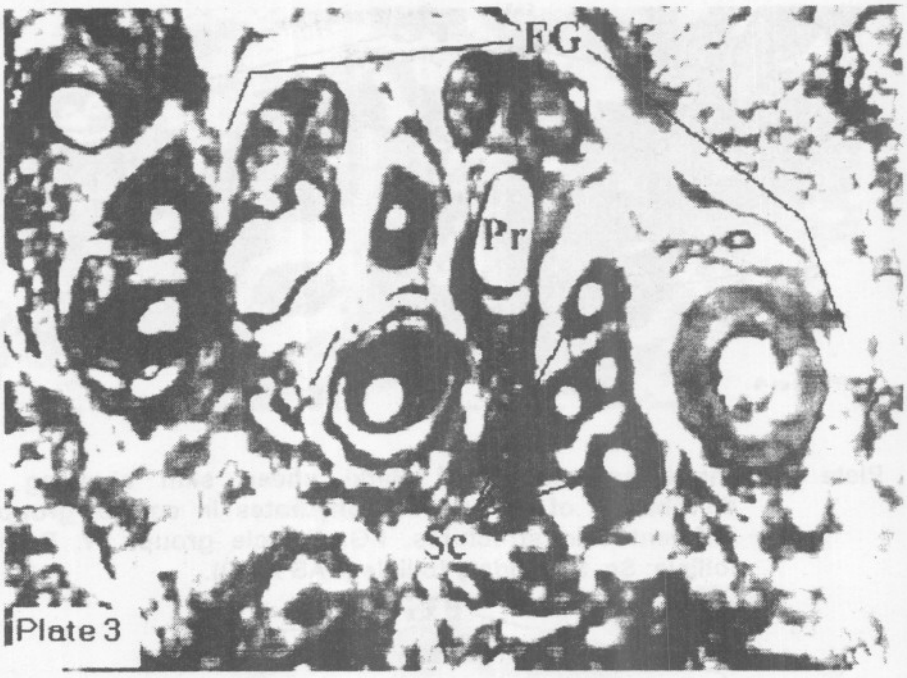

Plate (3): Transverse section of Barki sheep skin showing the distribution of general proteins in different skin structures. FG. Follicle group: Pr. Primary follicle: Sc. Secondary follicle (bromophenol blue X100).

The carbohydrate contents of the outer root sheath and the inner root sheath of the primary and secondary follicles of the experimental groups are illustrated in Table (5 and plate 4). The highest carbohydrate contents in the follicles structures were found in group (1) followed by group (3). While group (2) had the lowest follicle structures contents of carbohydrate (Plate 5). Montagna (1956) and Matter *et al.* (1998) considered the carbohydrate contents of the follicle structures as an indicator to the wool follicle activity.

Table (5): Least squares means (± SE) of the concentration of general carbohydrates in outer root sheath and inner root sheath of the primary and secondary wool follicles (expressed as percentages of optical density values).

Treatment	Outer root sheath		Inner root sheath	
	Primary follicles	Secondary follicles	Primary follicles	Secondary follicles
Group 1	55.87±1.865 [a]	68.06±2.209 [b]	60.40±2.708 [b]	59.41±3.179 [a]
Group 2	53.70±1.585 [a]	61.34±1.913 [ab]	52.50±2.301 [a]	55.25±2.753 [a]
Group 3	51.97±1.503 [a]	64.38±1.913 [a]	53.31±2.183 [a]	60.99±2.753 [a]

Means with different letters in the same column differed significantly at P<0.05.
SE: Standard error

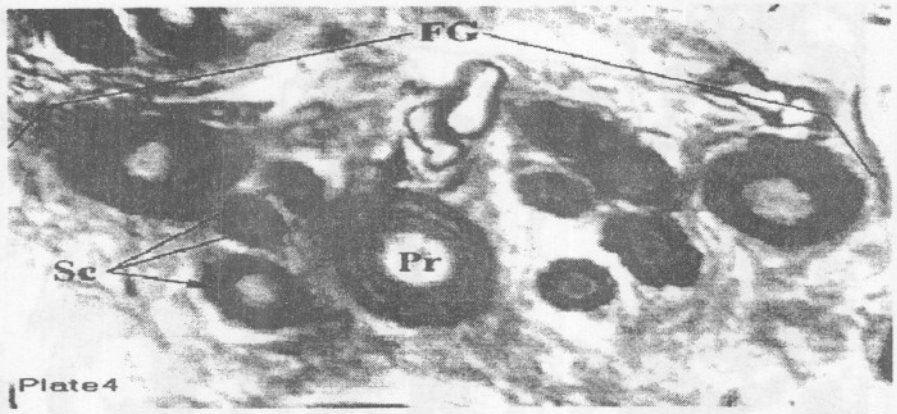

Plate (4):Transverse section of Barki sheep skin showing the distribution of general Carbohydrates in control group in different skin structures. FG. Follicle group: Pr. Primary follicle: Sc. Secondary follicle (PAS X100).

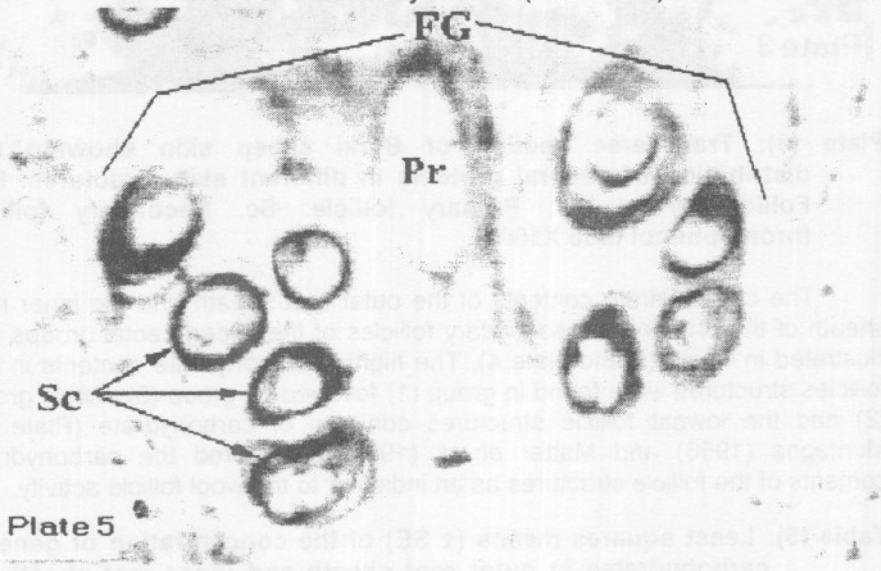

Plate (5):Transverse section of Barki sheep skin showing the distribution of general Carbohydrates in silage group in different skin structures. FG. Follicle group: Pr. Primary follicle: Sc. Secondary follicle (PAS X100).

The low protein and carbohydrate contents in follicle structures of animal fed on fresh halophytes mixture revealed an inhibitory effect of the fresh halophyte mixture diet on the wool follicle activity.

Wool production declined ($p<0.05$) in group (2) compared with those of the other groups. However, no significant differences were detected among the different groups in clean wool yield (Table 6). The decline in wool production might be due to the high contents of tannins and/or the high concentration of sodium and potassium in fresh halophytes mixture (Table 1). Barry (1985) reported a negative effect of tannins on wool growth while David *et al.* (2005) reported that wool growth was depressed at high levels sodium and potassium.

Condensed tannins were considered as the primary anti-nutritional factor that decreases the nutritive value of *Acacia saligna* (Reed and Soller, 1987; Abdulrazek *et al.*, 2000 and Norton 2000). Krebs *et al.* (2003) detected a reduction in wool growth (8.88 %) when *Acacia saligna* leaves were offered *ad libtum* to sheep fed on balanced diet of lupins and straw. They suggested that this response in wool growth to the addition of *A. saligna* leaves could reflect a lack of increase in post ruminal supply of S-containing amino acids and/or an imbalance of protein and energy postruminally. In coincidence, sulfur concentration in wool samples declined ($p<0.05$) in animals fed on fresh halophytes (Table 7). This might enhance the belief that tannins in halophytic plants influenced wool growth via reducing the availability of the S-containing amino acids. Sulfur amino acids have been suggested as a limiting nutrient to wool growth (Reis, 1989).

Table (6): Least squares means (± SE) of wool characteristics of treated groups.

Characteristics	Treatment		
	Group1	Group2	Group3
Wool production (g/10² cm)	31.00 ±0.010 ^{a}	24.00 ± 0.001 ^{b}	30.00 ± 0.010 ^{a}
Yield (%)	57.83 ± 2.970 ^{a}	56.24 ± 4.060 ^{a}	61.85 ± 4.060 ^{a}
Fiber diameter (µm)	32.53 ± 0.328 ^{a}	27.97 ± 0.354 ^{b}	28.34 ± 0.354 ^{b}
Staple length (cm)	11.00 ± 0.304 ^{a}	10.21 ± 0.254 ^{b}	10.20 ± 0.254 ^{b}
Kemp (%)	2.10 ± 0.947	2.12 ± 1.059	2.00 ± 1.059
Medullated fibers (%)	33.80 ± 3.634 ^{b}	37.35 ± 4.063 ^{ab}	47.25 ± 4.063 ^{a}
Fine fibers (%)	64.10 ± 3.264 ^{a}	60.52 ± 3.649 ^{ab}	50.75 ± 3.649 ^{b}
Crimps/cm	3.30 ± 0.358 ^{a}	2.98 ± 0.414 ^{b}	3.11 ± 0.358 ^{ab}
Medullation Index	19.82 ± 0.820 ^{ab}	18.93 ± 0.917 ^{b}	21.21 ± 0.917 ^{a}
Staple Strength (N/K tex)	40.86 ± 4.001 ^{a}	32.88 ± 3.645 ^{b}	30.97 ± 3.645 ^{b}
Staple elongation (%)	28.92 ± 3.391 ^{a}	19.86 ± 3.916 ^{b}	17.72 ± 3.391 ^{b}
Point of staple break (%)	47.94 ± 1.277 ^{a}	42.50 ± 1.475 ^{b}	45.22 ± 1.277 ^{ab}
Bulk	30.00 ± 0.210 ^{a}	27.14 ± 0.290 ^{c}	28.00 ± 0.290 ^{b}
Resilience	9.50 ± 0.100 ^{a}	8.92 ± 0.140 ^{b}	8.92 ± 0.140 ^{b}

Values with different superscripts within the same row are significantly different ($p<0.05$). SE: Standard error

Animals fed on halophytes, either in the fresh (group 2) or silage (group 3) forms, had lower ($p<0.05$) fiber diameter and shorter staples than those of the control group (table 6). This reduction in fiber diameter and stable length might indicate the effect of nutritional stress on animal fed halophytes as a result of the presence of some anti-nutritional factors in the feeding materials (phenols and tannins in *Acacia saligna* and the high level of oxalates in *Atriplex nummularia*) and / or the effect of the high level of sodium and potassium in halophytic plants (Table 1).

Table (7): Concentrations of some minerals in wool samples of each treated group (PPM).

	Treatment		
	Group1	Group2	Group3
Zn	25.25 ± 1.832 [a]	24.20 ± 2.3183 [a]	24.20 ± 2.3183 [a]
Cu	124.12 ± 4.456 [a]	130.00 ± 5.636 [a]	133.00 ± 5.636 [a]
Cad	16.25 ± 1.501 [a]	16.00 ± 1.899 [a]	13.40 ± 1.899 [a]
Cob	68.62 ± 7.235 [a]	53.20 ± 9.151 [a]	45.60 ± 9.151 [a]
Na	11.30 ± 1.347 [b]	18.80 ± 1.702 [a]	12.59 ± 1.553 [b]
S	6208.50 ± 275.574 [ab]	4533.20 ± 334.014 [b]	9599.80 ± 334.014 [a]

Values with different superscripts within the same row are significantly different (p<0.05). PPM: part per million.

Hunter *et al.* (1990) reported a reduction in fiber diameter of up to 40% in nutritional stressed animals. Moreover, Lee and Williams (1993) demonstrated that the overall availability of amino acids is less important for wool growth than that of sulfur amino acids. They also reported a positive environmental correlation between the rate of wool growth and the wool content of sulfur. The previous findings could explain the decrease of wool sulfur (Table 7) found in fresh group compared with the other groups. Helal (2005) found that fiber diameter tended to increase as sulfur in blood or wool increased.

The histogram illustrated in (Fig. 1) shows the percentages of fiber diameter frequencies from ≤ 20 to >55 µm (at 5 µm intervals), where it could be noticed that the percentages of the finer fiber diameters were higher in groups (2) and (3) than in the control group and vice versa. The reduction in length and diameter in the groups (2) and (3) might indicate a nutritional disorder affecting the fiber growth.

Acacia species contains high level of condensed tannins that negatively affects the nutritional value, the intake and digestibility of the browse (Abdulrazek *et al*, 2000). Norton, 2000 reported that condensed tannins have a potential effect on animal production via depressing protein and fiber digestibility. Pritchard *et al.*, (1992) implicated that condensed tannins are the primary inhibitory factor on performance of animals fed on *Acacia aneura* leaves. They reported a significant improvement in wool production when animals were supplemented with poly ethylene glycol (PEG) as detaninification agent. Similar results were reported by Krebs *et al.* (2003) on *Acacia saligna*.

Although kemp percentage did not differ among treatments, medullated fiber percentage and medullattion index (MI) were higher in group (3) than those of the other groups. On the other hand, fine fiber percentage was higher in group (1) compared with the other groups (Table 6).

These results, for the first sight, could be in contrary with the results of the average fiber diameter which increased in the control group compared with the other groups. Fiber diameter distribution (Fig. 1) might explain this conflict where the percentage of the thicker fibers (more than 55µ) in the control group was about twice that of the other groups (7.8%, 3.1% and 4.2 % in groups (1), (2) and (3), respectively). Crimp frequency followed a similar trend to the percentage of fine fibers (Table 6).

There was an obvious deterioration ($p<0.05$) in staple strength, elongation and point of staple break in groups (2) and (3) compared with that of the control group (Table 6). The low staple strength (tenderness) increases the incidence of fiber breaking during processing. Consequently, it increases wastage; slows the time of processing and therefore it increases the unit cost (Rogan, 1988 and El-Gabbas *et al.*, 1999). Morcombe *et al.* (1994) reported the negative effect of saltbush pastures on wool staple strength. They recommended the removal of sheep from the saltland pastures before their live weight values declined, to prevent loss in staple strength. This reduction in staple strength could be attributed to the effect of anti-nutritional factors on the availability of sulfur amino acids to the follicles (Gartner and Hurwood, 1967). Helal (2005) reported that staple strength tended to increase when the availability of sulfur amino acids to the wool follicle increased. Moreover, it could also be partly attributed to the higher fiber diameter of the control group compared with groups (2) and (3) where Thompson and Hynd (1998) found that an increase of 1 µm in minimum fiber diameter was associated with an increase in staple strength of about 5 N/ktex.

Elongation indicated the ability of wool fiber to straighten without breaking and implied the elasticity of the wool fibers (Tellioglu, 1983). Staple elongation of group (2) (19.86 ± 3.916) and group (3) (17.72 ± 3.391) were lower ($p<0.05$) than that of the control (28.92 ± 3.391). The lower staple elongation of treated groups might indicate lower withstanding to processing (El-Gabbas *et al.*, 1999).

Point of staple break (POB) referred to the weakest point at which the staple would be cut into two parts. The control group had higher POB (47.94 ± 1.277 %) than those of group (2) (42.50 ± 1.475 %, $p<0.05$) and group (3) (45.22 ± 1.277 %). Regarding the staple length of each group; the remaining two parts after cutting of the control group staples were longer and more symmetrical in length. These results might indicate a decline in processing traits of the staple due to feeding halophyte fodder either in fresh or silage forms.

Loose wool bulk and resilience of groups (2) and (3) were lower ($p<0.01$) than those of the control group (Table 6). These results indicate negative effects of feeding halophytes on the ability of wool to resist pressure and resume its normal volume after the removal of pressure. Al-Betar (2000) reported a significant effect of nutrition on bulk and resilience.

The highest sulfur content in wool samples was observed in ensiled halophytes group followed by that of the control, while the lowest one was that of the fresh halophytes group. This might be due to the restriction effect of tannins on amino acids and sulfur availability for metabolizable protein synthesis (Norton 1994).

The results revealed that ensiled process of halophytic plants decreased the negative effect of feeding fresh halophytes on some of the studied traits. This might indicate to an improvement in the nutritional status due to the effect of feed processing of fresh shrubs to produce silage. During ensiling process, plants were exposed to molasses addition, high temperature, pressure and moist environment. All these factors were reported

to play an important role in detannificatoin. Makkar and Singh (1993) reported the role of temperature and high moisture in the inactivation of tannins in stored oak leaves. Moreover, Molasses supplementation, as a source of energy and sulfur, enhanced dry matter intake and body weight gain of sheep grazing on tannins containing plants (Haryanto and Djajanegara, 1993).

Abd El-Halim (2003) reported that ensiling processing of fresh shrubs decreased the concentration of anti-nutritional factors e.g. tannins, oxalates, flavonoids and alkaloids. Khattab (2007) recommended the offering of *Atriplex nummilaria* and *Acacia saligna* to animals in silage form to avoid the effects of these anti-nutritional factors on sheep.

Conclusion

Feeding fresh halophytic plants negatively affected wool production and characteristics. The undesirable effect of feeding halophytic forages on wool growth could be attributed to the lower availability of amino acids especially the sulfur amino acids to skin follicles due to the formation of tannin-protein complex.

Ensilage processing of halophytes decreased the negative effect of the feeding halophytic plants on wool growth and characteristics due to decrease the levels of the anti-nutritional factors contained in ensiled forages.

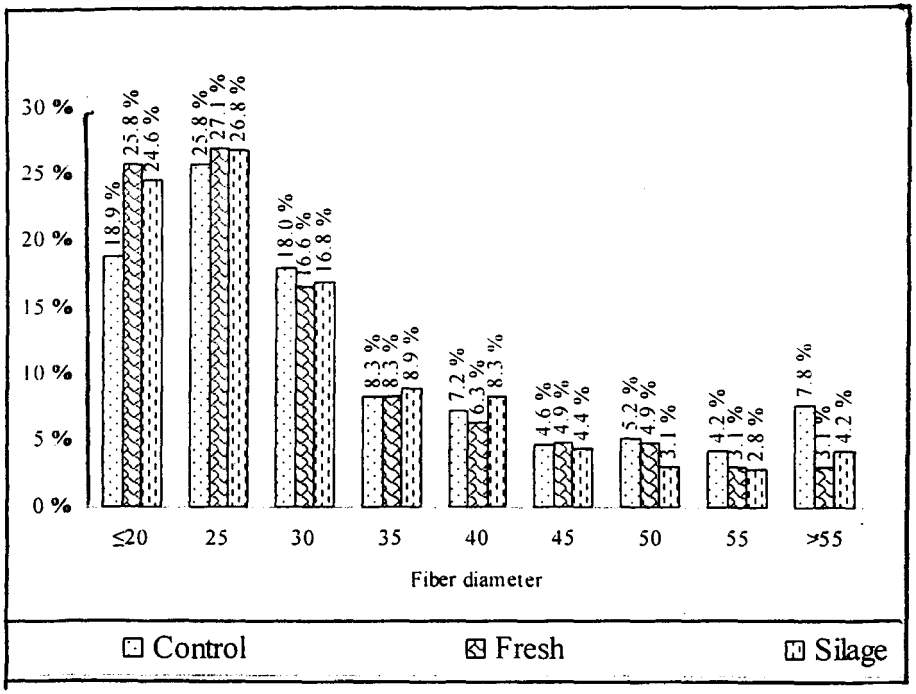

Figure (1): Histogram of the percentages of fiber diameter frequencies in each treated group.

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بعض صفات الصوف للأغنام البرقي المغذاة على بعض النباتات الملحية تحت الظروف الصحراوية

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أجريت هذه التجربة على ثلاثين من نعاج البرقي بهدف دراسة تأثير التغذية على نباتات القطف و الأكاسيا والتي تنتشر في مراعي الساحل الشمالي الغربي على صفات الجلد والصوف حيث قسمت الحيوانات عشوائيا لثلاث مجاميع (ن=١٠) غذيت جميعها على الشعير لتغطية الاحتياجات الحافظة. المجموعة الأولى (كنترول) اتيح لها التغذية الحرة على دريس البرسيم بينما المجموعة الثانية اتيح لها التغذية على خليط من نباتات القطف و الأكاسيا (١:١) في صورة طازجة و غذيت المجموعة الثالثة على ذات الخليط في صورة سيلاج.

أظهرت النتائج انخفاضا في أقطار بصيلات الصوف الأولية و الثانوية وتركيز البروتين الكلي في تراكيب بصيلات الصوف في المجموعة الثانية مقارنة بالمجموعتين الأولى و الثالثة. كما ظهر تدهور في معظم صفات الصوف المدروسة في المجموعتين الثانية و الثالثة مقارنة بالكنترول حيث انخفض معدل انتاج الصوف مقدراً بالجرام في ١٠سم^{٢} انخفاضا ملحوظا في المجموعة الثانية (٧,٤٤%) مقارنة بالكنترول. كما انخفض قطر الألياف وطول وقوة الخصلة في المجموعتين الثانية و الثالثة مقارنة بالكنترول.

كما أظهرت النتائج انخفاضا في نقطة قطع الخصلة وقدرة الألياف على مقاومة الضغط واستعادة حجمها بعد زوال الضغط في المجموعات المغذاة على خليط النباتات الملحية سواء في الصورة الطازجة (المجموعة الثانية) أو في صورة سيلاج (المجموعة الثالثة).

بينت النتائج أن المجموعة الثالثة المغذاة على سيلاج خليط النباتات الملحية حققت تركيزا أعلى من عنصر الكبريت في عينات الصوف مقارنة بالكنترول كما أن صفات الصوف بها كانت أفضل نسبيا من المجموعة الثانية المغذاة على الصورة الطازجة من الخليط وهو ما يمكن تفسيره بانخفاض نسب المضادات الغذائية في المجموعة الثالثة مقارنة بالمجموعة الثانية نتيجة عملية السيلجة حيث انخفضت التركيزات الكلية للفينولات والتانينات والأكسالات في المجموعة الثالثة مقارنة بالمجموعة الثانية وهو ما يشير لأهمية معاملة تلك النباتات بالسيلجة في خفض تركيزات هذه المضادات الغذائية تلافيا لاثارها الضاره على انتاج وصفات الصوف.