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GROWTH PERFORMANCE AND CARCASS CHARATERISTICS OF GROWING BARKI LAMBS AND BALADI GOAT KIDS FED HALOPHYTIC FORAGES

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ABSTRACT

Eighteen growing Barki lambs and 18 growing Baladi goat kids with an average live body weight of 30.75 ± 0.25 kg and 16.45 ± 0.15 kg, respectively were used in a fattening trial for 90 days to study the effect of feeding halophytic forages (fresh *Acacia saligna* or *Atriplex halimus*) plus barley grains as a concentrate on growth performance and carcass characteristics. Lambs and kids were divided into two equal groups of 9 each. The first group of lambs and kids was fed fresh *Acacia ad libitum*, while the second group was fed fresh *Atriplex ad libitum*. All groups were supplemented with barley grains to cover their energy maintenance requirments. At the end of the feeding trial, all animals were slaughtered and carcass traits were recorded.

Results showed that the comparable mean values of total dry matter intake for lambs and kids were 91.58 vs104.99 g/kg$^{0.75}$/day for *Acacia* and 86.47 vs 93.98 g/kg$^{0.75}$/day for *Atriplex*, respectively. However, avarage dry matter intake from *Acacia* was higher than that of *Atriplex* (60.39 vs.52.48 g/kg$^{0.75}$/day). When fed *Atriplex*, lambs versus kids gained more weight (11.83 vs. 5.78 kg) and had better feed conversion ratio (8.96 vs 12.56 kg DMI/kg gain). An opposite species trend in feed conversion ratio was found when fed *Acacia* forage (10.34 vs 9.39 kg DMI/kg gain). Results showed that dressing % differed significantly ($P<0.01$) between lambs and kids based on either slaughter or empty body weight (44.24 vs. 43.79% and 51.51 vs. 51.56%, respectively). Also, the type of halophytic forages caused a significant effect on the dressing % based on slaughter or empty body weight for *Acacia* and *Atriplex* groups (44.75 vs 43.29 % and 52.16 vs. 50.92 %, respectively). Results illustrated that percentages of organs, offals and wholesale cuts of lambs and kids were significantly ($P<0.01$) different, whereas the type of halophytic forage had no significant effect.

It was concluded that the halophytic forages, *Acacia saligna* or *Atriplex halimus* supplemented with barely grains can be used sucessfully in fattening the growing lambs and kids for a period of three months with no adverse effects on their growth performance and meat characteristics.

Keywords: Lambs, kids, halophytic forages, growth performance, carcass traits.

INTRODUCTION

Atriplex halimus is a common component of the natural range in the Egyptian North Western coastal region. Moreover, large areas of this region are cultivated swimmingly with *Acacia saligna* trees as a livestock fodder. Animal production in this region is concerned mainly with sheep, goats and camels. Thousands of weaned Barki lambs and goat kids are usually faced by over grazing of the natural vegetation particularly the palatable species.

This results in an acute shortage of feed ingredients during summer and autum seasons. In order for these animals to reach a suitable live body weight for marketing and/or slaughtering, they need to be kept under feedlot for few months. *Acacia* and *Atriplex* species represent the perennial forages along this extended area that are adapted to salt and drought stresses. Therefore, cultivation of such forages is recommended as good feed resources in desert and new reclaimed regions (Anon, 1992). The moderate protein content in soch halophytes might fulfil the livestock needs, while their energy content is almost deficient (Hassan and Abd El-Aziz, 1979). For these reasones, it is necessary to use an energy feed supplement. Barley grains, as energy source supplements, are grown and produced intensively in this area.

The present work was designed to evaluate the utilization of some range plants (fresh *Acacia saligna* and *Atriplex halimus*) supplemented with barley grains by Barki lambs and Baladi kids, in terms of feed intake, growth rate, feed conversion efficency and carcass characteristics.

MATERIALS AND METHODS

Location of study

This study was conducted at Maryout Research Station, 35 km North West of Alexandria, Desert Research Center, Egypt.

Animals and management

Eighteen Barki lambs (30.75± 0.25 Kg) and 18 Baladi goat kids (16.45 ± 0.15 Kg) at average 6 months of age were used in a fattening trial for 3 months. Each species was divided into two equal groups of 9 each. Each group was housed separately in shaded pens (5 x 5 x 4.5 meter). Animals were treated with antihelminths and left for two weeks before the start of the experiment for adaptation.

Feeding trial

The first group of each species was offered a fresh *Acacia saligna ad libtum*, while the second group was given a fresh *Atriplex halimus ad libtum.* The four groups were provided daily with barley grains at the rate of 100% of their maintenance requirements of energy, according to Kearl (1982).

Feed offered and refused were recorded to caculate the actual daily feed intake for each group. All animals were weighed at the beginning of the experiment and at biweekly intervals until marketing age (9 months). Feeding allowances of energy requirements (barley grains) were adjusted biweekly according to body weight changes for lambs and kids. Animals were allowed to drink fresh water twice daily.

Slaughter data

At the end of the fattening period, animals of each group were slaughtered after 18 hrs fasting pereiod to evaluate carcass traits. Animals were skinned, abdominal and thoracic organs were detached and weighed. The digestive tract was weighed both full and empty to get the gut fill weight by substraction. Empty body weight (EBW) was obtained by substracting alimantary tract content from pre- slaughter weight. Hot carcass weight was

determined immediately after devisceration and expressed as percentage of slaughter weight and empty body weight to estimate dressing percentage (Koch *et al.* 1963).

Carcasses were chilled at an average temperature of 4^0 C for 24 hours (Frild *et al.* 1963). Chilled carcasses and wholesale cuts (neck, shoulders, racks, flank, loin, legs and tail) were weighed. Wholesale cuts weights were expressed as percentages of chilled carcass weight.

The 9-10-11 rib cut was separated into its physical components (lean meat, fat, and bone) which were expressed as percentages of the weight of the whole rib cut. The area of the cross section of the *Longissimus dorsi* (LD) muscle was measured between 11^{th} and 12^{th} rib using a polar planemeter.

Analytical procedures

Chemical composition of feeds offered and refused were carried out according to the official methods (A.O.A.C., 1990).

Statistical analysis.

Data were statistically analyzed by one-way analysis of variance according to SAS (1995).

Procedure General Linear Model (GLM) using the following model:

$$Yij = \mu + Si + Hj + (SH)ij + eij$$

Where:

Yij = the observation on the ij^{th} traits,
μ = general mean,
Si = effect due to the i^{th} species i=1-2,
Hj = effect due to the i^{th} halophytes j=1-2,
(SH)ij = effect due to the interaction between the species and the halophytes.
eij = random error.

RESULTS AND DISCUSSION

1- Performance of lambs and goat kids

1.1. Feed intake

Chemical compositions of fresh *Acacia saligna* (AS), *Atriplex halimus* (AH) and barley grains used are presented in Table (1). Results of dry matter intake (DMI $g/Kg^{0.75}$/day) by experimental groups fed *Acacia* or *Atriplex*, both supplemented with barley grains are shown in Table (2). Statistical procedure for all feed intakes was not be possible in this study due to applaying group feeding.

It was found that mean values of total DMI were 89.02 and 99.48 $g/Kg^{0.75}$/day for lambs and kids, respectively. Higher total DMI of kids might be attributed to the maintenance requirements from energy and protein for goats are higher than those of sheep (Mohamed and Owen, 1980)

Results of forage groups resemble those attained by El-Shaer and Kandil, (1990) and Valderrabano *et. al*, (1996). Lambs preferred and consumed more DM of *Atriplex* as a halaphytic forages than kids (54.6 vs. 50.4 $g/Kg^{0.75}$/day), while kids conusmed more DM of *Acacia* (61.9 vs. 58.9

g/$Kg^{0.75}$/day). Goats are thought to tolerate high tannin levels present in *Acacia* than sheep (Woodward and Reed, 1995 and Degen, *et al.*, 1997). The low intake of *Atriplex* by goats could be attributed to its high ash content of 21.5 %, (Mohamed, 1996). Regardless of the animal species, average DMI from *Acacia saligna* was relatively higher than that of *Atriplex halimus* (60.38 vs. 52.47 g /$Kg^{0.075}$ /day). This may be due to the high salt content of *Atriplex halimus* that reduced its palatability (El-Shaer and Gihad, 1992; Hanafy, *et. al* 1996).

Table (1): Chemical composition of *Acacia saligna, Atriplex halimus* and barley grains (% on dry matter basis).

Nutrients	Acacia saligna	Atriplex halimus	Barley grains
Dry matter (DM)	39.39	28.60	92.10
Crude protein (CP)	14.72	15.24	10.37
Crude fiber (CF)	15.50	22.92	7.68
Ether extract (EE)	2.50	3.50	2.50
Nitrogen free extract (NFE)	57.78	36.84	75.20
Ash	9.50	21.50	4.25
Organic matter (OM)	90.50	78.50	95.75

Table (2): Average dry matter intake (DMI), body weight changes (average daily gain, ADG) and feed conversion ratio (FCR) of lambs and kids fed *Acacia* (AS) and *Atriplex* (AH) experimental groups.

Items	Lambs		Kids		±SE
	AS	AH	AS	AH	
No. of Animals	9	9	9	9	
Feeding days	90	90	90	90	
Body weight changes:					
Initial body wt (kg)	31.50	30.33	16.39	16.50	-
Final body wt (kg)	42.50	41.83	25.67	22.28	1.41**
Total gain (kg/head)	11.05	11.83	9.28	5.78	0.51**
ADG (g/head/day)	130.95	140.87	110.38	68.78	6.19**
DMI (g/$kg^{0.75}$ /day)					
Forage	58.87	54.58	61.90	50.37	-
Barley	32.71	31.89	43.09	43.61	-
Total	91.58	86.47	104.99	93.98	-
FCR, (kg DMI/kg gain)	10.34	8.96	9.39	12.56	0.62*

AS, Acacia saligna, AH, Atriplex haimus , DMI, Dry matter intake, ADG, Average daily gain, FCR, Feed conversion ratio.

1.2. Daily gain in body weight

Average daily gain (ADG) of growing lambs and kids fed either fresh *Acacia* or *Atiplex* supplemented with barley is presented in Table (2). Results indicated that animal species, type of forages and their interactions affect the average daily gain significantly effect ($P < 0.01$). Average daily gain of lambs fed *Acacia* and *Atriplex* were 130.95 and 140.87 g/day, respectively. The

corresponding values of kids were 110.38 and 68.78 g/day. However, results revealed that ADG of lambs fed *Atriplex* was nearly twice that of kids fed the same diet (137.0 vs. 69.0 g/day, respectively). Results were in agreement with those reported by El-Shear and Kandil (1990). Likewise, when feeding on *Acacia,* ADG of lambs was higher than that of kids (130.95 vs.110.38 g/day). The lambs fed diet containing *Atriplex* had a relatively higher ADG than those fed diet containing *Acacia* (140.87 vs.130.95 g/day). However, there was a opposite trend for goat kids fed the same diets (110.38 vs. 68.78 g/day). These findings might be due to the differences in the nutritive value of these diets for lambs and kids and their salt tolerance, where sheep are more tolerant than goats (El-Shear and Kandil, 1990; Badawy *et. al.*, 2002).

1.3. Feed conversion

Values of efficiency of feed conversion, as the amount of feed required to produce one kg of live body weight, for lambs and kids are illustrated in Table (2). Results indicated that lambs were more efficient in feed conversion than kids. A notable difference between lambs and kids in selectivity behavior might explain the reason of lambs being more efficient than goats when feeding on *Atriplex* forage. Goats prefer consuming stems instead of leaves at a higher rate than sheep (Shehata, *et. al.*, 1988). Stems are known to contain small amounts of sodium chloride compared to leaves (Wilson, 1966). Also, stems are less nutritious and had a higher content of indigestible fiber (Shehata, *et al.*, 1988; El-Shear and Kandil, 1990). The best feed conversion ratio (8.96 kg DMI/kg gain) attained by lambs fed *Atriplex* forage validates these results. On the other hand, kids fed *Acacia* forage have a better feed conversion ratio than lambs fed on the same pasture plant (9.39 vs. 10.34 kg DMI/kg gain). This might be due to the ability of goats to tolerate high tannins content of *Acacia* than sheep (Degen, *et al* 1995). Whereas, *Acacia* species contain tannins in their leaves and stems (Kumar and Singh, 1984 and Robbins, *et al.*, 1987). Tannins formulate of indigestible tannin–protein complexes (Robbins, *et al.*, 1987 and Makkar, 1993). Results of body weight gain and feed conversion efficiency indicated that lambs and kids were able to sustain their growth during a fattening period of 3 months on such halophytic forages without any adverse effects on their performance.

2. Carcass traits

2.1. Dressing percentage

Averages of slaughter weight, empty body weight (EBW), hot carcass weight and dressing % for lambs and kids fed Acacia and Atriplex with barely grains are shown in Table (3). Results showed that dressing % significantly($P < 0.01$) differed based on either slaughter or empty body weight due to animal species (44.24 vs 43.79 % or 51.51 vs 51.56 % for lambs and kids, respectively) and type of halophytic forage (44.75 vs 43.29 % or 52.16 vs 50.92 % for Acacia and *Atriplex* groups, respectively. Similar result was reported by Kewan, 2003 for camels, where the dressing percentage (based on slaughter or empty body weight) of camels fed *Acacia sailgna* were higher than that of their counterparts fed *Atriplex nummularia* (61.12 vs 59.11 % and

69.37 vs 68.06 %, respectively). Khatab (2000) showed that dressing % (based on EBW) ranged from 49.89 % for lambs fed *Acacia saligna* and barely grains to 52.3 % in control diet (berseem hay). While, dressing % (based on EBW) in kids, ranged from 46.35 % for lambs fed saltbush with *Acacia saligna* and barely grains to 49.27 % in control diet (berseem hay). It seems that fattening sheep and goats on diets including different sources of energy with berseem hay or, with Acacia saligna did not significantly affect the dressing percentages. Also, El-Shaer *et al*, (1992) found that dressing % from empty body weight ranged from 49.8 % in sheep given brioler litter-green berseem silage to 52.7 % in those fed control diet. On the other hand, some studies did not reveal significant effect on dressing % in rabbits fed *Acacia* or *Atriplex* (Abd El-Sammee et.al., 1994, Abd El-Galil and Khidr 2000 and Abd El-Galil and Khidr, 2001).

Table (3): Average slaughter body wt, empty body wt, hot carcass wt, dressing percentage and organs and ofalls percentages* of lambs and kids of *Acacia* and *Atriplex* experimental groups.

Items	Lambs		Kids		±SE		
	AS	AH	AS	AH	S	F	SXF
Slaughter wt	42.50	41.83	25.67	22.28	0.95**	0.95**	1.35*
Empty body wt	36.50	35.93	22.01	18.74	0.76**	0.76**	1.07*
Hot carcass wt	19.06	08.35	11.49	9.54	0.52**	0.52**	0.73^{ns}
Dressing % (1)	44.73	43.76	44.76	42.82	0.44**	0.44**	0.62^{ns}
(2)	52.11	50.91	52.20	50.92	0.65*	0.65*	0.92^{ns}
Organs and offals %							
Head	8.03	7.94	8.30	9.13	0.16**	0.16^{ns}	0.22^{ns}
Pelt	14.23	15.25	9.50	9.77	0.41**	0.41^{ns}	0.57^{ns}
Feet	3.17	2.70	3.55	3.54	0.05**	0.05^{ns}	0.08^{ns}
Heart	0.56	0.55	0.58	0.74	0.03**	0.03^{ns}	0.04^{ns}
Lungs & Tracheas	1.86	1.68	1.89	1.96	0.05**	0.05^{ns}	0.07^{ns}
Liver	1.45	1.58	2.28	2.49	0.05**	0.05^{ns}	0.08^{ns}
Kidneys	0.39	0.41	0.46	0.56	0.02**	0.02^{ns}	0.03^{ns}
Spleen	0.24	0.29	0.36	0.38	0.02**	0.02^{ns}	0.03^{ns}
Kidney fat	0.65	0.50	0.92	0.56	0.06^{ns}	0.06**	0.08^{ns}
Abdominal fat	1.73	1.36	1.61	1.10	0.14^{ns}	0.14**	0.20^{ns}
Testes	0.84	0.93	0.98	1.01	0.05**	0.05^{ns}	0.06^{ns}

AS, Acacia saligna. AH, Atriplex haimus. * , Expressed as a percentage of empty body wt. 1, Expressed as a percentage of slaughter body weight. 2, Expressed as a percentage of empty body weight. S, SE of species means. F, SE of forages mean. SXF, SE of interaction between species and forages.

2.2. Organs and offals

Results of organs and offals as percentages of EBW for lambs and kids fed *Acacia* and *Atriplex* with barely grains are presented in Table (3). The data indicated that organs and offals of lambs and kids were significantly ($P < 0.01$) affected by animal species except for kidneys and abdominal fat. This result might be attributed to the species differences in body weights (slaughter and empty body weight) between lambs and kids. While, there are no significant differences between animals fed *Acacia* and *Atriplex* in organs and offals except kidneys and abdominal fat was. Kidneys fat and abdominal

fat were found to be 0.79 vs 0.53 % and 1.67 vs 1.23 % for *Acacia* and *Atriplex* groups, respectively. These results were in agreement with the finding of Khatab (2000) who reported that organs and offals percentages of slaughter weight for growing lambs and kids were not significenty affected by experimental diets (fresh *Atriplex halimus* and *Acacia saligna* with different sources of energy supplementation).

2.3. Wholesale cuts

Results in Table (4) revealed that the percentages of wholesale cuts were significantly ($P < 0.01$) affected by animal species while, type of halophytic forage had no significant effect. These findings might be due to differences in chilled carcass weight between lambs and kids. Such results are in agreement with those obtained by El-Shaer *et al.* (1992) on Barki lambs fed different proportions of brioler litter and Khatab (2000), who found that wholesale cuts percentage (legs, loin, shoulder and neck) did not differ significantly by the type of diets (fresh *Atriplex halimus* and *Acacia saligna* with different sources of energy supplementation) in growing lambs and kids.

Table (4): Average chilled carcass wt, wholesale cuts percentage and physical components of carcass for lambs and kids of *Acacia* and *Atriplex* groups.

Items	Lambs		Kids		±SE		
	AS	AH	AS	AH	S	F	SXF
Chilled carcass wt (kg)	18.66	17.86	11.23	8.16	0.50**	0.50**	0.70ns
Wholesale cuts %[1]							
Neck	7.91	7.59	9.76	10.39	0.42**	0.42ns	0.59ns
Shoulder	19.34	18.96	21.72	22.73	0.31**	0.31ns	0.44ns
Racks	23.47	23.52	25.89	24.59	0.39**	0.39ns	0.52ns
Flank	6.79	6.52	5.40	5.07	0.21**	0.21ns	0.30ns
Loin	5.67	6.01	6.25	6.93	0.20**	0.20ns	0.28ns
Legs	31.62	31.93	30.67	29.30	0.48**	0.48**	0.67ns
Tail	5.20	5.47	0.31	0.99	0.40**	0.40ns	0.26 ns
9-10-11 rib cut wt (kg)	1.012	0.995	0.550	0.416	0.04 **	0.04 ns	0.05ns
Physical components %[2]							
Lean meat	50.79	53.42	61.15	54.27	1.15**	1.15ns	1.63**
Fat	29.24	28.04	17.41	20.57	1.28**	1.28ns	1.82ns
Bone	19.96	17.74	21.44	25.16	0.55**	0.55ns	0.78**
Lean: fat ratio	1.38	1.51	3.68	2.92	0.04**	0.04ns	0.05ns
Lean: bone ratio	2.30	2.80	2.87	2.18	0.09ns	0.09ns	0.13**
Meat coefficient	4.02	4.81	3.69	3.01	0.13**	0.13ns	0.19**

AS, Acacia saligna, AH, Atriplex haimus, 1, Expressed as a percentage of chilled carcass wt, 2, Expressed as a percentage of 9-10-11 rib cut wt, S, SE of species mean, F, SE of forages mean, SXF, SE of interaction between species and forages.

2.4. Physical components of 9-10-11 ribs cut

There were no significant differences in the lean meat, fat, or bone percentages. Also, lean : fat, lean : bone ratios and meat coefficient due to the holaphytic forage studied were not significant (Table 4). While, the effect of animal species was significant ($P < 0.01$) on these parameters.

Lean meat % of kids was higher than that of lambs (57.71 vs 52.11 %). On the contrary, fat % of kids was lower than that of lambs (18.99 vs 28.64 %). Many studies have shown that nutritional treatments has little effect on body composition (Winter *et al.*, 1976 and Theriez *et al.*, 1981). Also, Khatab (2000) reported that the physical composition of 9-10-11 ribs cuts for lambs and kids were not significantly affected by the nutritional treatments (fresh *Atriplex halimus* and *Acacia saligna* with different sources of energy supplementation).

It could be concluded that *Acacia saligna* and *Atriplex halimus* as a halophatic forages supplemented with barely grains (100% of their energy mainentance requirments), could be sucessfully used during a 3-month fattening for growing sheep and goats especially in arid and semi arid areas without adverse effects on their growth performance and meat characterics.

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أداء النمو وخصائص الذبيحة لذكور الأغنام والماعز النامية المغذاة على بعض النباتات الملحية

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استخدم فى هذا البحث عدد (١٨) من كل من حوالى الأغنام البرقى (متوسط وزن ٣٠,٧٥ كجم ± ٠,٢٥) ، عدد (١٨) من ذكور الماعز البلدى (متوسط وزن ١٦,٤٥ كجم ± ٠,٢٥) فى تجربة تسمين لدراسة تأثير التغذية على بعض النباتات الملحية (الأكاسيا والقطف) كأعلاف خشنة على إداء النمو وخصائص الذبيحة. قسمت الحيوانات فى كلا النوعين إلى مجموعتين متساويتين (٩حيوانات لكل مجموعة)، غذيت المجموعة الأولى فى كل من الحوالى والجديان على نبات الأكاسيا للشبع بينما غذيت المجموعة الثانية على نبات القطف للشبع كما تم تزويد جميع الحيوانات بحبوب الشعير لتغطى كل الإحتياجات الحافظة للطاقة لهذه الحيوانات .

أوضحت نتائج هذه الدراسة أنه لاتوجد فروق بين الأغنام والماعز فى المادة الجافة الكلية المأكولة من كلا النوعين من النباتات (٩١,٥٨ مقابل ١٠٤,٩٩ ، ٨٦,٤٧ مقابل ٩٣,٩٨ جم /كجم^{٠,٧٥}/ يوم لكل من الأكاسيا والقطف على التوالى). على الجانب الأخر ، فأن المادة الجافة المأكولة من نبات الأكاسيا كانت أعلى من القطف فى كلا النوعين من الحيوانات. بالنسبة لمعدلات الزيادة فى الوزن والكفاءة التحويلية للغذاء فإنها كانت أعلى معنويا فى الحوالى (التى غذيت على علائق تحتوى على القطف) من الجديان التى غذيت على نفس العلائق ألا أنه كان هناك إتجاه عكسى فى حالة التغذية على نبات الأكاسيا. كما دلت نتائج هذه الدراسة على أنه لاتوجد فروق معنوية فى معظم خصائص الذبيحة بين كلا النوعين من النباتات وأنها مشابهة للحيوانات التى تتغذى على الدريس (من دراسات أخرى).

وبناء على نتائج هذه الدراسة أنه يمكن التوصية بإستخدام نباتى الأكاسيا والقطف كأعلاف خشنة بنجاح وأمان (فى فترة تسمين لمدة ثلاثة شهور) فى تغذية ذكور الأغنام والماعز النامية خصوصا فى المناطق الجافة وشبه الجافة بدون تأثيرات عكسية على إدائها وخصائص الذبيحة.