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Productive Performance of Growing Farafra Lambs Fed Guar Forage or Guar Silage

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ABSTRACT

The present study was designed to investigate the effects of partial replacing green guar *(Cyamopsis tetragonoloba)* forage (GG) and rice straw or guar forage silage (GS) instead of concentrate feed mixture (CFM) on the digestibility, productive and economic performance and blood biochemical constituents of growing lambs. Twenty four weaned of Farafra male lambs 5 months age and weighed in average 16.69 ± 2.65 kg, were used in a feeding trial for 120 days in a complete block design. Animals were divided according to their live body weight into three experimental groups (8 lambs each), Ration 1 (R1) consists of 60% CFM + 40 % rice straw (control), R2: (40% CFM + 40% GGF + 20 % rice straw and R3: (40% CFM + 40% GFS + 20% rice straw). GGF and GFS were used to cover a partial of protein from CFM. The experimental rations fed according to NRC (1985). Results indicate that the apparent digestibility coefficients of all nutrients and feeding value of rations containing (GG) or (GFS) were better (P<0.05) compared to the control ration. Percentage of apparent N-utilization was currently higher (P<0.05) for the guar green forage and guar forage silage (R2 and R3) rations than the control ration (R1). Significant increased (P<0.05) were reported on total feed intakes, total weight gains, average daily gains (ADG) and better feed conversion ratios (FCR) and economic efficiencies for groups R2 and R3 compared with control group. The realized ADG were 198.08 and 185.83 g/day for R2 and R3, respectively, while lambs of the control recorded 177.11 g/day. No significant differences among experimental diets in serum total protein, albumin, globulin, trans-aminase enzymes (AST and ALT), cholesterol, triiodothyronine (T3) and Thyroxin (T4) hormones. It could be concluded that, feeding guar green forage or guar forage silage up to 40% as partial replacement of concentrate feed mixture for Farafra growing lambs rations were recommended. Such rations resulted in superior nutrition, better daily gain, feed conversion and economic efficiency.

Keywords: Performance, digestibility coefficients, nitrogen balance, guar green forage, Guar green forage silage, Farafra male sheep.

INTRODUCTION

Shortage of feed supply is the main constraint for any further increasing in animal production in Egypt. Furthermore, farm animals suffer malnutrition particularly during summer season where green forages with reasonable for protein content are not adequate. Many attempts were carried out to introduce new green forages or silages containing higher protein content such as guar (Gabra *et al*., 1990).

Guar (Cyamopsis tetragonoloba) is a multi-purpose plant, mostly used today as a source of galactomannan gum, which is used as a stabilizer in foods such as salad dressings, ice cream and yoghurt. The gum and the water-soluble resin extracted from the seeds are also used in other industries, including paper manufacturing, cosmetics, mining and oil drilling (Wong, and Parmar. (1997).

Guar is mainly grown in the semi arid and subtropical areas (Ecoport, 2010). Guar is hardy and drought-tolerant. It is well adapted to arid and semi-arid climates with hot temperatures, but can grow in sub-humid conditions. Like other legumes, guar improves nitrogen availability in soils and the ploughed crop residues have been shown to increase significantly the yields of succeeding crops (Wong, and Parmar. (1997).). It is used in the reclamation of low fertility, high salinity and high alkalinity soils (Ecoport, 2010).

Guar was found to be not very suitable for grazing due to its hairy leaves and unpalatability (Göhl, 1982). Guar is sometimes grazed to reduce the risk of bloat in ruminants (Wong, and Parmar. (1997).). Palatability improves after cutting and wilting (Göhl, 1982). The best time for cutting guar for fodder is during flowering and early pod formation (Wong, and Parmar. (1997).). In sheep, guar forage from two successive cuts was found to be palatable and digestible, with a DMI of 2.42% LW (Abd El-Baki *et al*., 1997).

In this respect Guar was chosen to study the possibility of using guar plant (guar green forage or/and guar forage silage) in sheep diets as a sole feed or as a partial replacer for concentrate feed mixture in the diet of sheep (Whistler and Hymowitz (1979).

Therefore, the objective of the present study was to evaluate the effects of guar plant (guar green forage or guar forage silage) on digestibility of nutrients and growth performance of Farafra male lambs under middle Egypt conditions.

MATERIALS AND METHODS

This research was carried out at Mallawi Animal Production Research Station, which lies between longitudes 27 º 43 ' N, latitudes 30 º 50 ' E and about 52 meters above sea level, Minia governorate, belongs to Animal Production Research Institute (APRI), Agriculture Research Center (ARC), Egypt. The present study was carried out, for 22 months, during the period from June, 2013 to March, 2015. Guar seeds were sown at two successive seasons (April – May, 2013 and 2014) 20 kg/feddan in hills, 2-3 seeds/hill, and 20 cm a part. The cultivated area was irrigated each 15 days interval in summer. The plants were grown for 15 weeks with 60-cm height then harvested every day for animal feeding as green forage.

Silage Making: Four tons of 1st cut of fodder plants were harvested and chopped (2–2.5 cm), pressed by tractor and ensiled in a horizontal bunker silo (3×3×1.5 meters). At ensiling time,1% common salt solution and 1.5% limestone and molasses were added to every layer at level of 5 % of fresh weight to increase activity of silage fermentation (w/w) and fairly distributed among the successive layers of the chopped guar plants, the plastic wings were collected together, compressed by tractor and conserved by 25cm layer of the ground to get anaerobic condition. Silo was opened after two months storage period

and the quantity of the produced silage were recorded daily before offering to animals. Nine Frafra rams (45 kg) body weight were used in digestibility trials. Three animals were chosen randomly from each group to be subjected to digestibility and nitrogen balance trial for 14 successive days, 7 days as preliminary period and 7 days for feces and urine collection in the metabolic cages. Collected samples of feces and urine were measured and subsample (10 % of the total daily collection) of the total collection daily for laboratory analysis. Commercial concentrated H2SO4 (10 ml) was infused in the jar of urine collection to avoid N-loss and stored at –20 C° until assayed.

A feeding trial lasted 120 days was carried out on twenty four Frafra growing lambs aged 5 months and average initial BW was 16.69 ± 2.65 kg. Animals were randomly divided into 3 equal groups (8 lambs each). The experimental groups allotted randomly into three rations as shown in (Table 1): control (R1): 60% CFM + 40% rice straw (RS), The first group (control R1) fed concentrate feed mixture and rice straw, while the second and third groups (R2 and R3) were fed the control ration with replace 40 % concentrate and rice straw by guar forage or guar silage receptively, while R2 received 40% CFM and 40% guar green forage and 20% RS, and R3 received 40% CFM, 40% GS and 20% RS, respectively. Concentrate feed mixture (CFM) consisted of 40% yellow corn grain, 25% undecorticated cotton seed meal, 22% wheat bran, 6% rice bran, 3.5% molasses, 2.5 lime stone and 1% common salt. Feeds were offered in group feeding in two equal portions at 8.00 am and 4.00 pm to the animals according to NRC, 1985 requirements of DM and DCP. Refused feeds (if any) were daily collected and recorded. The offered amounts of feed mixtures were biweekly adjusted according to body weight changes. Drinking water was freely available all times. Mineral blocks and Vitamins mixture were fixed among animals for licking whenever is required. All lambs were weighted at the beginning and at the end of the feeding period biweekly. Blood samples were withdrawn once before morning feeding (fasting) from the jugular vein monthly. Animals were individually weighed at 15 d-intervals in the morning before feeding and the average daily gain (ADG) was determined by dividing weight gain (initial LBW−final LBW) by the number of days in the study. Feed efficiency was calculated as the ratio between ADG and DMI (kg of LBW gain/kg of DMI). No abnormal veterinary syndrome was noticed in all experimental lambs.

Table 1. Calculated nutrients composition and gross energy (GE*) of the main ingredients and the experimental rations.

Item	DM%	Nutrients% (DM basis)						GE, MJ /kg DM
		OM	CP	CF	EE	NFE	Ash	
CFM	90.30	86.15	14.54	12.92	3.45	55.24	13.85	1.70
Rice straw	87.52	89.96	1.51	42.90	2.47	43.08	10.04	1.72
Guar green forage	21.50	85.69	15.42	23.52	2.33	44.42	14.31	1.68
Guar forage silage*	35.45	85.05	14.60	25.82	2.47	42.16	14.95	1.67
Ration 1 (60% CFM + 40% RS)	100	87.67	9.32	24.91	3.06	50.38	12.32	1.71
Ration 2 (40%CFM + 40% GGF+ *20% RS*).	100	86.72	12.27	23.17	2.80	49.47	13.27	1.69
Ration 3 (40%CFM + 40% GGS+ *20% RS*).	100	86.57	11.94	24.08	2.86	48.67	13.43	1.69

CFM = Concentrate feed mixture, RS = Rice straw, GGF=guar green forage, GFS= guar forage silage.
***pH 4.32, in DM%, acetic acid 2.64, propionic acid 0.70, butyric acid 0.35 and lactic acid 6.32.**
****GE, MJ/kg DM = 0.0226 CP + 0.0407 EE + 0.0192 CF + 0.0177 NFE (MAFF, 1975).**
R1: Control diet: 60% CFM + 40% (RS).; R2: Diet containing 40% CFM + 40% GGF + 20% RS.; R3: Diet containing 40% CFM + 40% GFS + 20%RS.

Blood samples were directly collected into clean dried glass culture tubes and centrifuged at 4000 rpm for 20 minutes. Blood plasma was then separated into a clean dried glass vial and stored at -20°C till biochemical analysis.

Chemical analysis:

Feeds: Guar green forage (GGF) and Guar forage silages (GS) stocks were collected, mixed and subsamples were taken for laboratory analysis. Green samples were taken from both guar plants at the time of harvest for laboratory analysis. Samples were chopped into 1-2 cm pieces then thoroughly mixed and dried in an oven at 60-70°C till constant weight. The dried samples were ground in a Willy – mill to pass through 1 mm sieve. They were kept in closely tied plastic jars for laboratory proximate feed analysis.

Proximate chemical analysis of feeds, ingredients, feces and urine were done according to A.O.A.C. (2005), while digestible energy (DE) and metabolizable energy (ME) MJ/kg DM of the tested rations were calculated according to (MAAF, 1975) equations. Individual volatile fatty acids and lactic acid of fodder guar silage were analyzed according to the procedure of Ackman and Burgher (1963), using gas liquid chromatography apparatus (GCV chromatograph PYE Unicam).

Blood Plasma Metabolites: Plasma total protein was determined according to Henry (1964) using assay kits supplied by Biocon, Egypt. Plasma albumin was determined according to Webster (1974) using assay kits supplied by Biocon, Egypt. Plasma globulin was obtained as the difference between the total protein and albumin concentration. Plasma GOT (AST) and GPT (ALT) were determined according to Reitman and Frankel (1957) using assay kits supplied by Diamond, Egypt. Plasma urea-N was measured according to Patton and Crouch (1977) using assay kits supplied by Diamond, Egypt. Plasma cholesterol was determined according to Finley *et al,* (1978) using assay kits supplied by Diamond, Egypt. Direct radioimmunoassay technique was used for determination of Plasma hormones. Triiodothyronine (T_3) was determined by the T3 kits produced by Immunotech Beckman Coulter Company (Czech) according to the method of Moenter *et al.,* (1991). Tetraiodothironine (T_4) was determined by the T4 kits produced by Immunotech Beckman Coulter Company (Czech) according to the method of Albertini (1982).

The data for all traits were statistically analyzed according to Snedecor and Cochran, 1980 in one way analysis of variance design using general linear model

(GLM) procedure by computer program of SAS (2004) using the model:

$$X_{ij} = \mu + A_i + e_{ij}$$

Where: X_{ij} = represents observation, μ = overall mean, A_i = effect of treatments (rations) and e_{ij} = experimental error (common error).

Significant differences among means were achieved using the (Duncan, 1955) of multiple range test was applied whenever possible. Significant differences between treatments were determined using Duncan's News Multiple Range Test.

RESULTS AND DISCUSSION

Chemical analysis of rations: Data in Table (1) show that, control ration (R1) had lower values of CP and ash contents than other rations, while ration (R2) had higher values of all contents except CF and EE. Increasing guar green forage (GGF) or guar forage silage (GFS) in growing lambs diets, increased all nutrients content of rations including CP and ash contents, while energy content was similar. This was mainly due to the high CP, NFE and ash contents of GGF which is that more than of rice straw, the energy value of forage or silage were primarily due to its resembles in NFE content (44.42 and 42.12%). Since GGF and GFS were relatively high in CP it is potentially a high source of protein in feedstuffs. Consequently it is commonly included in rations for growing lambs. In this respect, Suliman (2001) reported that, chemical analysis of 1st cut of whole plant of green guar at 60 cm height were: 14.91, 25.23, 1.90, 45.00 and 12.96% CP, CF, EE, NFE and ash, respectively, Abd El-Baki *et al.* (1997) mentioned the corresponding data were: 15.74, 17.09, 2.33, 51.72 and 13.06% on DM basis. Kehar and Johri (1959) mentioned that chemical composition of silage made of a mixture of green guar and wheat straw in ratio 3:2 on DM basis was: CP 8.13, EE1.35, CF34.20, NFE 41.24 and ash 15.08%.

Digestibility Coefficients and Feeding Values: Results obtained in (Table 2) indicated that the apparent digestibility coefficients of all nutrients and feeding values increased with introducing guar green forage or guar silage in the rations. The increase was significant ($P<0.05$) with R-2 and R-3 diets than control diet. Control ration was lower ($P<0.05$) than other experimental rations in all nutrients digestibility coefficients. However OM digestibility did not differ significantly among all tested rations. This may be due to the high energy and protein contents (OM and CP), which leads to increase the apparent digestibility significantly ($P<0.01$) with adding guar fodder or silage to the rations compared with rice straw (control). These results can be explained in light of the chemical composition and the reduced particles size of concentrate compared to fodder guar forage and guar silage that may be resulted in increasing DM intake, lowering rate of passage, increasing digestion time in rumen and subsequently higher the digestibility of guar green forage or silage containing rations for DM, CP, CF and EE. These results are in agreement with those found by Suliman and Marzouk (2006). Nasrullah *et al* (2013) mentioned that both sheep and goats showed similar ($P<0.05$) DM and CP digestibility that fed janter, guar, and cowpea, while Lindberg and Gonada (1997) reported no difference in goats and sheep with respect to fiber digestibility. Suliman (2001) reported that, the DM, OM, CP, EE, CF and NFE digestibilities for ration containing green guar forage (50%) were 53.15, 57.08, 63.68, 76.94 35.90 and 64.83%, respectively. Kehar and Johri (1959) mentioned that digestibility coefficients of silage made of a mixture of green guar and wheat straw in ratio 3:2 was: CP 51, EE 38, CF 50 and NFE 41%.

Table 2. Digestion coefficients and nutritive values of the experimental rations by sheep.

Item	Experimental rations			± SE
	R1 (CR	R2	R3	
Digestion coefficients (%):				
DM	64.05^{c}	65.86^{b}	67.90^{a}	1.03 *
OM	67.92^{a}	68.50^{a}	69.84^{a}	1.65NS
CP	66.21^{c}	69.08^{b}	69.86^{a}	1.25*
CF	53.62^{c}	56.32^{b}	58.80^{a}	1.46*
EE	72.60^{c}	76.50^{b}	78.95^{a}	1.14*
NFE	73.21^{b}	75.65^{a}	76.92^{a}	1.72*
Nutritive values:				
TDN%	61.39^{c}	63.02^{b}	64.33^{a}	1.80 *
DE (MJ/kg DM)*	1290.48	1301	1326.96	---
ME (MJ/kg DM)**	1058.19	1067.23	1088.11	---
DCP%	6.17^{b}	8.13^{a}	8.34^{a}	0.68 *

***DE and **ME, calculated according to MAAF (1975) using equations being DE (MJ/kg DM) = Digestible organic matter (DOM X 19) & ME (MJ/kg DM) = DE X 0.82.**

a, b and c Means with different superscripts on the same row are different at (P<0.05).

Replacement of concentrate mixture and rice straw with guar forage or guar silage (40%) were accompanied with increasing values of TDN and DCP which mainly attributed to the increase in digestibility of CP and other nutrients. Differences in TDN and DCP ($P<0.05$) values between the control ration and R2 and R3 rations were 2.66 and 2.78% for TDN and 26.25 and 24.15% for DCP, respectively. The observed increase in digestibilities of most nutrients of including guar forage or silage may be attributed to its high CP content (15.42 and 14.60%) compared to CP contents of CFM and rice straw (14.54 and 1.51%, respectively). Phillips *et al.,* (1995) concluded that increasing diet fat content encouraged digestibility coefficients of all nutrients especially CP and CF by growing lambs. Also, the observed progress in digestibilities of most nutrients for the guar forage or guar silage diets may be due to its slight higher CP content (12.27 and 11.94%) when compared with the control one which contained (9.32%) as explained by Suliman (2001). These results agree with the findings of Abd El-Baki *et al*. (1997) showed the values of digestibility of DM, OM, CP, CF, EE and NFE % for the 1st cut were 72.57, 76.00, 77.94, 44.53, 70.08 and 86.76 %, respectively, while, the nutritive values expressed as TDN and DCP were 14.61% and 67.34 on DM basis. Suliman (2001) showed that, the nutritive values as TDN and DCP for ration containing green guar forage (50%) were, 52.03 and 8.43%, respectively. Kehar and Johri (1959) mentioned that nutritive values of silage made of a mixture of green

guar and wheat straw in ratio 3:2 expressed as TDN and DCP were 51.1 and 2.35%, respectively.

Nitrogen Utilization: Data in Table (3) indicate a significant (P<0.05) differences among the experimental treatments and the control in the daily nitrogen intake of lambs. N intake of R2 and R3, were higher (P<0.05) than those of control. Percentage of apparent N utilization (NB/NI X100) was currently higher (P<0.05) for the guar green forage and guar forage silage (R2 and R3) rations than the control ration (R1), which can be attributed mainly to higher N intake of those rations. Similar, N retention values were recorded for the two treatment rations (R2 and R3). Therefore, it is suggested that lambs can utilize N of the rations containing guar green forage or guar silage more efficiently by 4.90 and 3.83% than control ration, respectively. In this respect, Gunter *et al* (1998) and Ghanem *et al.* (2000) came to the same conclusion with lambs and goats fed silage with concentrate feed mixture. In this respect, Gabra *et al*. (1990) showed a positive nitrogen balance with sheep fed guar as green forage or hay alone. The nitrogen balance values were +2.39 g/day when green forage was fed at 75 cm height. Suliman (2001) mentioned that the N-balance value was 5.83 g\day, while the apparent N utilization was 28.75% for the 1st cut of green guar after 60 days from planting for sheep fed ration containing green guar forage (50%). Abd el-Baki *et al.* (1997) found that the N-balance for sheep fed 1st cut of guar after 60 days from plating were 4.25 g\ h\d. Kehar and Johri (1959) mentioned that N-balance of silage made of a mixture of green guar and wheat straw in ratio 3:2 on DM basis was 2.63 g\h\d.

Table 3. Dietary nitrogen(n utilization of the experimental rations, by sheep (g/h/d).

Item	Experimental rations			± SE
	R1 (CR)	R2	R3	
N-balance:				
N. intake	16.70	21.56	20.80	--
Fecal N.	6.89 [b]	10.04 [a]	10.20 [a]	2.07 *
Urinary N.	2.58	1.73	1.25	
Retained N.	7.23	9.79	9. 35	
Apparent N utilization[1]	43.29 [b]	45.41 [a]	44.95 [a]	2.10 *

a, b and c means with different superscripts on the same row are different at (P<0.05).

Feed intake: Data presented in (Table 4) illustrated that estimation of consumed fodder offered to the experimental groups indicate that as CFM decreased the lambs consumed more GGF or GFS to a level made total feed intake decreased significantly (P<0.05) by decreasing CFM. However, when DM intake was related to metabolic body weights (g DM/kg $W^{0.75}$) the intake was significantly (P<0.05) reduced by increasing CFM offered. This might be a function of the increased feed bulk as guar forage or guar silage ratio increased in the ration. Meanwhile, when intake measured as TDN values it was increasing although concentrate was decreased because guar green forage or silage consumed increased. Accordingly, it seems that both feed bulk and nutritive value (TDN) shared to control consumption of feed. Suliman (2001) recorded that, daily feed intake of growing lambs fed ration containing green guar forage (50%) was 1.131 kg expressed as kg DM\h\day.

Lambs fed guar green forage or guar silage rations also consumed more TDN and DCP than control ration. Feed consumption of R2 and R3 (rations containing guar green forage or guar silage) lead to decreased the consumption of DM by 1.79 and 2.77%, respectively. Generally, replacement of 40% CFM and rice straw with guar green forage or guar silage improved (P<0.05) feed value on basis of TDN and DCP. This mean providing lambs with more CP and energy from tested rations. In this respect, Abd El-Baki *et al*. (1997) showed the values of digestibility of DM, OM, CP, CF, EE and NFE % for the 1st cut were 72.57, 76.00, 77.94, 44.53, 70.08 and 86.76 %, respectively. The nutritive values expressed as TDN and DCP were 67.34% and 14.44 g on DM basis. Results in this study were similarly to those obtained by Gabra*, et al.* (1990) who mentioned the TDN and DCP were 60.12% and 15.22%, respectively for guar when fed as green forage cut at 75 cm height. Also, Suliman (2001) found that the TDN and DCP values were 68.85% and 15.44% respectively. Gabra and Sherif (1986) mentioned that, dry matter intake of green guar for growing bulls 90.09 g\kg$^{0.075}$, while Gabra *et al* (1990) reported that DM intake of mature sheep of green guar alone cut at 75 cm heights was 55.83 g\kg $w^{0.75}$, while the respective values for TDN was 33.56 g\kg $w^{0.75}$. Abd el-Baki *et al.* (1997) indicated that, the daily MDI of 1st cut of green guar by sheep was 60.77 g\kg $w^{0.75}$, while the gross energy intake value was 251.9 kcal\kg $w^{0.75}$

Daily gain and Feed Conversion: Performance of the growing lambs (Table 4) indicated that lambs fed diet containing guar green forage or guar silage (R2 and R3) were heavier (P<0.05) by 11.84 and 8.72%, respectively over those fed the control diet. Lambs received the least 40% CFM + 40% guar green forage silage recorded the highest (P<0.05) average daily gain (ADG). Average daily gains of R2 and R3 were 198.08 and 185.83 g/day *vs.* (177.11) g/day for control, respectively. These results may be due to their high content of NFE, energy, and crude protein (Table 1). In this respect, these results are in agreement with those reported by Suliman and Marzouk (2006), who found that feeding high energy diets resulted in greater daily body weight gain. Nasrullah *et al* (2013) and Haddad and Obeida (2007) reported that, growth rate of lambs and kids fed green forages {guar (*Cyamopsis tetragonolba*) and cowpea (Vigna sinesis)} was better than control, however, both species showed marginal weight gain which can be increased by supplement feeding with these fodders. Suliman (2001) recorded that, the average daily gain of 162 g for growing lambs fed ration containing green guar forage (50%). On the other side, Cabello and Wrutniak. (1989) reported that the body growth rate is clearly stimulated by T3 in animals, In addition to its complex metabolic effects involved in the general mechanisms of body growth, thyroid hormone stimulates the production of growth factors.

Table 4. Performance of growing lambs fed the experimental rations.

Item	Experimental rations			± SE
	R1 (CR	R2	R3	
No. of Animals	8	8	8	- -
Duration of trail, d	120	120	120	- -
Av. Initial weight, kg	16.69	16.67	16.71	2.69 NS
Av. Final live wt., Kg	37.94	40.44	39.01	2.89 *
Total gain, kg	21.25	23.77	22.30	1.45 *
Av. Daily gain, g	177.11	198.08	185.83	2.12 *
Feed consumption:				
Av. CFM, g	672[a]	448[b]	448[b]	2.76 *
Rice straw DM intake, g	448	210	205	- -
Guar green fodder intake, g	--	2060	--	- -
Guar fodder silage intake, g	--	--	1230	- -
Av. daily DM intake (g)	1120 [a]	1100 [a]	1089 [b]	2.08*
Av. Daily DM intake, g/kg w $^{0.75}$/h/d)	85.190	89.18	90.68	1.32*
Av. daily TDN, kg	0.687	0.693	0.701	0.14 *
Av. daily DE (MJ/kg DM)	1302.09 [b]	1431.10 [a]	1445.06 [a]	2.56 *
Av. daily ME (MJ/kg DM)	1067.52 [c]	1173.95 [b]	1184.95 [a]	2.16*
Av. daily DCP, g	69.10 [b]	85.69 [a]	83.40 [a]	1.45 *
Feed Efficiency:				
Kg DM/Kg gain	6.32 [a]	5.55 [b]	5.86 [b]	0.67 *
Kg TDN/Kg gain	3.88	3.49	3.77	0.12 NS
Kg DCP/Kg gain	0.39	0.43	0.45	0.14 NS
Feed cost/kg gain	11.13[a]	6.92[b]	7.83 [a]	1.32 *
Daily revenue	5.82	5.94	5.57	1.04 NS
Economic efficiency	0.52	0.86	0.75	0.54 NS

a, b and c means with different superscripts on the same row are different at (P<0.05).

***Based on free market prices of feed ingredients 2015, the cost of experimental rations was estimated as the total prices of ingredients used in the concentrate feed mixture, rice straw, guar green forage and guar fresh silage, being, 2700, 350, 237 and 275 L.E. /ton, respectively and the price of one kg body weight on selling, 30.0 L.E.**

***Economic efficiency Y = [(A-B/B)], where A= selling cost of obtain gain, and B=feeding cost of this gain.**

Concerning feed conversion efficiency (Table 4), estimated as Kg DM or Kg TDN/kg gain, it was recognized that as concentrate feed mixture decreased by 40% and guar green forage or guar silage increased in the feed efficiency of feed conversion improved. Meanwhile, all guar forage and guar silage fed groups had better FCE than the control, i.e., use of guar forage or guar silage while reducing concentrate had better feed conversion. In this respect, Nasrullah *et al* (2013) and Haddad and Obeida (2007) reported that feeding green forages (guar (*Cyamopsis tetragonolba*) and cowpea)} enhanced feed conversion in lambs and kids. Suliman (2001) recorded that, feed conversion of growing lambs fed ration containing green guar forage (50%) was 6.25 expressed as kg TDN\kg. Sobiech *et al*. (2014) reported that, lambs offered legume silages showed better growth performance, in comparison with those offered grass silage, which resulted from greater intake and supply of metabolizable energy and protein from alfalfa silage, and more effective utilization of nutrients contained in red clover silage.

Accordingly, feed cost per kg gain and economic efficiency was better with the R2 and R3 rations than control ration. However, feed conversion expressed as kg DM and TDN were significant (P<0.5) difference and the figures were 5.55 and 5.85 for R2 and R3 vs. 6.32 kg /kg gain for control, respectively. While the feed conversions expressed as TDN were 3.49, 3.66 for R2 and R3 vs. 3.88 kg /kg gain for control, respectively. These results due to mainly for, high CP and energy content of silage ration content (Table 1) and the availability of nutrient utilization, also the efficiency of feeds. Results in (Table 4) indicated that Economic efficiency Data in Table (4) illustrated that the total cost of feeding for lambs fed the control diet (R1) was higher (11.13 LE) compared with those fed on R2 and R3, being 6.92 and 7.38 LE per kg gain, respectively. Moreover, lambs fed diets containing green forage guar or guar silage (R2 and R3) recorded the highest daily weight gain compared with control (R1).the figures were 23.77 and 22.30 kg body weight gain vs. 21.25 kg for R1. Therefore, the lowest feed cost and the best weight gain equal the best revenue and better economic efficiency which showed by lambs fed diets containing green guar or guar silage T2 and T3 compared with R1 (Table 4). These results may be due to the reduce of the quantity of high expensive concentrate feed mixture , increasing daily weight gain with diets containing guar. These results were in accordance with those findings by These findings are in agreement with Shehata *et al*. (2006); Suliman (1994) and Rossi and Loerch (2003), while it disagreement with finding of Nasrullah *et al* (2013) and Haddad and Obeida (2007) who reported that the cost per kg gain was very high in which suggest that feeding green forages (guar (*Cyamopsis tetragonolba*) and cowpea) increases cost of production in lambs and kids.

Clinical Blood Biochemistry*:* As shown in Table 5, no significant differences were found among the experimental treatments was noticed in serum total protein, albumin, globulin, trans-aminase enzymes (AST and ALT), cholesterol, triiodothyronine (T3) and Thyroxin (T4) hormones. In this respect, Abdelhmid *et al*. (1999) and Shehata *et al*. (2006) on goat, mentioned

that, all estimated values for measured parameters of blood serum constituents were within the normal levels for animals fed the different levels of silage rations. Sobiech *et al*. (2014) reported that, lambs fed legume silages were characterized by increased blood glucose levels, decreased total blood protein levels ($P<0.05$) and greater urea concentrations ($P<0.01$), compared with lambs receiving grass silage. El-Barody *et al.* (2002) and Novoselec *et al.* (2009) mentioned that, the Changes of thyroid hormones (T3 and T4) concentration in blood of sheep depending on age and reproductive status, while Todini (2007) mentioned that changes of blood thyroid hormone concentrations are an indirect measure of the changes in thyroid gland activity and circulating thyroid hormones can be considered as indicators of the metabolic and nutritional status of the animals.

Table 5. Effect of the experimental rations on some blood plasma parameters and hormones of growing lambs fed the experimental rations.

Item	Experimental rations			± SE
	R1 (CR)	R2	R3	
T. Protein (g/dI)	7.05	7.16	7.02	1.34 NS
Albumin (g/dI)	3.70	3.65	3.71	1.25 NS
Globulin (g/dI)	3.35	3.51	3.31	1.07 NS
AST, U/L	36.50	35.86	34.82	1.46 NS
ALT, U/L	17.80	16.93	16.96	1.03 NS
Cholesterol, mg/dl	148.50	150.12	151.78	3.56 NS
Triiodothyronine (T3), ng/dI	3.18	3.86	3.51	0.13 NS
Thyroxin (T4), ng/dI	44.71	42.38	45.18	3.95 NS

It could be concluded that, feeding guar green forage or guar forage silage as a partial replacement of concentrate feed mixture and rice straw up to 40% for Farafra growing lambs rations, resulted in superior nutrition, better daily gain, feed conversion and economic efficiency.

REFERENCES

Abdelhamid, A.M.; E.I. Shehata and M.E.Ahmed (1999). Physio-nutrional studies on pregnant and lactating goats fed on different feeding levels and / or not supplemented with bentonite.2.Effects on the blood profile. J.Agric. Sci., Mansoura Univ., 24 (9): 4587.

A.O.A.C. (2005). Association Of Analytic Chemists. *Official Methods of Analysis* .17th Ed. Published by the A.O.A.C. Washington, USA.

Abd El-Baki, S. M.;M. S. Nowar; F. T. Oraby;E. M. Hassona; S. M. Bassuny, and K. M.El-Gendy (1997). Nutritional studies on some green forages in Egypt. 2. studies on two successive cuts of guar (Cyamopsis Tetragonoloba L.) fed to sheep and rabbits. Int. Conf. on animal, poultry & rabbit production and health, Egyptian Int. Centre for Agric., Dokki, Cairo, Egypt 2-4 Sept, 1997, p. 535-545.

Ackman, R.G. and R.D., Burgher (1963): Analytical Chemistry. CF. J. Sci. Fd. Agric. 1972, 23, 377-385.

Albertini, A. (1982). Free hormones in blood. Amsterdam: Elsevier, Biochemical Press.

Bartels, H. (1971). Colorimetric determination of creatinine. Clin. Chem. Acta, 32: 81.

Doumas, B.T. and H.G. Blggs (1972). Standard Methods Of Chemical Chemistry. Vol. 7, Academic Press, New york.

Cabello, G. and C., Wrutniak. (1989). Thyroid hormone and growth: relationships with growth hormone effects and regulation. Reprot. Nuti. Develop., 29:387-402.

Duncan, D.B. (1955). Multiple Range and Multiple F-Test. Biometric, 11: 1-42.

Ecocrop (2010). Ecocrop database. FAO http://ecocrop.fao.org/ecocrop /srv/en/home.

El-Barody, M.A.A.; E.B. Abdalla and A.A. Abd El-Hakeam (2002). The changes in some blood metabolites associated with the physiological response in sheep. Liv. Prod. Sci. 75(1): 45-50.

Finley, P.R.; R. B. Schifmou; R.J. Williams and D.A.Lichti, (1978). Cholesterol in high density lipoprotein: Use of mg2+ destran sulfate in its enzymatic measurement. Clin. Chem. 24: 931 – 933.

Gabra, M.A. and S.Y. Sherif, (1986). Some nutritional studies on guar (Cyamopsis tatragonobal) growing singly or intercropped with sweet sorghum (sorghum vulgar var. saccharatum.) proceedings of the 7th conference of animal production Cairo 16-18 Sep., pp. 124-140.

Gabra, M.A.; N.M. El-Kholy; H. M. El-Hosseiny and A.M. Abde Khabir (1990): Guar (Cyamopsis tetragonolobal.) a promising leguminous summer forage in Egypt. I- productivity and feeding value. 3rd international symposium on feed Manufacture and quality control.

Göhl, B. (1982). Les aliments du bétail sous les tropiques. FAO, Division de Production et Santé Animale, Roma, Italy.

Ghanem, G.H. A.; E.A. Amer and F.A, EL-Zeer (2000). Evaluation of using Maize stover silage by sheep. J.Agric. Tanta University, 591: 603.

Gunter, S.A.; M.L., Galyean and K.J., Malcolmc allis (1998). Factors influencing the performance of feed lot steam limit fed high concentrate diets. Anim. Sci. 12: 167-175.

Haddad, S.G. and B.S., Obeidat (2007). Production efficiency and feeding behavior of Awassi lambs and Baladi kids fed on a high concentrate diet. Small Rumi. Res., 69: 23.27.

Henry, R.J. (1964): Clinical Chemistry, Principles and Technics, 2nd Edition, Harper and Row., P.525,1974.

Henry, E.J. (1964). Colorimetric Determination of Total Protein and Calcium. Clin. Chem.Principles and Techniques. Harper - Row, Newark, P. 182.

Kehar, N. D. and P. N. Johri, (1959) Investigations on silage making. Digestibility and nutritive value of green guar (Cyamopsis psoraloides) and wheat(Triticum vulgare) bhoosa silage. Indian Journal of Veterinary Science .29 : 47-49.

Lindberg J.E. and H.L Gonada (1997). Fibre and protein digestion in goats. CIHEAM – Options Mediterraneennes.

MAAF (1975). Ministry of Agriculture, Fisheries and Food Energy Allowances and Feeding System for Ruminants. Technical Bulletin, 99 London, H.M. 50.

Moenter, S. M.; C. J. Woodfill and F. J. Karsch (1991). Role of the thyroid gland in seasonal reproduction: thyroidectomy blocks seasonal suppression of reproductive neuroendocrine activity in ewes. Endocrinology 128:1337-1344.

Nasrullah, M. A., M. E. Baber, M. Abdul Jabbar and J. A. Bahtti (2013). Feeding Behavior, Voluntary Intake and Digestibility of Various Summer Fodders in Sheep and Goats. Pakistan J. Zool., vol. 45 (1), pp. 53-58.

Novoselec J; Z Antunović.; M. Šperanda; Z. Steiner; T. Šperanda (2009). Changes of thyroid hormones concentration in blood of sheep depending on age and reproductive status. Ital.J.Anim.Sci. vol. 8 (Suppl. 3), 208-210.

N.R. C. (1985): Nutritional requirement of sheep. Sixth revised edition.

Patton, C. J. and S.R. Grouch (1977). Colorimetric determination of urea. Anal. Chem. 49, 464 – 469.

Philips, W.A.; G.W., Horn and M.E., Smith (1995). Effect of protein supplementation on forage intake and nitrogen balance of lambs fed freshly harvested wheat forage. J. Anim. Sci., 73: 2687-2693.

Reitman, S. and Frankel, S. (1957). Anim.J. Clinical Pathology. 28: 56-63.

Rossi, J.E. and S.C. Lorech. (2003). Altering the Proportion of corn silage in diets of Feedlot steers fed to achieve Stepwise increases in growth. The Ohio State University Department of Animal Sciences.

SAS-Statistical Analysis System. (2004). SAS User's Guide: Statitics. SAS Inst. Inc., Cary, NC; Version 9.1 for Window.

Shehata, E.I.; M.E. Ahmed; Faten F. Abou Ammou; A.M. Soliman; K.M. Aiad and A.M. Abdel-Gawad (2006). Comparison of feeding reed hay or silage with feeding berseem hay or maize silage to dairy Zaraibi goat. Egypt. J. Sheep, Goat and Desert Animals Sci. 1 (1): 233-247.

Snedecor, G.W. and W.G., Cochran (1980). Statistical Methods .7*th* Ed. Allied Pacific, Bombay.

Sobiech P.; C. Purwin; S. Milewski and K.Ząbek (2014). The effect of nutritional and fermentational characteristics of grass and legume silages on feed intake, growth performance and blood indices of lambs.

Suliman, A.I.A. (2001). Studies on using some green forages in sheep feeding . Ph.D. Thesis Fac. of Agric., El-Minia Univ.

Suliman, A. I. A. and. K. M, Marzouk (2006). Nutritional value and economical efficiency of whole maize silage for fattening lambs and carcass Characteristics. J. Agric. Sci. Mansoura Univ., 31(10): 6207-6215.

Todini, L. (2007). Thyroid hormones in small ruminants: effects of endogenous, environmental and nutritional factors. Animal. 1:997-1008.

Watson, D. (1960). A simple method for determination of serum cholesterol. Clin. Chem. Acta, 5: 637.

Webster, A. J. (1974). Energy metabolism and requirement. In: D. C. Church. (Ed), digestive physiology and nutrition of ruminants, PP.210-299.Oregon: O. and B. books Inc.

Whistler R.L. and T. Hymowitz (1979). Guar: agronomy, production, industrial use and nutrition. Purdue University Press, West Lafayette

Wong, L.J., C. Parmar. (1997). Cyamopsis tetragonoloba (L.) Taubert. Record from Proseabase. Faridah Hanum, I & van der Maesen, L.J.G. (Eds). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia.

الأداء الانتاجى للحملان النامية المغذاة على الجوار الاخضر أو سيلاجة

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تهدف هذة الدراسة إلى اختبار تأثير الأستبدال الجزئى لمخلوط العلف المركز و قش الارز فى علائق حملان الفرافرة النامية بعلف الجوار الاخضر او سيلاجة . استخدم فى هذه الدراسة 24 حمل من ذكور الفرافرة النامية بعمر 5 شهور و متوسط وزن حى 16.69± 2.69 كجم . قسمت الحيوانات إلى ثلاثة مجموعات تجريبية (8 حيوانات فى المجموعة) وزعت المجموعات التجريبية على ثلاثة علائق تجريبية (1) عليقة مقارنة (كنترول): 60% مخلوط علف مركز +40% قش أرز. بينما غذيت المجموعات الثانية على 40% مخلوط علف مركز + 40% علف الجوار الاخضر + 20% قش أرز أما العليقة الثالثة : 40 العلف مخلوط علف مركز + 40% سيلاج جوار + 20% قش أرز على التوالى. امتدت تجربة التغذية إلى 120 يوما حيث تضمنت تقدير كمية الغذاء المأكول و معاملات الهضم و القيمة الغذائية و ميزان الأزوت و معدلات النمو و الكفاءة التحويلية و الاقتصادية ووظائف الكبد و الكلى للحيوانات و كان من النتائج المتحصل عليها من هذة الدراسة: -زادت معاملات الهضم الظاهري لكل المركبات الغذائية و كذلك القيمة الغذائية و الطاقة الممثلة للعلائق المحتوية على علف الجوار الأخضر أو السيلاج بدرجة معنوية (5%) عن مجموعة الكنترول.كان المأكول اليومى معبرا عنة بالكجم / رأس / يوم أو كجم مادة جافة منسوبة لحيز الجسم التمثيلى أعلى معنويا (5%) مع الحملان التى غذيت على علائق تحتوى علف جوار أخضر عن الحملان التى غذيت على عليقة المقارنة. سجلت الحملان التى غذيت على علائق الجوار الاخضر أو سيلاج الجوار زيادة معنوية (5%) عن مجموعة المقارنة و كان متوسط النمو المحقق (198.08 & و 185.83) جم / يوم للحيوانات التى غذيت تحتوى 40% علف جوار أخضر أو سيلاج الجوار – أما عليقة المقارنة فقد حققت نمو يومى مقدارة 177.11 جم . لم يكن هناك تأثير معنوى.للعلائق على اتركيزات سيرم الدم فى محتواها من البروتين الكلى و الألبيومين و الجلوبيولين و انزيمات الترانسأمينيز و الكوليسترول و كذلك تركيزات كلا من هرمونى التاى أيودوسيريونين و الثيروكسين . كانت الكفاءة التحولية محسوبة كمادة جافة و مركبات كلية مهضومة/كجم نمو فى حملان العليقة الثانية و الثالثة أفضل عن الحملان التى غذيت على عليقة الكنترول.كانت الكفاءة الأقتصادية بالنسبة للحملان التى تم تغذيتها علىعلائق تحتوى على علف الجوار الاخضر أو و سيلاج االجوار أفضل من الحملان التى غذيت على عليقة المقارنة. من هذة الدراسة يمكن أن يوصى باحلال الجوار الاخضر أو سيلاج الجوار حتى 40% من مخلوط العلف المركز و قش الارز فى علائق الحملان النامية حيث تستطيع تحسين القيمة الغذائية و النمو اليومى و الكفاءة الغذائية و الاقتصادية