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INFLUENCE OF FEEDING FODDER BEET WITH DIFFERENT FORAGES AS NITROGEN SOURCES UNDER SALINE CONDITIONS ON BARKI RAMS PERFORMANCE IN SOUTHERN SINAI.

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SUMMARY

Experiment was conducted to study the effect of feeding different sources of nitrogen as green tropical plants e.g. alfalfa (Alf.) (*Medicago sativa*) (R_1), atriplex (*Atriplex nummularia*) (At.) (R_2) and leucaena (*Leucaena leucocephala*) (Leuc.) (R_3) with dietary inclusion of fodder beet (FB) as an energy source to cover 30% of maintenance energy requirements on nutrients digestibility, nitrogen balance, water utilization and some rumen and blood metabolites. The experiment was performed on fifteen adult Barki rams with average body weight (46 $\pm$ 0.47 kg) and age 3 years old were divided into three equal groups (5 animals for group) and used in feeding trial lasted for fourty five days. Three experimental plants were nutritionally evaluated through three digestibility trials. Higher crude protein content (CP) was obtained in Leuc. and alf while leuc was riche in CF. Nitrogen free extract (NFE) was highest in FB, while ash was maximum in At. and comparable in the rest of plants. Alfalfa and At. contained the highest levels of neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL). Leuc. had the highest tannin content. However, At. was the highest in saponins. The main results showed significant ($P \leq 0.05$) difference among groups in the digestibility coefficients for DM, OM, CF, CP, EE, NDF, ADF and ADL. Animals fed on Alf. indicated the highest dry matter intake (DMI g /kg Bw) and crude protein intake (CPI g /kg Bw). Alfalfa and At. had the highest TDN and DCP values. All animals were in positive N-balance but animals fed on Leuc. retained the least amount of nitrogen. Total water intake recorded maximum amount by animals fed on At. followed by those fed on Alf. then Leuc. Rumen characteristics ammonia-nitrogen (NH_3-N) and total volatile fatty acids (TVFA□s) were increased significantly ($P \leq 0.05$) to reach the peak value at 3 hr post feeding. There is a sampling time effect (zero and 6 hrs post feeding) on some of serum metabolites and liver enzyme. Also, plant species affected blood parameters. Na and K intake were highest in R_3, while Ca and P recorded the highest intake in R_2 and R_1, respectively. Sodium retention was negative in R_2 and R_3, negative potassium retention in R_2 and calcium retention was negative in R_1 and R_3. Finally, R_1 recorded the best TDN, DCP, nitrogen retention with normal blood parameters followed by R_2, then R_3.

Keywords: *green roughages, nutrients digestibility, nitrogen balance, water utilization, rumen, blood serum metabolites*

INTRODUCTION

Egypt suffers from a large shortage in fodder needed for feeding animals, especially in summer season. Fodder beet among the other fodder crops can be planted for correcting the imbalance between the increased requirements of farm animals and the shortage of fodders. In addition to the possibility of storing it so as to compensate for the shortage in fodder in summer season. Fodder beet is typically high in energy with an ME of around 12 mg/kg but low in protein with crude protein values of 6%. Like other root feeds, their high sugar content makes them very palatable, stimulates rumen activity. Its dry matter content differ widely depending upon growing conditions and varieties from 12 to over 20%. Due to its low content of protein level, it needs other source of roughage which contain moderate amount of protein, like alfalfa, atriplex and leucaena. Supplementation with energy or protein can increase dry matter intake. Instead of purchasing a protein supplement, producers may use homegrown forages such as alfalfa to provide supplemental protein to grazing livestock (Philips et al 2002).

Alfalfa (*Medicago sativa*) as green leguminous forage, is preferred by farmers in the newly reclaimed and semi arid areas due mainly to its high nutritive value (Fayed et al., 2010) especially protein level in comparison with other forage plants along with the lower irrigation water requirement in comparison with other forages.

Atriplex nummularia contains high level of digestible crude protein, low carbohydrates and high ash contents (Na and Cl ions) (Ben Salem et al., 2005). The seasonal contents of Na ranged between 5.59 and 6.66 % for spring and all seasons, respectively (Abu- Zanata et al., 2003).

Leucaena leucocephala leaves are very palatable for animal especially ruminants (Purwantari, 2005) have high biomass productivity and digestibility and contain high crude protein (18.9- 27.57) (Ghosh and Bandyopadhyay, 2007). The plant contains low crude fiber and tannins which promotes protein by- pass (Purwantri, 2005). Leucaena species contain many secondary plant metabolities (Lowry *et al.*, 1984), one of them which affects nutritive value is mimosine. Mimosine may be metabolized to DHP (3-hydroxy- 4 (IH)- pyridone) in leaf tissue and in the rumen. In ruminants adapted to leucaena consumption, specialised rumen bacteria may degrade DHP further to harmless compound Panhwar (2005).

Therefore, nutritional evaluation of different forages as nitrogen sources with fodder beet as an energy source in terms of secondary metabolites, tannins, sponins and mimosine, feed intake, digestibility, nitrogen retention, rumen characteristics, water consumption and serum constituents were under taken.

MATERIALS AND METHODS

Animals and Rations:

The present study was carried out at Ras Suder Research Station (Desert Research Center). Fifteen adult Barki rams with an average live body weight 46 $\pm$ 47 kg (3 years) were divided randomly into three groups (5 animals each). Rams were used in feeding trial lasted about fourty five day. The metabolism trial were conducted after feeding trial to get the most nutritious forage with fodder beet as concentrate diet.

Fodder beet (FB) was cutting to small cuts using cutter and offered to all experimental animals at 9 a.m. Forages were collected daily and offered to the animals at 12 a.m. Animals were fed fodder beet to cover 30% of maintenance energy requirements according to Kearl (1982) and green forage *ad lib* as alfafa (R_1) (Alf.), *Atriplex nummularia* (At.) (R_2) and *Leucaena leucocephala* (Leuc.) for (R_3). Drinking water was available twice daily. Combined water was calculated as Fresh diet – Dry diet ml/ kg BW. Metabolic water was calculated from TDN intake a yield of 0.6 gm water per gm TDN (Farid et al., 1986)

Digestibility trial:

Three digestibility trials were carried out at the end of feeding trial. Four rams from each group were used for the digestibility trail as fifteen days adaptation period followed by 5 days collection period.

During the collection period, fecal and urine samples were collected daily (10% by weight of daily samples). At the end of the collection period of the digestibility trial, rumen liquor was sampled by stomach tube at 0, 3 and 6 hours and blood samples were taken from jugular vein at 0 and 6 hours after feeding.

Analysis :

The proximate constituents of feeds, feed refusals, feces and total nitrogen in urine were determined by A.O.A.C. (1997). Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined by Goering and Van Soest (1970). Sodium (Na) and potassium (K) were measured using flame photometer model (Jenway PFP 7) and calcium (Ca) and phosphorus, (P) were determined using atomic absorption spectrophotometer model (Unicam 929) in all dietary, fecal and urinary samples.

Anti-nutritional factors (ANF□s) analysis: quantitative estimation of total tannins (TT), condensed tannins (CT) and saponins (Sap) as the main (ANF□s) in all feed ingredients was determined according to Ali *et al.* (1991), Porter *et al.* (1980) and Balbaa *et al.* (1981), respectively. Rumen total volatile fatty acids (TVFA□s) (Warner 1964) and ammonia nitrogen (NH_3-N) (A.O.A.C. 1997) were determined. Serum samples were taken to determine total protein (Armstrong and Carr, 1964), albumin (Doumas and Biggs, 1971) globulin was obtained by subtracting the albumin values from the total proteins. Creatinine

(Henry, 1965), urea (Patton and Cruouch, 1977), serum AST and ALT (Schmidt and Schmidt 1963) were detected.

Statistical analysis:

General linear model procedure was used for statistical analysis (SAS, 2000). However, Duncan□s multiple range test (Duncan,1955) was applied for comparison of means.

RESULTS AND DISCUSSION

Chemical composition:

The chemical composition of the three forages and fodder beet is presented in Table (1). The results revealed that there are wide variations in chemical composition of the investigated forages. In particular, *Leucaena leucocephala* (Leuc.) is richable forage in crude protein (CP) in this study (22.83%). This finding agree with that reported by Ghosh and Bandyopadhyay (2007). They found that CP content of Leuc. ranged from 18.9 to 27.57%. The CP content in the rest of forages indicated that Leuc. is followed by alfalfa (Alf.) (18.83%) and atriplex (At.) (12.25%). Similar figures were recorded by Aganga and Tshwenyane (2003) and Fayed *et al.* (2010), respectively.

Table (1): Chemical composition, fiber constituents, secondary metabolites and minerals contents of the experimental fodder.

Item	Rations			
	Alfalfa	Atriplex	Leucaena	Fodder beet
Chemical composition %:				
DM	91.35	94.72	92.46	89.22
OM	92.45	79.93	92.49	87.25
CP	18.82	12.25	22.83	8.50
CF	20.63	19.45	22.71	7.75
EE	2.51	1.57	3.02	2.43
Ash	7.55	20.07	7.51	12.75
NFE	50.49	46.66	43.93	68.57
ME M cal /kg DM	425.07	358.28	433.93	387.55
Fiber constituents:				
NDF	61.49	60.73	53.26	32.39
ADF	47.72	36.36	35.1	19.47
ADL	26.93	24.65	23.53	8.25
Cellulose	20.78	11.70	21.13	11.22
Hemicellulose	13.77	24.37	18.16	12.92
Secondary metabolites:				
TT mg/100gm	4.61	5.4	5.61	-
CT g/100 gm	1.35	2.33	2.51	-
Saponins g/100 DM	3.0	4.5	3.71	-
* Mimosine %	n.ev.	n.ev.	2.8	n.ev.
Mineral contents:				
Sodium (Na) %	0.579	1.651	0.240	0.218
Potassium (K) %	0.672	0.575	1.44	0.336
Calcium (Ca) %	0.664	0.624	0.295	0.292
Phosphorus (P) %	0.495	0.419	0.457	0.172

** detected according to Gupta and Chopra (1985). n.ev.: not evaluated, - : absent*
TT: Total tannins, CT: Condensed tannins ,ME, M cal/ kg DM = (TDN × 3.6) / 100 (Church and Pond, 1982).

The CP trend of the studied forages is similar to that reported previously by Sallam *et al.* (2010). Crude fiber (CF) was highest in Leuc. (22.71%) where this value is less than that reported by other workers Aganga and Tshwenyane (2003) and Ghosh and Bandyopadhyay (2007). Alfalfa and At. showed comparable values (20.63 and 19.45%, respectively) which are less than those reported by Fayed *et al.* (2010). These differences could be attributed to different climatic, environmental, stage of growth factors.

Fodder beet (FB) indicated the least one in (CF). Ether extract (EE) was highest in Leuc followed by Alf, FB then At. was the lowest one in EE content. FB attained the highest NFE and this result coincide with the fact that reported by Brabander *et al.* (1999) who reported that FB was characterized by low DM, CP, CF and EE, moderate ash content because of adherent soil and high sugar and starch contents resulting in high digestibility. Leucaena indicated the least NFE. Ash levels are highest in At. followed by FB (20.07% and 12.75%), respectively while Leuc. and Alf. revealed comparable values. Similar trend in ash levels of three roughages was reported by Sallam *et al.* (2010). On the other hand NDF, ADF and ADL concentrations were higher in Alf. and At. compared to Leuc. and FB. Results of the current study are different from that reported by Sallam *et al.* (2010) who found that At. had the lowest content of NDF, ADF and ADL. They attributes the differences in NDF and ADF to the species genotypic differences and to the browses collection period in wet season in Egypt that control fiber accumulation in the plant.

The secondary metabolites or anti-nutritional factors (ANF□s) concentrations in the experimental plants are summarized in Table (1). It is obvious to note that Alf. is the lowest one in total tannins (TT) and condensed tannins (CT). Also, Sallem *et al.* (2010) consistent with this finding, they found that Alf. and At. have negligible CT content while Leuc had the highest contents. Concerning saponins content, it was clear that *Atriplex nummularia* attained the highest concentration of saponins followed by Leuc. then Alf. These findings consistent with Fayed *et al.* (2010). It is well known that the levels of ANF□s are varied from plant to plant and from season to season (El-Shaer *et al.*, 2005). Mimosine content of Leuc. was determined by Gupta and Chopra (1985). They found that mimosine content in leucaena leaves plus twigs was 2.8%. Mimosine is a non- protein, free amino acid that is toxic to non ruminants and un adapted ruminants. However, most leucaena contains about 3 to 5 % of mimosine on a DM basis (Hammond, 1995).

Minerals in feed stuffs are summarized in Table (1). Sodium and potassium are mainly involved in maintenance of osmotic pressure and acid base balance in the body (McDowell, 1997). The greatest concentration of Na was reported in At. followed by Alf., then Leuc., respectively. This result was matched with Anon (2009) who reported that high salt content is the major negative component in atriplex species. K levels indicated opposite figure where it was highest in Leuc. and lowest in At. Alfalfa was the richest one with Ca while Leuc. contained the least Ca level. Alfalfa, leucaena and atriplex indicated comparable levels of P.

Feed intake, digestion coefficients and nutritive values are presented in Table (2). It is clear that dry matter intake (DMI) of roughages (as basal diets) and feed supplements (FB) revealed significant ($P \leq 0.05$) differences. Animals fed on R_1 recorded the highest total dry matter intake (TDMI) of FB and roughage ($P \leq 0.05$) followed by those fed on R_2, R_3 in descending order. The lowest FB intake was recorded by animals fed on R_3. This may be attributed to higher content of ash and saponin in atriplex (Fayed *et al.*, 2010, Hassan., 2009) and mimosine in Leucaena (Puchala *et al.*, 1996).

CP intake g/kg BW (Table 2) was significantly ($P \leq 0.05$) high in animals fed R_1 followed by those fed R_3 and the lowest was R_2, respectively. This finding related to the high content of protein in Alfalfa, Leucaena and atriplex.

It is clearly indicated that Alf. fed animals (R_1) followed by At. fed animals (R_2) recorded the highest digestibility coefficients of DM, OM, CP, CF, EE, NDF, ADF and ADL with significant variations ($P \leq 0.05$). The present results indicated that Leuc. contained the highest CT levels (Table 1) which reduce the nutrients digestibility as reported by Mousa (2011) who found low digestibility of acacia and ascribed that to the inhibitory effect of its high tannin content on microbial activity. Moreover, high polyphenols are believed to interfere with digestion (Karachi, 1998) and consequently increase their out put in faeces (Robbins and Brooker, 2005).

When the nutritive values expressed as TND g/kg B.W and DCP g/kg B.W or DCP%, a significant difference ($P \leq 0.05$) was detected among groups. It was higher in animals fed R_1 followed by R_2 and the lowest was R_3.

Data of N-balance recorded for the three experimental rations are reported in Table (3). Nitrogen utilization (mg/Kg B.W.) in terms of nitrogen intake (NI), urinary or fecal nitrogen, nitrogen excretion and retention were affected significantly ($P \leq 0.05$) by the type of roughage among the three treatments. NI in animals fed R_1 and R_3 were significantly ($P \leq 0.05$) higher than that of R_2. These findings could be attributed to high CP content of Alfalfa and Leucaena (Table, 1) and CP intake (Table 2). Total nitrogen excretion and urinary nitrogen had the same trends of nitrogen intake. These findings may be attributed to the rapid hydrolysis of Alf., Leuc. and At. The CP of At. in the rumen when hydrolysed led to accumulation of ammonia which is inefficiently increase urinary nitrogen execration (Fayed *et al.*, 2010).

Table (2): Average daily feed intake, digestion coefficient and nutritive value of the experimental rations fed to sheep.

Item	Rations			
	R1	R2	R3	± SE
DM intake g/Kg B.W.				
Concentrate	9.62[a]	8.61[b]	8.58[b]	0.262
Roughages	23.06[a]	18.42[b]	16.02[c]	0.152
Total	32.68[a]	27.03[b]	26.60 [b]	0.415
CP intake g/kg. B.W.				
Concentrate	0.795[a]	0.730[b]	0.700[b]	0.022
Roughages	4.335[a]	2.252[c]	3.655[b]	0.029
Total	5.130[a]	2.982[c]	4.355[b]	0.041
Digestion coefficients:				
DM	79.29[a]	76.03[a]	70.58[b]	1.39
OM	81.84[a]	80.81[a]	74.30[b]	1.150
CP	75.71[a]	73.08[ab]	62.28[b]	1.61
CF	63.96[a]	61.98[a]	55.83[b]	1.63
EE	70.09	68.75	67.07	1.61
NFE	87.35	87.58	82.72	1.67
NDF	69.52[a]	67.68[a]	56.84[b]	2.72
ADF	63.58[a]	61.59[a]	52.48[b]	1.71
ADL	25.26[a]	16.26[b]	13.73[b]	1.69
Nutritive value:				
TDN g/kg B.W.	22.89[a]	20.56[ab]	18.46[b]	0.840
TDN %	74.06	73.08	70.74	2.086
DCP g/kg B.W.	2.57	2.49	2.13	0.131
DCP %	9.43[a]	8.36[ab]	7.31[b]	0.527

R_1: fodder beet + alfalfa, R_2 : fodder beet + Atriplex, R_3: fodder beet+ Leucaena
a, b, c: values with different letters in the same raw means statistically significant at ($P \leq 0.05$).

Table (3): Nitrogen utilization (mg/Kg BW) of sheep fed the experimental rations.

Item	Rations			
	R1	R2	R3	± SE
Nitrogen intake	633.58[a]	444.15[b]	513.32[b]	34.03
Excreted nitrogen:				
Fecal nitrogen	145.07	121.51	160.17	14.28
urinary nitrogen	289.95[a]	211.66[b]	293.63[a]	22.05
Total excretion	435.02[a]	333.17[b]	453.80[a]	29.96
Nitrogen retention (NR)	198.56[a]	110.98[b]	59.52[c]	12.95
NR % of intake	31.34[a]	24.99[a]	11.60[b]	2.42
FN % of intake	22.90[b]	27.36[ab]	31.20[a]	2.03
UN % of intake	45.76[b]	47.66[b]	57.20[a]	1.79

R_1: fodder beet + alfalfa, R_2 : fodder beet + Atriplex, R_3: fodder beet+ Leucaena
a, b, c: values with different letters in the same raw means statistically significant at ($P \leq 0.05$).

Nitrogen retention was highest in sheep fed R_1 followed by R_2 and the lowest value was recorded in R_3. This may be due to higher CP content and its digestibility in Alf. (Fayed *et al.*, 2010) and mimosine in leucaena as toxic amino acid which led to loss of enzyme and functional protein activity (Reisner *et al.*, 1979). Similar results were reported by D□Mello *et al.* (1983) who found that trypsin inhibitors in Leuc. severely reduce protein utilization.

Nitrogen retention (NR) as a percent of total nitrogen intake (NR % of NI) was significantly ($P \leq 0.05$) higher in R_1 followed by R_2 and then R_3. These findings may be attributed to lower digestibility of CP in Leucaena as indicated in (Table 2).

The negative effect of tannins on N-balance was demonstrated in numerous studies on sheep and goats (Degen *et al.*, 1995; Ben Salem *et al.*, 2002, 2005 and Mousa, 2011). In addition, Srivastava and Sharma (1998) found that all goats were in positive nitrogen balance, but daily nitrogen retention decreased ($P \leq$

0.05) at medium and high leucaena levels as a result of the poor utilization of the high protein content because of its content of anti- nutritional factors.

Data of Table (4) showed that the highest water intake was reported in sheep fed R_2 and R_1 followed by R_3, respectively. These findings attributed to high content of ash in Atriplex and combined water in Alfalfa (Table 1). The differences among treatments were significant ($P \leq 0.05$). These findings are closed with those reported by Fayed *et al.* (2010) and Hassan (2009) who reported that the ash content of atriplex can influence the animal water requirements because additional water is required to excrete their high ash content specially Na. Concerning Leuc., the least water intake could be explained according to the fact reported by Puchala *et al.* (1996) who found that mimosine decrease water consumption.

Table (4): Water balance (ml/ Kg BW) of sheep fed the experimental ration.

Item	Rations			
	R1	R2	R3	± SE
Drinking water	20.91^c	57.83^a	33.41^b	3.19
Combined water	55.01^a	35.42^b	26.25^b	6.30
Metabolic water	13.73^a	12.34^{ab}	11.67^b	0.504
Total water intake	89.65^a	105.59^{ab}	71.37^b	7.73
Urinary water	39.50^{ab}	60.61^a	35.04^b	3.45
Fecal water	15.76^{ab}	13.56^b	16.00^a	0.677
Total water excreted	55.26^{ab}	74.17^a	51.04^b	3.51
water balance	34.39	31.42	20.33	13.10

R_1: fodder beet + alfalfa, R_2 : fodder beet + Atriplex, R_3: fodder beet+ Leucaena
a, b, c: values with different letters in the same raw means statistically significant at ($P \leq 0.05$).

Urinary water had the same trend. It was higher ($P \leq 0.05$) in R_2 followed by R_1 and the lowest was R_3. These results are in harmony with those reported by Allam *et al.* (2006) and Fayed *et al.* (2010) who indicated that the high content of ash in halophytes leads to push animals to increase excretion of urine as natural channel to excrete minerals. Water balance ml/kg B.W. was significantly higher for animals fed R_2 and R_1 and the lowest was R_3.

Rumen parameters:

Data of rumen total volatile fatty acids (TVFA□s) Table (5) revealed that the highest ($P \leq 0.05$) value was recorded in R_1 followed by R_3 and R_2. This finding may be attributed to higher salt in At. and lower contents of energy in and At which shortening the rumen turn over time with consequently influences on rumen physiology and metabolism (Fayed et al, 2010 and Konig, 1993) and decrease the production of total volatile fatty acids in the rumen. (Shawket and Ahmed, 2009). The concentration of TVFA□s increased significantly after feeding and reach its peak after 3 hrs post feeding. Similar trends were obtained by Fayed *et al.* (2009).

Table (5): Some rumen parameters of sheep fed the experimental ration.

Item	Time	Rations			
		R1	R2	R3	overall mean
Total volatile fatty	0	5.49^b ±0.51	5.83^a ±0.32	5.44^b ±0.1	5.58^c ±0.29
acids (TVFA's)	3	11.34^a±0.42	7.81^c±0.22	8.13^b±0.3	9.09^a ±0.34
meq/ 100 ml.	6	8.59^a±0.73	6.46^b ±0.16	7.53^b±0.9	7.52^b±0.35
overall mean		8.47^a±0.47	6.70^b±0.2	7.03^b±0.6	7.39^b ±0.65
Ammonia (NH_3-	0	22.05^b±0.58	21.55^c±1.00	28.36^{ab}±1.66	23.98^b±2.53
N) mg/100 ml	3	39.40^a±4.34	30.52^b±2.31	36.48^a±3.45	35.46^a±3.89
	6	35.70^a±5.79	27.70^{ab}±4.48	30.04^a±4.62	31.14^a±2.85
overall mean		32.38^a±4.01	26.59^b±2.21	31.63^a±3.24	30.19^a±2.17

R_1: fodder beet + alfalfa, R_2 : fodder beet + Atriplex, R_3: fodder beet+ Leucaena
a, b, c: values with different letters in the same raw means statistically significant at ($P \leq 0.05$).

Similar results were obtained with ammonia nitrogen (NH_3-N) concentration. Thus the greatest value of NH_3-N was recorded for sheep fed R_1 followed by R_3. This is may be due to high content of CP in Alf. and Leuc. and consequently CPI. Hassan (2009) found that ruminal microbial protein synthesis requires an adequate supply of nitrogen to achieve maximal efficiency. McMeniman (1976) also, reported that lower nitrogen content uncoupled fermentation could occur.

Serum Biochemistry:

Serum constituents of the studied sheep as affected by roughage source with fodder beet are given in Table (6). Serum urea-N was affected significantly by roughage type ($P \leq 0.01$). The highest value was recorded in atripelx fed animals (R_2) while the rest of animals showed similar values of (urea-N) when neglecting sampling time. Although Leuc. and Alf. had higher CP values than that of At. but Samanta *et al.* (2003) reported that plasma urea-N reflects the dietary CP intake. Romero et al (2000) also showed that sheep fed with tanniferous diet had reduced blood urea-N level than sheep fed lower dietary tannin. Serum creatinine was significantly influenced by the dietary roughage ($P \leq 0.05$) and sampling time ($P \leq 0.05$). The highest serum creatinine levels were reported in animals fed on R_3 when neglecting time factor and this result could be explained by the fact that it's mimosine content.

Table (6): Serum metabolites and electrolytes concentration of sheep fed the experimental ration.

Item	Rations R1		R2		R3		significance		
	0 hr	6 hr	0 hr	6 hr	0 hr	6 hr	diet	time	diet x time
Urea (mg/dl)	37.85	39.76	43.27	52.81	37.55	52.8	***	NS	***
Creatinine (mg/dl)	1.36	1.1	1.40	1.78	1.64	1.2	**	**	***
Total protein (g/dl)	5.65	7.37	5.13	6.55	5.93	6.53	NS	**	NS
Albumin (g/dl)	2.46	2.5	2.53	2.66	2.66	2.93	NS	NS	NS
Globulin (g/dl)	3.18	4.86	2.6	3.88	3.26	3.6	NS	*	NS
Cholesterol (mg/dl)	59.13	71.9	76.96	105.0	69.3	113.65	***	***	***
Triglycerides (mg/dl)	46.75	65.53	59.25	93.95	37.5	66.2	***	***	*
ALT (U/L)	12.0	14.5	8.0	10.0	7.0	8.33	*	NS	NS
AST (U/L)	25.33	14.5	21.0	16.5	24.0	18.0	NS	***	NS
Calcium (mg/dl)	9.35	10.27	8.16	8.30	7.03	7.56	**	NS	NS
Phosphorus (mg/dl)	5.55	6.16	4.90	5.10	6.07	6.73	**	NS	NS
Sodium (mg/dl)	148.1	149.0	142	142.5	136	138	NS	NS	NS
Potassium (mg/dl)	4.6	4.7	4.0	4.1	4.5	4.61	NS	NS	NS

R_1: fodder beet + alfalfa, R_2 : fodder beet + Atriplex R_3: fodder beet + Leucaena
ALT: Alanine amino transferase AST Aspartate amino transferase
* $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$ NS: not significant

Mimosine decreased water consumption (Puchala *et al.*, 1996) and this consistent with the present finding as reported previously. So this may affect renal function. Also, Brenner *et al.* (1987) reported that when creatinine levels increased indicating impairment of renal functions. Concerning serum protein profile, there are significant differences in total protein (TP) ($P \leq 0.05$) and globulin ($P \leq 0.05$) among treated animals when compared fasting with 6 hrs. post feeding values, but there are no diet type effect on these parameters. Animals fed on Alf. (R_1) showed normal physiological range of total protein according to Puls (1988) (6-7.9 g/dl). Although Alf. contained considerable levels of CT and saponins but At. and Leuc. showed higher levels of tannins and saponins. Aganga and Tshwenyane (2003) reported that CT is known to complex with both protein and fiber and reduce digestibility of the plant. On the other hand Leuc. was the richest roughage in CP in the current study (Table 1) and recorded a considerable total CP intake (4.355 g/kg B.W) (Table 2). High polyphenols are believed to interfere with digestion and may also contribute to low DMD values (Karachi, 1998). The limiting factor of Leuc. feeding in ruminants is mimosine which inhibits protein biosynthesis in living body resulting in growth retardation (Sethi and Kulkarni, 1995). Puchala *et al.* (1996) observed during mimosine infusion a decrease in plasma amino acids to half pre-infusion values was resulted. Some other metabolically active toxic constituents like protease inhibitor is also present in Leuc. leaf meal (D□Mello and Fraser, 1981). Moreover, saponins reduce protein digestibility by the formation of less digestible saponin- protein complexes affecting the nutritive value of the diet (Potter *et al.*, 1993). Albumin showed non- significant variations among animals. Cholesterol and triglycerides levels indicated significant variations affected by diet ($P \leq 0.05$) and sampling time ($P \leq 0.05$). These findings could be explained by Matsura (2001) who found that saponins from different sources causing lower serum cholesterol levels in a variety of animals as several dietary saponins have a hypocholesterolaemic action (Francis *et al.*, 2002). saponins cause a delaying of intestinal absorption of dietary fat by inhibiting pancreatic lipase activity (Han *et al.*, 2000). In addition to that, tannins play a considerable role in lipids digestibility by complexing with fatty acids (Romero *et al.*,2000) causing a decrease in cholesterol absorption and increase in fat excretion (Bravo *et al.*,1993). Puchala *et al.* (1996) found that mimosine causes a decrease in fatty acid absorption thereby causing a deficiency of fat- soluble vitamins.

Serum enzymes revealed that, alanine amino transferase (ALT) was significantly influenced ($P \leq 0.05$) only by dietary roughage while aspartate amino transferase (AST) was significantly affected by sampling time ($P \leq 0.05$).

The present results could be explained according to the hypothesis of Acamovic and Brooker (2005) who reported that there is considerable interaction between ingested plant secondary metabolites (PSM) or phytochemicals and tissues, enzymes and other compounds within the animal. Makkar *et al.* (1988) assumed that the inhibitory or stimulatory effect of tannins on enzyme activity may result from a change in the conformation of the enzyme in the presence of tannins leading to a variable variability of substrate at the catalytic site of the enzyme.

Also, Narjisse *et al.* (1995) elucidated that the biological role of tannins dependent upon their origin and structure. Furthermore, the toxic effects of tannin containing feeds could be due to both absorption of degraded products of hydrolysable tannins and higher concentration of phenols in the blood stream exceeding liver detoxification capacity (Makkar, 2003).

Another factor could explain variations in ALT enzyme is that, Prasad and Paliwal (1989) observed that sheep fed on Leuc. diet revealed nephritis and Cirrhosis. Ghosh and Bandyopadhyay (2007) found that mimosine reduced the activity of AST. Conversely, Srivastava and Sharma (1998) reported that non of the activities of serum ALT and AST of goats fed on Leuc. varied significantly. Also, Mousa (2011) reported similar results with lambs fed acacia, Romero *et al.* (2000) with goats and cattle fed on tanniferous forages, Getachew *et al.* (2008) with sheep fed on alfalfa. On the other hand, Fayed et al (2010) consistent with the present result of AST activity with lambs fed on alfalfa or *Atriplex nummularia.*

Serum minerals revealed that Na and K were not significantly influenced by the dietary plants while other minerals were significantly ($P \leq 0.05$) affected. Serum Ca of sheep fed studied plants At. and Leuc. indicated lower Ca levels than normal physiological range (9-13 mg/dl) according to Puls (1988). This hypocalcemia consistent with Ahmed and Abdelati (2011) in birds fed Leucaena seeds diets and they explained their results according to low mineral intake or metal chelating effect of mimosine (Sethi and Kulkarni, 1995) and/or mineral chelating effect of phytate (Sell *et al.*, 2000). Tannins also, may be share in hypocalcemia because tannins can disturb the absorption of minerals by chelation of them within the GIT of the animal (Cowieson *et al.*, 2004) and/ or increase the endogenous losses of the minerals such as Ca (Mansoori and Acamovic, 1997). Moreover, At. contains oxalate as oxalic acid (El-Shaer *et al.*, 2005) and oxalic acid binds with Ca to form non- soluble, non digestible Ca- oxalate (Cheek, 1995). There is no sampling time effect on Ca levels, while, considerable variations in serum levels of P were evaluated ($P \leq 0.05$). Rasool *et al.* (1996) found that Ca serum level was decreased and P level was increased as a result of increasing At in diet because of binding of Ca with oxalic acid.

Data on Na, K, Ca and P utilization (Table 7) revealed that Na intake was significantly affected ($P \leq 0.05$) by plant species. Animals fed on Alf recorded the highest Na intake although At. contained the highest Na levels (Table 1). This finding could be attributed to that high Na and K content may limit feed intake and reduce digestibility by shortening rumen turnover times (Rossi *et al.*, 1998). Animals fed Alf. excrete highest fecal Na with significant variations ($P \leq 0.05$), while animals fed Leuc. recorded highest urinary Na excretion ($P \leq 0.05$). These findings, could be attributed to the presence of considerable levels of TT and CT in Alf. because tannins can disturb the absorption of minerals by chelation of them within the gastrointestinal tract of the animals (Cowieson *et al.*, 2004). Highest urinary Na excretion in Leuc. fed group could be attributed to the presence of mimosine because Puchala *et al.* (1996) found that mimosine possesses very strong chelating properties and is excreted in the urine as a chelate. Also, McDowell and Arthington (2005) recorded that urine is generally accepted as main pathway for Na excretion. Total excretion of Na revealed a non significant variations among groups.

Type of diet was significantly affect Na balance where, all animals groups except animals fed Alf. showed negative Na balance with significant variations ($P \leq 0.05$). These results could be attributed to the presence of higher levels of secondary metabolites in At. and Leuc. while Alf. showed the least levels of ANF□s. Also, Alf. fed animals recorded the highest DM intake (Table 2). Data on K utilization revealed that K intake ($P \leq 0.05$), K excretion ($P \leq 0.05$) and K retention ($P \leq 0.05$) were significantly affected by plant species. Animals fed on Leuc. recorded highest K intake and excretion. This was matched with the fact that Leuc. recorded the highest potassium content followed by Alf. (Table 1). Negative K balance was recorded in At fed animals. This negative balance could be due to that ANF□s interfere with the normal digestive function and reduce availability of nutrients (Wiryawan, 1997). The highest Ca intake ($P \leq 0.05$) was recorded in R_2 and the lowest intake was in R_3.

Table (7): Mineral balance (gm/dl) of sheep fed the experimental ration.

Mineral	Item	Rations			
		R1	R2	R3	± SE
Na	Intake (g/d)	7.31[a]	5.53[b]	4.09[b]	0.669
	feces (g/d)	4.92[a]	3.21[b]	4.19[ab]	0.106
	Urine (g/d)	2.24[a]	5.89[b]	5.95[b]	0.867
	Total excretion	7.16[b]	9.10[ab]	10.14[a]	0.853
	Balance	0.15[a]	-3.57[b]	-6.06[c]	0.645
K	Intake (g/d)	7.81[ab]	6.22[b]	10.23[a]	0.720
	feces (g/d)	1.06[b]	2.85[a]	3.66[a]	0.464
	Urine (g/d)	3.01[b]	6.17[a]	6.24[a]	0.455
	Total excretion	4.07[b]	9.02[a]	9.91[a]	662
	Balance	3.74[a]	-2.8[c]	0.32[b]	0.899
Ca	Intake (g/d)	6.02[b]	11.16[a]	3.16[c]	0.596
	feces (g/d)	0.73[b]	0.81[ab]	1.32[a]	0.153
	Urine (g/d)	5.53[b]	9.68[a]	5.23[b]	0.868
	Total excretion	6.26[b]	10.48[a]	6.55[b]	0.925
	Balance	-0.24[a]	0.67[a]	-3.39[b]	0.789
P	Intake (g/d)	5.01[a]	3.87[b]	3.83[b]	0.350
	feces (g/d)	0.25[a]	0.14[b]	0.13[b]	0.022
	Urine (g/d)	0.13	0.35	0.25	0.072
	Total excretion	0.39	0.49	0.38	0.093
	Balance	4.63[a]	3.39[b]	3.45[b]	0.54

R_1: fodder beet + alfalfa, R_2 : fodder beet + Atriplex, R_3: fodder beet+ Leucaena
a, b, c: values with different letters in the same raw means statistically significant at ($P \leq 0.05$).

Highest Ca intake in saltbush fed group could be due to the high content of these minerals in saltbush leaves (Alazzeh and Abu-Zanata, 2004). Fecal Ca revealed significant differences ($P \leq 0.05$) among groups, Leuc. fed animals excrete most of Ca in feces. Chester *et al.* (1990) recorded that calcium in plants often exists as complexes with phytate and oxalate that reduce its bio availability. Moreover, tannins form insoluble complexes with essential minerals and disturb their absorption by chelation of them (Cowieson *et al.*, 2004). Urinary Ca loss varied significantly ($P \leq 0.05$) among groups and the highest urinary Ca output was reported in R_2. Indeed, R_2 fed animals revealed the highest total excretion of Ca with significant differences ($P \leq 0.05$). Calcium balance was negative for all different groups except R_2 with significant variations ($P \leq 0.05$) and this could be due to highest Ca intake in R_2.

Alfalfa fed animals recorded elevated levels of P intake ($P \leq 0.05$) and of fecal P ($P \leq 0.05$) output as a result of it□s high content (Table 1) in Alf. and highest DM intake (Table 2).

There were no significant differences among studied animals in urinary phosphorus and in total excretion. Positive phosphorus retention was recorded in all animals groups with significant variations ($P \leq 0.05$).

CONCLUSION

Therefore, analysis of the nutritive value of the individual plants does not necessarily reflect the nutritive value of the diet of the animal. There is an urgent need to solve one of the most serious problems which is shortage of feed and water sources in arid zones of Egypt. The experimental plants represent an important fodder reserve for ruminants and they contained enough nutrients to cover their nutritional requirement but they contained anti- nutritional factors which affecting negatively on DMI, TDN, DCP and NR as in R_2 and R_3. Finally, R_1 recorded the best TDN, DCP, nitrogen retention with normal blood parameters followed by R_2 then R_3.

It is recommended that these plants must not used solely as a dietary source for small ruminants for long time.

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تاثير التغذية على بنجر العلف وبعض الأعلاف الخضراء كمصادر مختلفة للنيتروجين على اداء الكباش البرقى تحت ظروف الملوحة فى جنوب سيناء - مصر

عبير محمد عبد الحليم العيسوى و ايهاب يحيى عيد و عفاف محمود فايد و أحلام رمضان عبده و حسن جودة هلال و حسن محمد الشاعر

قسم تغذية الحيوان والدواجن، مركز بحوث الصحراء، المطرية، مصر

استخدم فى هذا البحث عدد 15كبش بمتوسط وزن 46 كجم وعمر 3 سنوات وتم تقسيمهم عشوانيا إلى ثلاث معاملات (5 حيوانات بكل معاملة) وتم استخدامهم فى تجربة تغذية استمرت 45 يوم تلتها تجربة هضم (15 يوم) وتم تغذية كل المعاملات التجريبية على بنجر العلف كمصدر للطاقة (30 % من احتياجات الطاقة) بالاضافة إلى البرسيم الحجازى، فى المعاملة الأولى، والقطف فى المعاملة الثانية والليوكينا فى المعاملة الثالثة وكانت التغذية على الاعلاف الخشنة تغذية حرة.

وكانت اهم النتائج ما يلى:

- ارتفاع محتوى الليوكينا والبرسيم الحجازى من البروتين مقارنة بالقطف.

- زيادة محتوى البرسيم الحجازى والقطف من مكونات الالياف (الطبيعية والحمضية واللجنين) .

- كان محتوى التانينات مرتفع فى الليوكينا، والصابونين فى القطف .

- زاد استهلاك الغذاء كمادة جافة مأكولة أو بروتين مأكول فى المعاملة الاولى المغذاة على البرسيم الحجازى

- وجود اختلافات معنوية بين المعاملات فى قيم هضم كلا من المادة الجافة والمادة العضوية والالياف الخام والبروتين الخام والمستخلص الخالى من النيتروجين ومكونات الالياف .

- كانت قيم مجموع المركبات الكلية المهضومة والبروتين الخام المهضوم مرتفعة فى المعاملة الأولى (البرسيم الحجازى) والمعاملة الثانية (القطف).

- كان ميزان النيتروجين موجب فى كل المعاملات وكان اقل نيتروجين محتجر فى المعاملة الثالثة والمغذاه على البنجر + الليوكينا.

- زاد استهلاك الماء فى المعاملة الثانية والمغذاة على القطف تلتها المعاملة الاولى والمغذاة على البرسيم الحجازى تلتها مجموعة الليوكينا.

- زاد تركيز الاحماض الدهنية الطيارة والأمونيا معنويا بالكرش نتيجة للمعاملة فكانت اعلى قيمة لها فى المجموعة الاولى تلتها المجموعة الثالثة ثم الثانية.

- أيضا تأثرت بعض معاملات الدم والإنزيمات و المعادن بنوع النباتات المستخدمة في تغذيتها، حيث زاد المأكول من الصوديوم و البوتاسيوم في المجموعة الثالثة بينما زاد المأكول من الكالسيوم و الفسفور في المجموعة الثانية و الأولي .

- سجلت حيوانات المجموعة الثانية و الثالثة ميزان صوديوم سلبي، والمجموعة الثانية فقط ميزان بوتاسيوم سلبي، وحيوانات المجموعة الأولي و الثالثة ميزان كالسيوم سلبي.

أخيرا نستخلص من هذا البحث أن التغذية علي البرسيم الحجازي وبنجر العلف سجلت أعلي وأفضل مجموع المركبات الكلية المهضومة والبروتين الخام المهضوم و ميزان نيتروجين مع معاملات دم طبيعية تلتها المجموعة المغذاه علي القطف ثم الليوكينا