

IMPACT OF FEEDING *ATRIPLEX HALIMUS* AND *ACACIA SALIGNA* WITH DIFFERENT SOURCES OF ENERGY ON LAMBS PERFORMANCE

Safinaz M. Shawket¹, M.H. Ahmed² and M. A. Ibrahim¹

1-Animal and Poultry Production Department, Desert Research Center, Cairo, Egypt.

2- Department of Animal and Fish Production, Faculty of Agriculture (Saba Basha), Alexandria University, Alexandria.

Correspondence : drsafinazshawket@hotmail.com

ABSTRACT

This study was conducted to evaluate *Atriplex* (saltbush) and *Acacia* supplemented with crushed barley grains (CBG) alone or with crushed date seeds (CDS) for fattening growing Barki lambs. Forty lambs (initial weight of 30.6 ± 3.50 kg), 6-8 months age were divided by weight into four groups for 140 days. The first is control group (CG) was fed berseem hay *ad lib.* plus CBG to cover 100% of their maintenance energy requirement (MER). The other three groups were fed *ad lib.* on fresh leaves and succulent stems of both *Atriplex* and *Acacia* supplemented with either 100% of their MER from CBG for diet A, 50% CBG plus 50% CDS for diet B or 25% CBG plus 75% CDS for diet C, respectively. Lambs fed diets A, B, and C consumed slightly higher DMI ($\text{g/day/kg w}^{0.75}$) than the CG. The apparent digestibility of DM, OM and NFE for diets A, B, and C decreased ($P < 0.05$) than CG which related mainly to changes in the type of roughage. Similarly, TDN values of the experimental diets were decreased ($P < 0.01$) according to both type of roughage (diet A) and source of energy (diets B and C). Contrariwise, digestible crude protein (DCP %) increased ($P < 0.01$) due to replacing *Atriplex* and *Acacia* for berseem hay. Average daily gain (g/day) decreased ($P < 0.01$) as a result of changing type of roughage. The best feed conversion was recorded for control diet followed by A and B diets with no significant differences. Otherwise, lamb groups fed *Atriplex* and *Acacia* recorded the highest ($P < 0.01$) insensible water loss ($\text{ml/kgw}^{0.82}$). Nitrogen retention ($\text{g/kgw}^{0.57}$) was decreased ($P < 0.05$) by changing type of roughage. This study indicate that lambs could gain satisfy growth under harsh condition in arid and semi-arid areas of marginal lands, when fed *Atriplex* and *Acacia* shrubs supplemented with CBG and/or CDS at ratio 1:1 of MER as fodder sources.

Keywords: lambs, *Atriplex*, *Acacia*, intake, growth, digestibility, nitrogen retention.

INTRODUCTION

Feed shortage will be increased in the next decades due to the expected global climate changes which will lead to increase desertification in many arid and semi-arid aeries of the world that leads to; accelerate soil erosion by wind and water; increasing salinity in water wells and soil with rain drop. These phenomena will lead to despair the natural range plant cover. Halophytes are widely distributed in high density in these aeries under harsh conditions . This refers to their high resistance to salinity in water and/ or soil especially during dry periods preventing soil erosion. So, feeding halophytes is a feasible solution to minimize the expected problems of feed shortage in such aeries. The suitable halophytic forage species that show better adaptability and chances of establishment are *Atriplex* and *Acacia* species (Le Houerou, 1991; 1992 and Degan *et al.*, 1995 and 1997). High salt content is the major negative component in *Atriplex* species (Wilson, 1992).

Acacia saligna is the most successful species of *Acacia* due to its tolerance to drought, ability to grow in salty soil, higher production of green biomass, higher crude protein content and good nutritive value (Degan *et al.*, 1997). But, it cannot serve as a sole feed for sheep due to its high content of condensed tannins (Degan *et al.*, 1997) which form precipitates with proteins, resulting in the formation of indigestible tannin-protein complexes (Makkar, 1993; Degen *et al.*, 1995) and also form complexes with soluble carbohydrates, cellulose, hemicelluloses and amino acids reducing their digestibilities (Barry, 1985).

Saltbushes, in general, are characterized by moderate digestible crude protein (DCP), low digestible ether extract, soluble carbohydrates and high mineral contents, particularly Na, K, Cl and Ca concentrations. Deficiency of available carbohydrates and the rapid fermentation of its crude protein (CP) together in the rumen may be responsible for the poor utilization of saltbush protein. Feeding on *Atriplex* solely adversely affects the general condition of sheep. Coordination between the concentration of dietary readily available carbohydrates and ruminal ammonia-nitrogen is recognized to maximize the utilization of dietary nitrogen by micro-organisms (El-Shaer and Gihad, 1992). So, energy sources supplementation (i.e. barley grains, yellow corn grains or date seeds) was suggested to stimulate saltbush intake and to make better use of ruminal ammonia-nitrogen by rumen microorganisms. Also, high salt content of *Atriplex* species (saltbush) may be the major factor that limits intake and reduce digestibility as a result of increasing intake of drinking water which lead to shorten the rumen turnover times which reduce the feed ingredients transit time in the rumen (Warren and Casson 1992).

Accordingly, feeding leguminous trees with *Acacia* species seems to be a recommended practice to dilute the negative effects of possible anti-nutritional factors (tannins, oxalates, high salts, etc.) for best utilization of the nutritive value of the both halophytic forages (Franclet and Le Houerou, 1971; Shawket, 1999; Ben Salem, *et*

al., 2002).

Date seeds are an agro-industrial by product of palm trees which grow successfully in arid and semi-arid areas. El-Shear *et al.* (1986) and Khamis *et al.* (1989) found that date seeds used successfully as unconventional supplementary feed for livestock grazing in the native range lands. It serve as source of energy and considerably reduce the feeding costs in comparison with the conventional supplement like barley grains.

The aim of this study was to evaluate the impact of feeding both *Atriplex halimus* (saltbush) and *Acacia saligna* supplemented with ground barley grains alone/or with ground date seeds on the performance of growing lambs.

MATERIAL & METHODS

Animals and Management

Forty growing male lambs of North African desert Barki breed, averaged 6-8 months old and 30.60 ± 3.50 kg body weight were randomly blocked by weight and assigned to four dietary treatments. Each group of 10 animals was housed separately in shaded pen. Animals were left two weeks for adaptation prior the start of experimentation. During that period they were treated with anti-helmenthics. The growth experiment lasted for 120 days plus 22 days for the digestibility trials.

Experimental treatments

The first group (CG) was offered berseem hay *ad lib.* and daily supplement of crushed barley grains (CBG) to cover 100% of MER according to Kearn (1982) allowances. The other three groups, were fed indoors *ad libitum* on fresh cut leaves and succulent stems of *Atriplex halimus* plus *Acacia saligna*. Offered and refused amounts of feeds were recorded to estimate the actual voluntary feed intake for each group. These groups were also provided daily with supplement to cover 100% of MER. The supplement was CBG for group A, 50% CBG plus 50% crushed date seeds (CDS) for group B and 25% CBG plus 75% CDS for group C. All animals were weighed weekly. Fresh water was available all the day for each group.

Digestibility and nitrogen balance trials

Digestibility trial was conducted using three animals chosen randomly from each group. The digestibility trial lasted 22 days, the first 15 days were considered as a preliminary period, followed by a 7 days as collection period. The animals were weighed at the beginning and at the end of the metabolism trial. Animals were housed in individual metabolic cages. During the metabolism trials, animals were fed their normal allowances according to the experimental scheme. Faeces and urine were

quantitatively collected from each animal. The daily faeces excreted of each animal were recorded and 10% was sub-sampled, pooled on animal basis and frozen pending chemical analysis. The urine was collected in plastic buckets containing a solution of 100 ml of 10% H₂SO₄ to prevent ammonia-N loss. The daily output from each animal was weighed and 10% sub-sampled, pooled on animal basis and stored at 4 °C until the analysis of nitrogen. Feed residues were removed daily at 7 a.m and weighed. Daily drinking water volume was recorded.

Analytical Methods

Chemical composition of feeds, residues, faeces and urine were determined according to the procedure of A.O.A.C (1990).

Statistical Analysis

The data were subjected to the statistical analysis according to SAS (1993). Differences in mean values among groups were compared by Duncan's Multiple Range Test (Duncan, 1955).

RESULTS

Chemical composition of feed ingredients

Chemical composition of the experimental basal ingredients (berseem hay, fresh *Atriplex halimus* and *Acacia saligna*) and feed supplements (CBG and CDS) are presented in Table (1). Dry matter content of berseem hay was higher than that of *Atriplex* and *Acacia* by 3.2 and 2.4 times, respectively. *Atriplex* contain higher CP by about 1.4 and 1.3 times and ash by about 20.1 and 2.5 times than B. hay and *Acacia*, respectively. However, *Atriplex* contain less CF and NFE than B. hay and *Acacia* (18.22 vs. 32.3 and 25.5% and 39.28 vs. 41.43 and 49.2%, respectively).

It was noticed that CP and nitrogen free extract of barley grains were higher than that of date seeds by 1.8 and 1.2 times, respectively. On the other hand, date seeds contain higher ash and CF than barley grains by about 2 and 3 times, respectively. These data revealed that CDS were rich in energy content (as NFE) and slightly poor in CP content than CBG.

Digestion coefficient and nutritive value

Nutrient digestibilities and nutritive values of the experimental diets are presented in Table (2). Changing the type of roughage by adding *Atriplex* plus *Acacia* instead of berseem hay significantly ($P < 0.05$) decreased the DM, OM and NFF digestibility of A, B and C diets. There were no significant differences among CP, CF

and EE digestibilities of dietary treatments. Also, changing type of the experimental diets either by adding *Atriplex* and *Acacia* instead of berseem hay or date seeds at rates of 50 and 75% instead of barley grains, were significantly ($P < 0.01$) decreased their nutritive value as TDN%. Inclusion of *Atriplex* and *Acacia* instead of berseem hay promoted higher ($P < 0.01$) DCP% (diet A), while inclusion of 50 or 75% date seeds instead of CBG (diets B and C) decreased DCP% comparing to diet A, but still higher than the control diet.

Voluntary feed intake, growth performance and feed conversion efficiency

Voluntary feed intake and daily nutrients intake $g/day/Kg^{0.75}$ of growing lambs are shown in Table (3). The supplements offered were entirely consumed. Generally, irrespective of energy supplementation, it was noticeable that lambs fed diets A, B and C, consumed almost equal amounts ($g\ DMI/day/kg^{0.75}$) from fresh *Atriplex* and fresh *Acacia*. Total dry matter intake by lambs of CG and the experimental diets A, B and C were almost equal. Total digestible nutrients intake (TDNI, $g/day/Kw^{0.75}$) values revealed that the maximum intake was recorded by lambs of CG and A diets, respectively. Groups fed diets A, B and C which contained *Atriplex* and *Acacia* revealed higher digestible crude protein (DCP, $g/day/Kw^{0.75}$) than CG group. It was noticed that when lambs had a free choice for feeding *Atriplex* or *Acacia* at the same time depending on their selectivity behavior, they consumed an equal amount from *Atriplex* and *Acacia* at ratio 1:1 (diets A, B and C) (This is not valid because all amounts offered were consumed, accordingly there was no real selection choice).

Growth performance and feed conversion were presented in Table 2. Generally, changing the type of roughage by adding *Atriplex* and *Acacia* instead of berseem hay decreased average daily gain ($P < 0.01$) of growing lambs (Fig.1). Feeding diets A and B for lambs accomplished significant better average daily gain than group C, but they were less than CG. Control diet revealed the best feed conversion as DM Kg/Kg gain followed by diets A (*Atriplex* and *Acacia* with 100% CBG), B (*Atriplex* and *Acacia* with 50% CBG plus 50% CDS) and lastly C, but with no significance in differences.

Water utilization

Responses of water intake, excretion and insensible loss to the experimental diets are shown in Table (4). Free drinking water ($ml/kg^{0.82}$) was higher ($P < 0.01$) for CG than the other experimental diet groups. Oppositely, feed water and total water intake ($ml/kg^{0.82}$) for lambs fed diets A, B and C which contained *Atriplex* and *Acacia*, were higher ($P < 0.01$) than for CG. Faecal water, urinary water and total water loss were higher ($P < 0.01$) for animals fed the experimental diets A, B and C (halophytic diets) than for CG. The same trend was observed for the insensible water loss. There was no significance in differences in the insensible water loss % of water intake and dietary treatments compared with value for CG.

Nitrogen balance:

As indicated in Table (5), using *Atriplex* plus *Acacia* (A, B and C) instead of berseem hay (CG) promoted higher ($P<0.01$) nitrogen and total nitrogen intake. Nitrogen loss in both faeces and urine were followed the same pattern of nitrogen intake. Nevertheless, all animal groups fed the experimental diets showed a positive nitrogen balance ($P<0.05$). When the nitrogen retention expressed as a percentage of total nitrogen intakes (NB/TNI) a significant differences ($P<0.01$) among treatments was noticed. The control diet showed the highest value, about double values, compared to those containing *Atriplex* and *Acacia*.

DISCUSSION

Lambs had free choice to consume *Atriplex* and *Acacia* beside being supplemented with CBG alone or plus CDS at rate of 50 or 75% instead of CBG to cover the maintenance energy requirements aiming to overcome the poor energy content of halophytic shrubs.

Results revealed that date seeds are rich in energy (as NFE %) content but slightly poor in protein content and had higher ash, ether extract and crude fiber content (**Rashid and Alwash, 1976**). As an agro-industrial by product, it was 60% cheaper than barley grains (**El-Shear, et al., 1986**). It was noticeable that fresh *Atriplex* had higher CP than berseem hay and fresh *Acacia* (**Shawket et al., 1998**), higher ash content (**Wilson, 1966 a, b, and El-Shaer et al., 1984**) and deficient in available carbohydrates as NFE content (**Hassan and Abd El-Aziz, 1979**).

The apparent digestibility of DM %, OM % and NFE% of the experimental diets were significantly ($P<0.05$) decreased as a result of changing type of roughage by replacing *Atriplex* and *Acacia* instead of berseem hay (diets A, B and C). This may be due to the anti-nutritional factors content especially condensed tannins (CT) in *Acacia*. Condensed tannins link with protein and/or carbohydrates to form undegradable complexes (**Makkar, 1993; Waghorn et al., 1994 and Fall-Toure et al., 1998**) which may have reduced rumen fermentation metabolism and nutrient digestibilities (**Ngwa et al., 2002**). This may explain the depressive effect of CT on DM, OM and NFE digestibility. But **Ben Salem et al. (2002)** indicated that provision of *Atriplex* in combination with barley in the diet of sheep fed *Acacia* reduced its astringency and increased proteins degradation in the rumen by sparing microbial enzymes and improving nutrients digestibility. This improvement was reflected on a higher ($P<0.01$) nutritive value as TDN for diet A than B and C regardless of CG. Also, diet A recorded higher ($P<0.01$) DCP (%) than control and B and C diets, respectively. It is noticeable that provision of date seeds instead of barley grains either by 50% or 75% on the basis of maintenance requirement decreased ($P<0.01$) diet's nutritive value. This

NUTRITION & HUSBANDRY

may be due to the higher CF of date seeds (19.55%), about 3.0 times, than that of barley grains (5.80%). Date seeds also may be responsible of the decrease in NFE digestibility of B and C diets ($P < 0.05$) leading to deficiency in carbohydrates availability of the diet. Carbohydrates deficiency inhibit rumen microbial population of synthesizing enough nitrogen. This is also the reason of decreased DCP% in diets B and C in comparison with diet A ($P < 0.01$). On the other hand, the poor palatability of date seeds reduced its intake by lambs so that they did not eat all the offered amounts calculated to cover 75% of their maintenance energy requirements preferring to consume barley. This may be another reason for reduction in OM, DM and NFE digestibilities of diets which could be responsible of the decrease of the nutritive value as TDN% for B and C diets than that of A diet. The higher DCP% values of the experimental diets A, B and C based on *Atriplex* and *Acacia* as basal roughage than CG (berseem hay) ($P < 0.01$) lead to an interpretation may seems conflict with reports that supplementation with tanniferous roughage-basal diets depressed microbial activity in the rumen (Makkar, 1993 and Nsahlai *et al.*, 1994). The nutritional effects of tannins are associated with their ability to bind with proteins (dietary and enzymes), structural carbohydrates polymers found in plant cell walls and minerals with an overall effect of lowering the bioavailability of nutrients at specific sites in the gastro-intestinal tract (Ndluvo, 2000). Other workers (Waghorn and Shelton, 1992; Wang *et al.*, 1994) had reported that low concentrations of tannins are beneficial to ruminants because they protect plant proteins from degradation in the rumen and increase quantity of dietary protein reaching the lower gastro-intestinal tract. Condensed tannins (at low concentrations) bind with plant protein at nearly neutral PH in the mouth and rumen to form tannin-protein complexes which are stable and insoluble at PH 3.6 -7.0, but dissociate and release protein at PH < 3.5 in the abomasums with little effect on DM, OM and fiber apparent digestibility (Wang *et al.*, 1996, Ngwa *et al.*, 2002). Results of the present study confirm the previous observation. The average daily gain for the successive diets, control, A and B were 174.58, 141.25 and 136.25 g/day, respectively, which appeared more affected ($P < 0.01$) by TDN intake than by increasing DCP intake values of the *Atriplex-Acacia* basal diets. This may be explained by the indicative report of McNeill *et al.* (1999) that dietary protein complexes with tannin was made available in the abomasums and digested in the intestine but tannin released from the protein-tannin complexes may react with non-dietary protein (including digestive enzymes) as it passes along the intestine thus counteracting the benefits of by-pass dietary protein. This may explain the significant ($P < 0.05$) decrease in digestibility of dietary DM, OM and NFE components when *Atriplex* and *Acacia* were replaced berseem hay.

It was noticeable that the higher total water intake of lambs fed on the basal diets of *Atriplex* and *Acacia* (diets A, B and C) might be attributed to the higher ($P < 0.01$) feed water intake ($\text{ml}/\text{kg}^{0.82}$) while not for free water intake which decreased ($P < 0.01$) than those drank when fed control diet. This due to the higher humidity of *Atriplex* and *Acacia* than berseem hay (about 72% and 62% vs. 11%, respectively). This result was conflict with the other findings of previous studies that the higher ash content

of *Atriplex* forced animals to consume relatively more water intake in order to excrete the ingested salt with consequential influences on rumen physiology and metabolism (Konig, 1993, Ben Salem *et al.*, 2002 and Abu-Zanat and Tabbaa, 2005). This result confirmed that feeding animals with a mixture of shrub species seems to be a recommended practice to dilute the negative effects of possible anti-nutritional factors (tannins, oxalates, higher salt content etc.) as indicated previously by Shawket *et al.* (1998) and Ben Salem *et al.*, (2002). Insensible water losses ($P < 0.01$) were in favor of the growing lambs fed diets containing *Atriplex* and *Acacia*, which might have vital significant regulation under the intensive heat load of arid and semi-arid areas (El-Shaer and Kandil, 1990).

Total nitrogen intake of the experimental basal diets were different among diets ($P < 0.01$). Whereas, changing type of roughage by using *Atriplex* with *Acacia* (diets A, B and C) instead of berseem hay (control diet) increased nitrogen intake and total nitrogen intake due to the higher CP content of *Atriplex* than berseem hay and *Acacia* (18.17% vs. 13.15% and 13.67%, respectively). Also, nitrogen excretion in urine and faeces was higher ($P < 0.01$) for lambs fed halophytic basal diets by about 2.4 and 1.9 times that for lambs fed berseem hay. This may be due to the anti-nutritional factors in the halophytic basal diets which form insoluble complexes with diet proteins rendering them indigestible (Degan *et al.*, 1995, 1997 and Ben Salem, 1998) and excreted in faeces. The greater ($P < 0.01$) nitrogen excretion in urine of lambs fed diets of basal roughages of *Atriplex* and *Acacia* could be attributed to the high solubility of nitrogen levels content of *Atriplex* foliage (45% of total N, Kaitho *et al.*, 1998a,b). This also explain the reduction ($P < 0.05$) in nitrogen retention values for these diets. The present study indicated that the N digestibility did not affected significantly by feeding growing lambs this halophytic basal diet (*Atriplex* and *Acacia*) instead of berseem hay. This may be due to the higher NI from halophytic basal diets which can cover the undesirable impact of their anti-nutritional factors that bind feed proteins to be indigestible. Also the inclusion of *Atriplex* with *Acacia* in the experimental basal diets diluted the impair effects of *Acacia* tannins on nutrients digestibility.

CONCLUSION

Under arid and semi-arid conditions, it is desirable to allow sheep grazing more than one kind of halophytic forages i.e. *Atriplex halimus* (saltbush) and *Acacia saligna* (leguminous tree shrubs). These combinations encourage the selection behavior to better obtain the animal needs and help to dilute the possible concentration of anti-nutritional factors in halophytic forages (i.e. tannins, oxalates, salts etc.). Supplement with a suitable source of energy like barley grains either alone or with date seeds (1:1) could improve rumen fermentation and overcome halophytic nutrients deficiency which help to obtain satisfied body weight gain.

REFERENCES

- AOAC, (1990). Association of Official Agriculture Chemists "Official Methods of analysis" 13th ed., Washington, D.C.
- Abu-Zanat, M.M.W. and Tabbaa, M.J. (2005). Effect of feeding *Atriplex* browse to lactating ewes on milk yield and growth rate of their lambs. J. Small Rum. Res. pp: 1-10.
- Barry, T.N., (1985). The role of condensed tannins in the nutritional value of *Lotus pedunculatus* for sheep 3-rates of body and wool growth, Br. J. nutr. 54, 211-217.
- Ben Salem, H., (1998). Effects de l'Acacia cyanophylla Lind I. sur l'ingestion des régimes destinés aux ovins. Rôle des tannins et perspective d'amélioration de sa valeur alimentaire. These Doctorat de l'Université de Dijon (France), P. 252.
- Ben Salem, H., Nefzaouf, A., Ben Salem, L., (2002). *Opuntia ficus-indica* f. *inermis* and *Atriplex nummularia* L.T. on complementary fodder shrubs for sheep and goats. Acta Horticult., 333-341.
- Degan, A.A., Becker, K., Makkar, H.P.S., Borowy, N., (1995). *Acacia saligna* as fodder tree for desert livestock and the interaction of its tannins with fiber fractions., J. Sci. Food Agric., 68: 65-71.
- Degan, A.A., Blankc, A., Beker, K., Kam, M., Benjamin, R.W., Makkar, H.P.S., (1997). The nutritive value of *Acacia saligna* and *Acacia saligna* for goats and sheep. J. Anim Sci., 64: 253-259.
- Duncan, D.B., (1955). Multiple Range and Multiple F Test. Biometric. 11: 1-24.
- El-Shaer, H.M., Gihad, E.A., (1992). Halophytes as animal feeds in Egyptian deserts. Proc. of the Inter. Workshop on "Halophytes for rehabilitation of saline Wastelands and a resource for livestock: Problems and prospects". Nov. 22-27, Nairobi, Kenya.
- El-Shaer, H.N., Hassan, N.I., El-Ashry, M.A., El-Serafy, A.M., (1984). Seasonal variation in the nutritive value of the southern Sinai native range pastures. Proc. 1st Egyptian British Conf. on Animal Production., 11-13 Sept., Zagazig, Egypt.
- El-Shaer, H.M. and Kandil, H.M., (1990). Comparative study on the nutritional value of wild and cultivated *Atriplex halimus* by sheep and goat in Sinai. Com. Sci. and Dev. Res., 29: 8 81-90.
- El-Shaer, H.M., Kandil, H.M., Farid, M.F.A., (1986). The use of agro-industrial by products in supplementary feeding of pregnant and lactating sheep and goats. Proc. of the 2nd Egyptian-British Conf. on Animal and Poultry Production.

**3rd International Scientific Conference on Small Ruminant Development, Hurghada,
Egypt, 12-15 April, 2010**

August 26-28, Bangor, UK.

- Fall-Toure, S., Michalet-Doreau, B., Friot, D., (1998). Occurrence of digestive interactions in tree forage-based diets for sheep. *Anim. Feed Sci. Technol.* 74, 63-78.
- Francllet, A., Le Houerou, H.N., (1971). *Les Atriplex en Timisie et en Afrique de Nord*. Fo: SF/TU N. Rapport technique 7PNUD/FAO. Roma.
- Hassan, N.I., Abd El-Aziz, H.M., (1979). Effect of barley supplement on the nutritive value of saltbush (*Atriplex nummularid*). *World Rev. Anim. Prod.*, 15:47.
- Kaitho, R.J., Nsahlai, I.V., Williams, B.A., Umunna, N.N., Tamminga, S. and Van Bruchem, J., (1998a). Relationships between performance, rumen digestibility, gas production and chemical composition of browses. *Agrofor. Syst.* 39, 129 – 144.
- Kaitho, R.J., Umunna, N.N., Nsahlai, I.V., Tamminga, S. and Van Bruchem, J., (1998b). Nitrogen in browse species: ruminal Degradability and post-ruminal digestability measured by mobile nylon and in vitro technique. *J. Sci. Food Agric.* 76, 488 - 498.
- Kearl, I.C., (1982). Nutrients requirements in developing countries. Utah Agric. Exp. Stat., Utah State University, Logan, USA.
- Khamis, H.S., El-Shaer, H.M., Farid, M.F.A., Shalaby, A.S., Salem, O.A., (1989). Utilization of date seeds and olive pulp supplementary feed for lactating ewes in Sinai. Proc. 3rd Egyptian-British Conf. on Animal and Poultry production, Oct. 7-10, A Egypt.
- Konig, K.W.R., (1993). Influence of saltbush (*Atriplex* spp.) as diet component on performance of sheep and goats under semi arid range conditions. Ph. D. dissertation, Reihe Agrarwissenschaft, Institute for Animal Production in the Tropics and Subtropics, Aachen, Germany (ISB N: 3 – 86III – 706 – 1).
- Le Houerou, H.N., (1991). The role of saltbushes (*Atriplex* spp.) in the development and rehabilitation of arid and semi-arid zones in the Mediterranean Basin. Int. Conf. on the Agricultural Management in Salt Affected Areas. Agadir. Morocco, April 26-3 May.
- Le Houerou, H.N., (1992). The role of saltbushes (*Atriplex* spp.) in arid land rehabilitation in the Mediterranean Basin: A review, *Agro forestry systems*, 18: 108-148.
- Makkar, H.P.S., (1993). Antinutritinal factors in foods for livestock in Animal Production in Developing Countries (ed. M. Gill, E. Owen, G.E. Pollott and T.L.J. Lawrence), Accessional publication, British Society of Animal Production, no. 16, PP. 69-85.

NUTRITION & HUSBANDRY

- McNeill, D.M., Osborne, N., Komolong, M., Nankervis, D., (1999). Condensed tannins in the *Leucaena* genus and their nutritional significance for ruminants. In: Shelton, H.M., Gutteridge, R.C., Mullin, B.F., Bray, R.A. (Eds.). *Leucaena. Adaptation, Quality and Farming Systems*. ACIAR Proceeding No. 86, pp. 205-214.
- Ndluvo, L.R., (2000). Tannins in animal agriculture: friend or foe. In: Proceedings of the South African Society of Animal Science Congress, 25-27 July 2000, pp. 51-52.
- Nsahlai, I.V., Siaw, D.E.K.A., Osuji, P.O., (1994). The relationships between gas production and chemical composition of 23 browses of the genus *Sesbania*. *J. Sci. Food Agric.* 65, 13-20.
- Ngwa, A.T., Nsahlai, I.V., Iji, P.A., (2002). Effect of feeding legume pods or alfalfa in combination with poor quality grass straw on microbial enzyme activity and production of VFA in the rumen of South African Merino sheep. *Small ruminant Res.* 48: 83-94.
- Rashed, N.H. and Alwash, A.H., (1976). The effect of the proportion of date stones in the diet on its digestion and fermentation in the sheep rumen. *Iraqi. J. Agric. Sci.*, 12: 56 – 65.
- SAS, (1993). *SAS user's guide: Statistics*, SAS Inst. Inc. Gary, NC. Rel. eigh.
- Shawket, M.S., (1999). Effect of energy level supplementation on the utilization of some pasture plants by goats. *J. Agric. Sci. Mansoura Univ.*, 24: 4565-4573.
- Shawket, M.S., Ahmed, M.H., Nour, A.A., (1998). Effect of barley grains supplementation on the performance of growing Barki lambs fed on fresh saltbush (*Atriplex halimus*). *Alex. J. Agric. Res.*, 43:1-15.
- Waghorn, G.C., Shelton, I.D., (1992). The nutritive value of Lotus for sheep. *Proc. NZ Soc. Anim. Prod.* 52, 89-92.
- Waghorn, G.C., Sheltn, I.D., McNabb, W.C., (1994). Effect of condensed tannins in *Lotus pedunculatus* on its nutritive value for sheep Non-nitrogenous aspects. *J. Agric. Sci.* 123: 99-107.
- Wang, Y., Douglas, G.B., Waghorn, G.C., Barry, T.N., Foote, A.G., Purchas, R.W., (1996). Effects of condensed tannins upon the performance of lambs grazing *Lotus corniculatus* and Lucerne (*Medicago sativa*). *J. Agric. Sci. (Camb.)* 126, 87-98.
- Wang, Y., Waghorn, G.C., Barry, T.N., Shelton, L.D., (1994) The effect of condensed tannins in *Lotus corniculatus* on plasma metabolism of methionine, cystine and

3rd International Scientific Conference on Small Ruminant Development, Hurghada,
Egypt, 12-15 April, 2010

inorganic sulphate by sheep. Br. J. Nutr. 72, 923-935.

Warren, B.E., Casson, T., (1992). Performance of sheep grazing salt tolerant forages on revegetated saltland. Aust. Soc. For Animal Production: 19, 237-241.

Wilson, A.D., (1966 a). The value of Atriplex (saltbush) and Kochi (Bluebush) species as food for sheep. Aust. J. Agric. Res., 17: 147.

Wilson, A.D., (1966 b). the tolerance of sheep to sodium chloride in drinking water. Aust. J. Agric. Res., 17: 503-514.

Wilson, A.D., (1992). Halophytic plants communities in Australia: Ecology and potential as a rangeland resource. Proc. Inter. Workshop. Halophytes as a resource for livestock and for rehabilitation of degraded land.

Table 1: Chemical composition (% on DM basis) of the experimental diets.

| Item | Berseem Hay | <i>Atriplex</i> <i>halimus</i> | <i>Acacia</i> <i>saligna</i> | Barley grains | Date seeds |
|-----------------------|----------------|-----------------------------------|---------------------------------|------------------|---------------|
| Dry matter (DM) | 89.42 | 27.98 | 37.93 | 87.13 | 91.71 |
| Organic matter (OM) | 89.44 | 78.13 | 91.17 | 96.49 | 92.89 |
| Crude protein (CP) | 13.15 | 18.17 | 13.76 | 10.37 | 5.92 |
| Crude fiber (CF) | 32.20 | 18.22 | 25.50 | 5.80 | 17.55 |
| Ether extract (EE) | 2.66 | 2.46 | 2.71 | 3.89 | 3.65 |
| Nitrogen free extract | 41.43 | 39.28 | 49.20 | 76.43 | 65.77 |
| Ash | 10.56 | 21.87 | 8.83 | 3.51 | 7.11 |

NUTRITION & HUSBANDRY

Table 2: Voluntary feed intake, growth performance, feed conversion of lambs fed *Atriplex* and *Acacia* with different sources of energy supplementation.

| Items | Experimental diets ¹ | | | | F test |
|-------------------------------------|---------------------------------|-------------------------|------------------------|------------------------|--------|
| | Control | A | B | C | |
| No. of animals | 10 | 10 | 10 | 10 | |
| Experimental periods, day | | | 120 | | |
| Initial BW, Kg | 30.55±1.5 | 30.55±0.83 | 30.5±1.33 | 30.8±0.78 | NS |
| Final BW, Kg | 51.5±1.73 | 47.5±1.05 | 46.85±1.31 | 46.35±1.87 | * |
| BW changes, Kg | 21.13±2.47 | 17.09±1.29 | 16.49±1.29 | 15.68±0.96 | * |
| Average daily gain, g/day | 174.6±18.5 ^a | 141.3±11.9 ^b | 136.3±9.5 ^b | 129.6±8.3 ^c | ** |
| DM intake, g/day/Kg ^{0.75} | | | | | |
| Barley grains | 33.95 | 33.44 | 16.92 | 9.02 | |
| Date seeds | - | - | - | - | |
| Berseem hay | 74.23 | - | - | - | |
| <i>Atriplex halimus</i> | - | 38.52 | 38.78 | 35.57 | |
| <i>Acacia saligna</i> | - | 40.56 | 37.41 | 38.78 | |
| Daily nutrient intake, | | | | | |
| DM | 108.18 | 112.52 | 111.38 | 110.77 | NS |
| TDN | 79.6 ^a | 76.46 ^a | 71.79 ^b | 70.75 ^b | ** |
| DCP | 8.8 ^c | 11.02 ^a | 9.77 ^b | 9.90 ^b | * |
| Feed conversion | | | | | |
| DM Kg/Kg gain | 10.49 | 12.44 | 12.5 | 12.97 | NS |
| DCP g/kg gain | 7.68 | 8.45 | 7.89 | 8.46 | NS |

a, b, c values in the same row with different superscripts are significant different. *P<0.05; **P<0.01; NS not significant.

¹Control diet: *ad lib.* B.hay plus 100% ground barley grains (GBG) of maintenance energy requirements (MER). Diet A: *ad lib.* *Atriplex* – *Acacia* plus 100% GBG of MER. Diet B: *ad lib.* *Atriplex* – *Acacia* plus 50% GBG + 50% ground date seeds (GDS) of MER. Diet C: *ad lib.* *Atriplex* – *Acacia* plus 25% GBG + 75% GDS of MER.

Table 3: Apparent nutrients digestibility and nutritive value of the experimental diets fed to growing lambs.

| Item | Control | A | B | C | Sig. |
|-----------------------------|-----------------------------|------------------------------|-----------------------------|-----------------------------|------|
| Dry matter (DM) | 73.95± 0.73 ^a | 71.06± 0.82 ^b | 69.18± 0.71 ^b | 69.39± 0.68 ^b | * |
| Organic matter (OM) | 74.55± 0.65 ^a | 70.81± 0.84 ^b | 71.03± 0.41 ^b | 71.35± 0.80 ^b | * |
| Crude protein (CP) | 70.85± 2.06 | 69.64± 0.65 | 69.84± 0.44 | 70.44± 0.68 | NS |
| Crude fiber (CF) | 17± 0.51 | 9.61± 1.25 | 69.31± 0.28 | 69.32± 0.40 | NS |
| Ether extract (EE) | 69.62± 0.54 | 69.64± 0.58 | 67.99± 1.21 | 68.45± 0.23 | NS |
| Nitrogen free extract (NFE) | 73.91± 0.78 ^a | 71.87± 0.62 ^{ab} | 66.65± 1.77 ^b | 67.12± 1.15 ^b | * |
| Nutritive value (%) | | | | | |
| TDN | 73.19± 1.70 ^a | 67.95± 0.38 ^b | 64.45± 1.31 ^c | 63.87± 1.46 ^c | ** |
| DCP | 8.14± 0.36 ^b | 9.79± 0.32 ^a | 8.77± 0.09 ^{ab} | 8.97± 0.27 ^{ab} | * |

a, b, c values in the same row with different superscripts are significant different, *P<0.05; **P<0.01; NS not significant.

NUTRITION & HUSBANDRY

Table 3: Voluntary feed intake, growth performance, feed conversion of lambs fed *Atriplex* and *Acacia* with different sources of energy supplementation

| Items | Control | A | B | C | Sig. |
|---|-----------------|-------------------|-------------------|------------------|------|
| Water intake, ml/kg w^{0.82} | | | | | |
| Free drinking water | 86.86± 3.43α | 64.67± 1.02 β | 64.51± 2.15β | 70.59± 2.55β | ** |
| Feed water | 9.63±0.0 4β | 112.27± 2.3 8α | 109.33±2.6 6α | 119.61± 3.74α | ** |
| Total water intake (TWI) | 94.70± 2.51χ | 176.94±1.68 β | 173.84±1.6 3αβ | 190.20± 1.28α | ** |
| Water excretion, ml/kg w^{0.82} | | | | | |
| Feacal water (FW) | 19.98± 1.83β | 27.73±1.0 0α | 25.82± 1.05α | 25.10± 0.99α | ** |
| Urinary water (UW) | 31.77± 1.09χ | 67.89±0.86 β | 67.39± 1.82β | 77.17± 1.66α | ** |
| Total water excretion (TWE) | 51.75± 2.34β | 95.62±3.52 α | 93.21± 1.88α | 102.27± 4.09α | ** |
| Insensible water loss ml / kg w ^{0.82} | 42.95± 3.56β | 81.32±5.68α | 80.63± 6.27α | 87.93± 6.34α | ** |
| % of Water intake | 45.35±1.22 | 45.93±3.81 | 46.38± 3.62 | 46.23± 1.52 | NS |

a, b, c values in the same row with different superscripts are significant different. *P<0.05; **P< 0.01; NS not significant.

¹Control diet: *ad lib.* B.hay plus 100% crushed barley grains (CBG) of maintenance energy requirements (MER). Diet A: *ad lib.* *Atriplex* – *Acacia* plus 100% CBG of MER. Diet B: *ad lib.* *Atriplex* – *Acacia* plus 50% CBG + 50% crushed date seeds (CDS) of MER. Diet C: *ad lib.* *Atriplex* – *Acacia* plus 25% CBG + 75% CDS of MER.

Table 4: Water utilization of growing lambs fed *Atriplex* and *acacia* with different sources of energy.

| Items | Control | A | B | C | Sig. |
|--|-----------------|------------------|-------------------|------------------|------|
| Water intake, ml/kg w^{0.82} | | | | | |
| Free drinking water | 86.86± 3.43α | 64.67± 1.02β | 64.51± 2.15β | 70.59± 2.55β | ** |
| Feed water | 9.63± 0.04β | 112.27± 2.38α | 109.33± 2.66α | 119.61± 3.74α | ** |
| Total water intake (TWI) | 94.70± 2.51χ | 176.94±1.6 8β | 173.84± 1.63αβ | 190.20± 1.28α | ** |
| Water excretion, ml/kg w^{0.82} | | | | | |
| Feecal water (FW) | 19.98± 1.83β | 27.73± 1.00α | 25.82± 1.05α | 25.10± 0.99α | ** |
| Urinary water (UW) | 31.77± 1.09χ | 67.89± 0.86β | 67.39± 1.82β | 77.17± 1.66α | ** |
| Total water excretion (TWE) | 51.75± 2.34β | 95.62± 3.52α | 93.21± 1.88α | 102.27± 4.09α | ** |
| Insensible water loss ml / kg w ^{0.82} | 42.95± 3.56β | 81.32± 5.68α | 80.63± 6.27α | 87.93± 6.34α | ** |
| % of Water intake | 45.35± 1.22 | 45.93± 3.81 | 46.38± 3.62 | 46.23± 1.52 | NS |

a,b,c values in the same row with different superscripts are significant different.** p <0.01; NS not significant.

NUTRITION & HUSBANDRY

Table 5: Nitrogen utilization (g/kgw^{0.75}) for growing lambs fed *Atriplex* and *Acacia* with of the tested energy supplements.

| | Control | A | B | C | Sig. |
|-----------------------|---------|--------|--------|--------|------|
| | 0.66± | 2.08± | 2.19± | 2.21± | |
| NI of basal diets | 0.13b | 0.92a | 1.19a | 0.64a | ** |
| | 0.83± | 0.63± | 0.57± | 0.60± | |
| NI of supplement | 3.5a | 3.09b | 2.7b | 3.04b | ** |
| | 1.49± | 2.71± | 2.76± | 2.81± | |
| Total NI (TNI) | 3.5b | 1.18a | 1.24a | 0.9a | ** |
| | 0.43± | 0.82± | 0.83± | 0.83± | |
| Feacal nitrogen (FN) | 0.64b | 0.62a | 0.26a | 0.34a | ** |
| | 1.06± | 1.89± | 1.93± | 1.98± | |
| Digest nitrogen (DN) | 0.45b | 0.85a | 0.81a | 0.93a | ** |
| | 0.66± | 1.52± | 1.58± | 1.60± | |
| Urinary nitrogen (UN) | 0.17b | 1.0a | 0.76a | 0.75a | ** |
| | 0.40± | 0.37± | 0.36± | 0.38± | |
| Nitrogen balance (NB) | 0.21a | 0.15b | 0.60b | 0.21b | * |
| | 26.85±3 | 13.65± | 13.04± | 13.52± | |
| NB/TNI | .42a | 0.76b | 0.37b | 0.49b | ** |

a, b values in the same row with different superscripts are significantly different, ** P < 0.01, NS not significant.

تأثير التغذية على القطف والأكاسيا مع مصادر مختلفة من الطاقة على إنتاجية حملان الأغنام البرقى

سافيناز محمد شوكت¹ - محمد حسن أحمد² - إبراهيم عبد الحافظ

1- قسم تغذية الحيوان والدواجن - مركز بحوث الصحراء - القاهرة - مصر.

2- قسم الإنتاج الحيوانى والسمكى - كلية الزراعة (سبا باشا) - جامعة الإسكندرية - إسكندرية - مصر.

استخدم في هذه الدراسة 40 ذكر نامى برقى - متوسط وزن 30.6±3.50 كجم. قُسمت الحيوانات إلى أربع مجموعات متماثلة لدراسة تأثير إضافة الشعير المجروش بمفرده أو مع نوى البلخ المجروش كمصدر للطاقة لعلائق طازجة من القطف و الأكاسيا على معدلات نمو الحملان. وكانت العلائق المختبرة كما يلي:

- 1 - عليقة الكنترول: دريس البرسيم حتى الشبع + 100 % شعير مجروش
 - 2 - عليقة (أ) : قطف + أكاسيا حتى الشبع + 100 % شعير مجروش
 - 3 - عليقة (ب) : قطف + أكاسيا حتى الشبع + 50 % شعير مجروش + 50 % نوى البلح المجروش
 - 4 - عليقة (ث) : قطف + أكاسيا حتى الشبع + 25 % شعير مجروش + 75 % نوى بلح مجروش
- أوضحت النتائج أن الحوالب المغذاة لمدة 120 يوما على العلائق أ ، ب ، ث سجلت نسبيا أعلا مادة جافة مأكولة (جم/اليوم/كجم^{0.75}) ولا توجد اختلافات معنوية نتيجة المعاملات الغذائية. إحلال القطف والأكاسيا بدل دريس البرسيم أدى إلى انخفاض معنوي ($P<0.05$) في معاملات هضم المادة الجافة والمادة العضوية والكربوهيدرات الذاتية. إنخفاض معنويا ($P<0.01$) الملوكول من المواد الغذائية المهضومة بإحلال دريس البرسيم بالقطف + الأكاسيا في عليقة (أ) ونتيجة إحلال الشعير بنوى البلح بنسبة 50% و 75% من الطاقة الحافظة في العليقة (ب) و (ث). لوحظ أن الملوكول من البروتين المهضوم قد زاد ($P<0.05$) في المجموع التجريبية المغذاة على القطف + الأكاسيا أ ، ب ، ث بالمقارنة بمجموعة الكنترول. معدل الزيادة اليومية في الوزن (جم/اليوم) إنخفض معنويا ($P<0.01$) بإحلال القطف + الأكاسيا بدلا من دريس البرسيم وسجلت المعدلات التالية 174.58 ، 141.26 لعلائق الكنترول ، أ على الترتيب وإحلال الشعير محل نوى البلح بنسبة 50% ، 75% من الطاقة الحافظة في العليقة ب ، ث أدى لإستمرار إنخفاض معدل الزيادة اليومية إلى 129.58 ، 136.25 ، على التوالي. معدل التحويل الغذائي معبرا عنه بوحدات كجم ملاء جافة أو عناصر غذائية كلية مهضومة/كجم زياده في وزن الجسم لم يتغير معنويا سواء بإحلال القطف والأكاسيا محل الدريس أو إحلال نوى البلح بنسبة 50% أو 75%. سجلت الحوالب النامية المغذاة على القطف + الأكاسيا أعلا مستوى معنوي ($P<0.01$) من المياه المحتجزه بالجسم (مل/كجم^{0.82}) وكانت 256.60 ، 254.63 ، 268.16 للحوالب المغذاه على العلائق أ ، ب ، ث على الترتيب بالمقارنة بمجموعة الكنترول (172.80). إحلال القطف والأكاسيا بدل دريس البرسيم أدى إلى خفض ($P<0.05$) النيتروجين المحتجز بالجسم للحوالب المغذاه على العلائق التجريبية أ ، ب ، ث بالمقارنة بتلك المغذاه على عليقة الكنترول.
- من هذه النتائج يمكن أن توصى بإستخدام القطف الطازج + الأكاسيا الطازجه مع الشعير (100 % من الإحتياجات الحافظة) أو مع مخلوط من الشعير ونوى البلح بنسبة 1:1 في تغذية الحملان النامية تحت الظروف الجافة والشبه جافه حيث يمكن أن يحقق ذلك معدلات نمو جيد.