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GROWTH PERFORMANCE, SOME RUMEN PARAMETERS AND BLOOD PROFILE OF MALE ZARAIBI GOATS FED DIETS ADDED WITH CHUFA TUBERS (CYPRUS ESCULENTUS L.)DURING THE GROWING PERIOD

Gabr, A.A.[1]; M.E. Ahmed[2] ; Fathia A. Ibrahim[2] and M. S. Seleem[2]

[1] Fac. Agric., Mansoura Univ., Mansoura, Egypt.

[2]Animal Production Research Institute, Agriculture Research Center, Dokki, Giza, Egypt.

ABSTRACT

This research work was carried out to investigate the effect of adding Egyptian Chufa tubers in goats diets on nutrients digestibility, some rumen and blood parameters and growth performance of Zaraibi goats kids. Eighteen kids (average 21.3±0.45 kg live weight) were divided into 3 groups (6 kids each). Animals in groups G_1, G_2 and G_3 received 0, 5 and 10 g Chufa tubers /head/day, respectively in their diets. In addition, 9 Zaraibi bucks averaging 51.0 kg body weight were used in three digestion trails. The obtained results showed that the digestion coefficients of all nutrients as well as the feeding values (TDN and DCP %) were significantly improved ($P<0.05$) as a result of adding Chufa tubers. Ruminal NH_3-N concentration was tended to decrease with increasing level of Chufa tubers. But, ruminal total VFA's concentration was increased with increasing level of Chufa tubers. Molar proportion of ruminal VFA's showed higher acetate ($P<0.05$) and propionate concentration but lower butyrate with the two treatment groups (G_2 and G_3) compared with G_1. Daily body gain recorded the highest ($P<0.05$) value (90.22g) with G_3 followed by G_2 (84.67g) and lastly G_1 (76.07 g/head/day). The best feed conversion efficiency, based on DM, TDN and DCP was 8.51, 5.91 and 0.743, respectively with G_3 in comparison with the other groups. The feed economic efficiency was tended to be increased with increasing level of Chufa tubers in goats diets.

Keywords: Zaraibi kids- Chufa tubers- growth performance- rumen parameters- Feed economic efficiency.

INTRODUCTION

Beneficial effects of herbs or botanicals in farm animals may arise from the activation of feed intake and the secretion of digestive secretions, immune stimulation, anti-bacterial. Herbs can also contribute to the nutrient requirements of the animals, stimulate the endocrine system and intermediate nutrients metabolic (Wenk , 2003 and Mirzaei*et al*.,2012). One of the most successful attempts accomplished in the last decade in using feed additives such as natural additives (medicinal plants as its seeds, leaves and roots). These supplements assist in improving animal productivity and milk production enhancement (Gabr *et al*.,2012 , Mirzaei *et al*.,2012 and Chaturvedi *et al*.,2013). Chufa tubers is a grass-like plant widely distributed in many areas over the world and have been used in Egypt as a source of food , medicine and perfumes (Arafat *et al* ., 2009). The latter authors stated that

Chufa tubers were characterized by low moisture content (3.75 %) , high level of starch (295 g/kg) and fat (30.0 %) and rich in Ca , P and Na (152.0 , 123.0 and 140.0 ppm , respectively). In another study showed that the nut (Chufa) is rich in energy content (sugars, starch and fat), protein, mineral (phosphorus and potassium) and vitamin E and C (Belewu and Belewu , 2007). In addition, Chufa tubers are a good source of amino acids and its profiles were dominated by aspartic acid followed by glutamic acid , leucine , alanine and arginine. Recently, Ahmed and El-Kholany (2012) and Ibrahim *et al*.(2013) reported that using Chufa tubers in dairy goats diets had a positive effect in improving daily DM intake, some metabolic parameters and performance , without any adverse effect on blood profile or general health.

Studies on using Chufa tubers as feed additives in feeding growing Zaraibi kids is scarce. Therefore , the present study was carried out to investigate the effect of adding Chufa tubers to Zaraibi kids diets on digestion coefficients , some rumen parameters , feed conversion and growth performance and feed economic efficiency.

MATERIALS AND METHODS

This study was conducted at the Animal Production Research Station , El-Serw , belonging to Animal Production Research Institute, Agriculture Research Center and Animal Production Department, Faculty of Agriculture , Mansoura University. Egypt, during the period from 2013 to 2015.

Eighteen growing male Zaraibi kids, selected from the herd station , aged about 6 months and weighed in average 21.30±0.45 kg were divided according to their live body weight (LBW) into three similar groups (6 animals each). Animals were fed for 3 weeks as a transitional period on the experimental diets before starting the experimental work. Kids were weighted at the beginning and thereafter at two-weeks intervals. The diets were offered in two equal meals at 8.00 a.m. and at 4 p.m. Water was available at all times and was measured as average for each group (ml/h/d). The feeding experiment lasted for 18 weeks (126 days).

The three groups were assigned at random to receive the three experimental diets. Animals received diets in groups. Zaraibi kids in groups G_1 , G_2 and G_3 received daily (0 , 5 and 10 g Chufa tubers/head, respectively) along with the basal diet . Feed additive as Chufa tubers was mixed with approximately 10 g of ground concentrate and spread daily over the concentrate feed mixture (CFM) as reported by Ahmed and El-Kholany (2012) and Ibrahim *et al*.(2013). The different tested levels were determined based on the findings of Ibrahim *et al.*(2007) and Ahmed and El-Kholany (2012). Three digestibility trails were conducted using 9 bucks Zaraibi goats (3 in each averaged 51 kg) to evaluate the feeding values of the tested diets before feeding trails. Three metabolic cages were used. Feeding allowances were calculated according to NRC (1981) for goats. Animals were fed at 90% of ad Lib. feeding to avoid any feed refusals. The concentrate (CFM) and roughages (corn silage) were offered at 60 : 40 ratio as reported by Tawfik *et al*.(2005) and Soliman *et al*.(2010) on growing Rahmani lambs and Zaraibi

kids, respectively. The used CFM, (El-Marg factory) contained : undecortecated cotton seed meal (25%), yellow corn (40%), wheat bran (28%), molasses (3.5%), limestone (2%), common salt (1%) and minerals mixture (0.5%). Corn silage was prepared without any additives in El-Serw Station and the amount of Chufa tubers was purchased from local market. Proximate analysis of feed ingredients , additive and feces as well as total carbohydrates , starch , sucrose , fructose and glucose content of Chufa tubers were carried out according to the A.O.A.C (1995) procedures at the laboratory of Animal Production Research Institute.

At the end of digestibility trails rumen fluid samples were taken from 3 animals of each experimental group using stomach tube before feeding (0 time) and at 2 , 4 , 6 and 8 hrs post-feeding. The samples were filtered through 3 layers of gauze without squeezing and immediately subjected to the determination of pH value by pH meter. Ammonia nitrogen (NH_3-N) concentration was measured according to A.O.A.C (1995) and total volatile fatty acids and their fractions were determined by Gas chromatography technique at the laboratory of National Research center Dokki Cairo, Egypt.

At the end of growing period blood samples were collected from the jugular vein once before feeding (3 animals in each). The whole blood was immediately direct to hematological studies. Another blood samples were centrifuged at 4000 rpm for 20 min. part of the separated serum was directed to enzymes activity determination , while the other part stored frozen at- 20°c till the biochemical analysis. Commercial kits were used for colorimetric determinations at private Laboratory. Blood serum samples were analyzed for the following parameters : Hemoglobin, (Linne and Ringsrud,1992), Hematocrit, (Linne and Ringsrud,1992), Erthrcyte count, (Miller and weller ,1971), Mean corpuscular volume, Mean corpuscular hemoglobin, Mean corpuscular hemoglobin con., (Schalm *et al.*, 1975), Total leukocyte count, (Coles ,1986), Differential leukocyte count, Platelet count, (Linne and Ringsrud,1992), Total protein, (Doumas *et al.*,1981), Albumin, (Hill and Wells ,1983), Globulin, (Coles ,1986), Urea-N, (Freidman *et al.*,1980), Creatinine, (Ullmann 1976), Glucose, (Teuscher and Richterich,1971), Triglyceride, (Megraw *et al.*,1979), Cholesterol, (Schettler and Nussel,1975), Calcium, (Elveback,1970), Phosphorus, (Freidman *et al.*, 1980), Aspartic aminotransferase (AST), Alanine N (ALT), (Reitman and Frankel,1957), Alkaline phosphotase (ALP), (Belfield and Goldberg,1971). Globulin was calculated by subtraction of serum albumin from total serum protein.

Data was statistically analyzed using SAS (2003). The significant differences among means were assigned according to Duncan (1955).

RESULTS AND DISCUSSION

Digestion trials :

Chemical composition :

The chemical composition of feed ingredients and experimental diets are presented in Table (1). The obtained data indicated that Chufa tubers contained 24.70% EE, 7.5 % CP, 55.70% NFE, 9.80% CF and 2.30% ash, on DM basis. Similar results were reported by Ahmed and El-Kholany (2012)

who found that Chufa tubers contained 25.0% EE, 56.2% NFE, 7.20% CP, 9.50% CF and 2.1% ash, but DM was lower than that obtained herein (91.50 vs. 95.70%). In a recent study, Ibrahim *et al*.(2013) reported that Chufa tubers contained 23.90% EE, 57.20% NFE, 10.0% CF, 7.0% CP on DM basis. In addition ,the data of determined chemical analysis of Chufa tubers used herein showed that Chufa tubers contained 60% , 30%, 19%, 3.3%, 6.5% for total carbohydrates , starch , sucrose , fructose and glucose , respectively. The obtained values for starch, sucrose, fructose , glucose were more close to the values reported by SouleymaneBado *et al*. (2015) who found that Chufa tubers contained 33.21 , 20.39 , 3.59 , 6.79 g/100g for starch , sucrose , fructose and glucose , respectively, except in case of total carbohydrates which was lower (60% vs. 69.21%).

Table (1): Chemical analysis of feed ingredients and calculated composition of tested diets.

Feeds		Chemical Composition (% DM basis)					
	DM%	OM	CF	CP	EE	NFE	Ash
Concentrate feed mixture, CFM	90.3	94.3	15.8	13.8	3.35	61.35	5.7
Corn silage, CS	33.0	90.9	29.0	8.5	3.15	50.25	9.1
Chufa tubers, CT	95.7	97.7	9.8	7.5	24.7	55.7	2.3
Experimental diets:							
CFM+CS(G_1)	67.38	92.94	21.08	11.68	3.27	56.91	7.06
CFM+CS+5%CT(G_2)	67.57	92.96	20.98	11.65	3.43	56.90	7.04
CFM+CS+10%CT(G_3)	67.69	93.01	20.93	11.62	3.58	56.88	6.99

As regard to experimental diets, the results indicated that the values of chemical composition were nearly similar except the EE content which was tended to be slightly lower in G_1 (3.27%) than G_2 and G_3 (3.43 and 3.58% , respectively) and this could be attributed to the high content (24.70%) of ether extract in Chufa tubers.

Digestion coefficients and feeding values :

The obtained data in Table 2 indicated that the digestibility of all nutrients were significantly higher with using of Chufa tubers (G_2 and G_3), compared with control group. Moreover, the digestibility of all nutrients were insignificantly higher of G_3 than G_2. These results are in line with those reported by Ibrahim *et al*.(2007) who showed that the digestion coefficients of all nutrients were gradually improved with increasing level of Chufa tubers in tested diets. The TDN and DCP% of tested diets were improved with increasing the level of Chufa tubers in goats diets and the differences were significant between G_1 (control) and G_2 or G_3 which contained Chufa tubers. This improvement in TDN and DCP as a result of increasing of digestion coefficients with adding Chufa tubers in diets. These results are in agreement with those obtained by Ibrahim *et al*.(2007). They reported that the feeding values as TDN and DCP were higher as a results to using of Chufa tubers in diets of lactating goats.

Table (2): Digestion coefficients and feeding values (%) of tested diets fed to bucks.

Items	Groups		
Digestion coefficients:	**G_1**	**G_2**	**G_3**
DM	63.27±1.00[b]	66.32±0.38[a]	68.27±0.26[a]
OM	66.60±0.91[b]	69.29±0.47[a]	70.83±0.31[a]
CF	58.70±0.85[b]	60.89±0.44[a]	62.15±0.17[a]
CP	70.70±0.47[b]	74.11±0.21[a]	75.13±0.66[a]
EE	78.54±0.66[b]	81.77±0.29[a]	83.03±0.30[a]
NFE	68.01±1.05[b]	70.59±0.62[a]	72.12±0.37[a]
Feeding value,%			
TDN	65.12±0.88[b]	67.88±0.44[a]	69.45±0.28[a]
DCP	8.26±0.06[b]	8.63±0.03[a]	8.73±0.08[a]

[a, b] **Means in the same row with different superscripts differ significantly at P < 0.05**

Ruminal parameters :

Results of pH values (Table, 3) indicated that the differences in pH values were not significant among the tested diets before and post-feeding (2, 6 and 8 hrs). But, the effect of the tested diets on pH values at 4 hrs were significant. Generally, the highest values of pH values (6.67, 6.37 , 6.57 and 6.77) post-feeding (2 , 4 , 6 and 8 hrs, respectively) were recorded with G_1 (control) and the lowest values were detected with G_3 (6.57 , 6.20 , 6.47 and 6.70, respectively) at the same times. These results are in line with those reported by Ibrahim *et al*.(2007) who found that the pH values at 4 hrs post-feeding were tended to decrease (6.15 and 6.17) with using of Chufa tubers at level 10 and 15 g/head/day , respectively, compared to control (6.23). the decreasing in pH values of groups contained Chufa tubers may be due to the high content of VFA's as acetic and propionic in this study and as reported by Ahmed *et al*.(2001) and Aboul-Fotouh *et al*.(2011) with Zaraibi goats and sheep , respectively.

Table (3): Effect of feeding the tested diets on ruminal pH value and ammonia concentration of goat bucks.

Items	Time	Groups		
	Hours	**G_1**	**G_2**	**G_3**
pH value	0	7.00±0.06	6.93±0.09	7.03±0.07
	2	6.67±0.07	6.63±0.03	6.57±0.07
	4	6.37±0.03[a]	6.33±0.03[ab]	6.20±0.07[b]
	6	6.57±0.03	6.50±0.06	6.47±0.07
	8	6.77±0.03	6.73±0.03	6.70±0.06
NH_3-N (mg/ 100 ml)	0	17.00±0.80	16.33±0.93	15.80±1.20
	2	21.40±0.64	20.67±0.47	20.40±1.10
	4	23.60±0.42[a]	22.33±0.41[ab]	21.47±0.35[b]
	6	22.60±0.64	21.40±0.12	20.93±0.87
	8	21.47±1.03	20.13±0.73	20.00±0.72

[a, b] **Means in the same row with different superscripts differ significantly at P < 0.05**

Ruminal ammonia-N concentration was greatly higher post-feeding than before feeding and that maximum values of NH_3-N in the rumen were reached at 4 hrs post-feeding then decreased with all groups as shown in Table 3. Rumen NH_3-N concentration tended to decrease as a result to using

of Chufa tubers in goats diets and the differences were significant at the 4 hours only. The same trend was observed by Mohamed *et al*.(2003), Maged (2004) and Ahmed and El-Kholany (2012) with using of chamomile and Chufa tubers in diets of small ruminants (sheep and goats). They suggested that these results might be attributed to the action of some medical herbs as a buffer. In another study, ruminal ammonia–N level was decreased with using Chufa tubers in goats diets (Ibrahim *et al*.,2007).

Data of ruminal total VFA's concentration as well as proportions of individual VFA's % are presented in Table 4. Ruminal total VFA's concentrations (m Eq/100ml rumen liquer) post-feeding were increased with increasing level of Chufa tubers in goats diets and the differences were significant during most sampling times. Molar proportion of ruminal VFA's showed higher acetate ($P<0.05$) and propionate but lower butyrate ($P<0.05$) with two treatment groups (G_2 and G_3) in comparison to control group . At the same time , the effect of tested diets on valeric, isobutyric and isovaleric was not significant. Similar results are recorded by Ibrahim et al.(2007) who found that rumen total VFA's concentrations after morning feeding was significantly ($P<0.05$) increased by 13.6 and 16.05 % for 10 and 15 g Chufa tubers /head/day , respectively comparing with the control diet. Actually, it could be reported that Chufa tubers stimulated the proper production of the energy precursors in the rumen. This finding may be possibly related to the high gross energy content of the Chufa tubers (Ibrahim *et al*.,2007 and Ahmed and El-Kholany, 2012). Generally, the highest value of total VFA's concentration was recorded at 4 hrs post-feeding. The obtained data of rumen parameters are within the normal range reported by Maged (2004), Zeid (1998) and Aboul-Fotouh *et al*.(2011).

Table (4): Effect of feeding tested diets on ruminal total volatile fatty acids (VFA's) and their fractions (%) of goat bucks.

Items	Time	Groups		
	Hours	G_1	G_2	G_3
Total VFA's (m Eq/100ml)	0	9.10±0.31	8.90±0.21	9.00±0.25
	2	10.40±0.21^{b}	10.60±0.15^{ab}	11.03±0.15^{a}
	4	11.73±0.15^{c}	12.50±0.12^{b}	13.03±0.18^{a}
	6	11.07±0.23^{b}	11.53±0.15^{ab}	12.03±0.27^{a}
	8	10.10±0.31	10.57±0.24	10.70±0.31
Ruminal VFA's %:				
Acetic	4	47.07±0.59^{b}	49.33±.60^{a}	49.83±.44^{a}
Propionic		26.10±0.44	27.67±0.58	28.0±.58
Butyric		18.33±0.44^{a}	16.00±.76^{b}	15.57±.35^{b}
Valeric		3.23±0.37	2.77±.34	2.53±.30
Isobutyric		2.97±0.24	2.33±.30	2.30±.44
Isovaleric		2.30±0.26	1.90±.12	1.77±.23

$^{a, b, c}$ **Means in the same row with different superscripts differ significantly at P < 0.05**

Feeding trial :

Daily feed intake and water consumption

The average daily DM intake of Zaraibi kids is summarized in Table (5). The total DM intake as g/h tended to gradually increased (707 , 744 and

768g) with increasing level of Chufa tubers (0 , 5 and 10 g/head) in goats diets. The corresponding values of intake when related to metabolic body size were 61.46 , 63.70 and 64.4 g/kg w^{075}, respectively. The same trend was observed also with daily intake as % BW among the tested diets. Similar results have been observed by Ahmed and El-Kholany (2012). In this respect, Ibrahim *et al*.(2013) stated that the daily DM intake increased with increasing level of Chufa tubers in diets of dairy goats.

Table (5): Growth performance, daily dry matter intake* and water consumption by goat bucks during growing period.

Items	Groups		
	G_1	G_2	G_3
Initial weight, kg	21.08±0.40	21.17±0.46	21.67±0.49
Final weight, kg	30.67±0.61^{b}	31.83±0.73^{ab}	33.03±0.66^{a}
Total body gain, kg	9.58±0.30^{b}	10.67±0.40^{ab}	11.37±0.44^{a}
Daily body gain, g	76.07±2.38^{b}	84.67±3.18^{ab}	90.22±3.50^{a}
DM intake, %BW	2.73	2.81	2.81
DM intake, g/kg $w^{0.75}$	61.64	63.70	64.21
Roughage: concentrate (R/C) ratio	40:60	40:60	40:60
Water consumption:			
Ml/h/d	2703	2590	2615
Ml/kg BW	104.5	97.7	95.6
Ml/kg $W^{0.75}$	235.7	221.7	218.6
Ml/g DM intake	3.82	3.48	3.40

*** Group feeding, $^{a, b}$ Means in the same row with different superscripts differ significantly at P<0.05**

As for water consumption, the obtained results showed that the daily water consumption tended to decrease with increasing level of Chufa tubers (235.7 , 221.7 and 218.6 ml/Kgw^{075} for 0 , 5 and 10 g/head, respectively). The corresponding values of water consumption when related to DM intake were 3.82 , 3.48 and 3.4 ml/g DM intake, respectively. Similar results were observed by Ibrahim *et al*.(2013) who found that the water consumption (ml/kg w^{075}) tended to decrease (268 , 265 , 261 and 254) with increasing level of Chufa tubers (0 , 5 , 10 and 15 g/head, respectively) and the corresponding values of water consumption when related to DM intake were 2.94 , 2.89 , 2.83 and 2.71 ml/g DM intake. Generally, these results indicated that using some medical herbs such as chamomile and rosemary (as reported by Zeid,1998 and El-Saadany *et al*.(2003) and Maged (2012) and Chufa tubers (as reported by Ahmed and El Kholany (2012), Ibrahim *et al*.(2013) and the present study) in ruminant diets seems more suitable for desert conditions where water resources are somewhat restricted.

Blood parameters :

The obtained results indicated that most blood parameters were not significantly affected by the tested experimental diets (Table 6). In the same time, the values of Hb , RBC's , MCHC, lymphocytes, platelets, glucose, total protein, globulin, calcium and phosphorus were increased with increasing level of Chufa tubers in goats diets and the differences were significant in

RBC's , MCHC , lymphocytes and phosphorus only. On contrary, the concentration of triglyceride, cholesterol, albumin, urea-N, creatinine, activity of AST and ALT as well as the values of Hct , WBC's and monocytes were decreased as a result to using of Chufa tubers and the differences were significant in serum triglyceride, cholesterol and ALT only. Serum ALP showed some fluctuation among groups, ranging from 22.33 (in G_1) to 25.00 (in G_2) . Similar results were observed by Ahmed and El-Kholany (2012) .

Generally, the obtained values are within the normal range reported by Jain 1986 (for hematological parameters) and Kaneko 1989(for biochemical parameters) for healthy goats.

Table (6): Effect of feeding tested diets on blood parameters of growing male goats.

Items	Groups		
Hematological parameters :	**G_1**	**G_2**	**G_3**
Hemoglobin (Hb), g/dl	10.73±0.08	10.97±0.18	11.10±0.20
Hematocrite (Hct), %	32.50±0.80	31.60±0.62	31.00±0.46
Red blood cells (RBcs), 10^6/.ul	12.20±0.33^b	12.93±0.17^a	13.07±0.12^a
Mean cell volume (MCV), fl	21.33±0.64	20.7±0.83	20.0±0.45
Mean cell hemoglobin (MCH), Pg	5.87±0.55	6.03±0.35	6.10±0.23
Mean cell hemoglobin concentration (MCHC),%	33.03±0.73^b	34.70±0.43^{ab}	35.80±0.23^a
White blood cell, (WBC_s),10^3/.ul	15.20±0.77^a	13.83±0.53^b	13.07±0.96^c
Nutrophils, %	42.63±1.77	42.0±2.30	41.0±1.76
Lymphocytes,%	51.93±1.73^b	53.37±4.05^a	54.80±1.42^a
Monocytes,%	5.43±0.56	4.67±3.30	4.20±0.85
Platelets,10^3/dl	792±28.85	817±24.65	834±21.85
Biochemical parameters :			
Glucose, mg/dl	59.00±1.15	60.00±2.65	65.00±1.15
Triglyceride, mg/dl	62.67±1.45^a	56.00±2.08^a	48.33±2.40^b
Cholesterol, mg/dl	68.00±1.73^a	65.67±1.76^a	53.33±2.03^b
Total protein, g/dl	6.50±0.23	6.57±0.24	7.03±0.18
Albumin(A), g/dl	4.20±0.06	3.97±0.23	4.07±0.07
Globulin(G), g/dl	2.30±0.29	2.70±0.20	2.97±0.24
A/G ratio	1.90±0.26	1.60±0.20	1.40±0.15
Urea-N, mg/dl	17.93±0.23	17.33±0.46	16.87±0.92
Creatinine, mg/dl	0.93 ±0.03	0.88±0.06	0.82±0.06
AST , IU /L	81.67±1.76	80.67±3.48	77.67±2.67
ALT , IU /L	32.33±1.76^a	27.67±1.76^{ab}	22.00±1.53^b
ALP ,IU /L	22.33±1.45	25.00±1.15	24.33±2.03
Calcium, mg /dl	10.03±0.32	10.07±0.23	10.17±0.24
Phosphorus, mg/dl	7.77±0.15^b	8.13±0.19^b	9.03±0.27^a

$^{a, b}$ **Means in the same row with different superscripts differ significantly at P<0.05**

Growth performance :

The obtained data showed that the effect of the tested diets on final weight, total gain and daily body gain (DBG) were significant (Table 5). The

daily body gain was increased (76.07 , 84.67 and 90.22g) with increasing level of Chufa tubers (0 , 5 and 10 g/ head, respectively) in goats diets and the differences were significant between G_1 and G_3 . The DBG increased by 11.31 and 18.60 % with G_2 and G_3, respectively compared with control group (G_1). The positive effect of Chufa tubers on growth performance may be due to the improve in nutrients digestibility and metabolic parameters (rumen and blood) as reported earlier. Similar results were observed by Ahmed and El-Kholany (2012).

Feed conversion :

The best feed conversion (the lowest value) as kg DM intake /kg gain was recorded with G_3 (8.51) followed by G_2 (8.79).The bad conversion was recorded with G_1 (9.49) as shown in table7. Thus, the improvement in feed utilization efficiency with adding Chufa tubers at levels 5 and 10 g/head/day were 7.38 and 10.33 % , respectively comparing with the control group. The same trend was observed also with feed conversion values expressed as kg TDN/kg gain. Moreover, the feed conversion based on DCP was better with G_2 and G_3 (0.758 and 0.743, respectively) compared with G_1(0.784). The obtained results are in line with those of Ibrahim *et al*.(2013) who reported that feed conversion (based on DM) was better by 8.80 , 11.32 and 12.58 % with Zaraibi goats fed Chufa tubers supplemented diets at levels 5 , 10 and 15 g/head compared with the control group(G_1). They found also that feed conversion expressed as kg CP/kg milk were noticeably better (0.165 , 0.160 and 0.156) with the same levels (5 , 10 and 15 g Chufa/head, respectively) compared with unsupplemented diet (control, 0.183).

Table (7): Feed Conversion efficiency* by goat bucks as affected by tested diets.

Items	Groups		
	G_1	G_2	G_3
Average body weight, kg	25.87	26.50	27.35
Metabolic body size,$w^{0.75}$	11.47	11.68	11.96
Average feed intake: g/h/d			
CFM	433	439	447
Corn silage, CS	289	300	311
Chufa tubers, CT	0.0	5.0	10.0
DM intake (g/h)	722	744	768
(g/kg $w^{0.75}$)	62.95	63.70	64.21
TDN intake (g/h)	470	505	533
(g/kg $w^{0.75}$)	40.98	43.24	44.57
DCP intake (g/h)	59.64	64.21	67.05
(g/kg $w^{0.75}$)	5.20	5.50	5.61
Feed conversion:			
kg DM/kg gain	9.49	8.79	8.51
kg TDN/kg gain	6.18	5.96	5.91
kg DCP/kg gain	0.784	0.758	0.743

***Group feeding**

Generally, the obtained values of feed conversion are within the range given by Ahmed *et al*.(2000) and El-Kholany *et al*.(2013) with growing Zaraibi kids. In a recent study, El-Emam *et al*.(2014) found that the feed utilization efficiency of growing lambs increasing from 8.77 to 9.65 kg DM intake/kg gain.

Table (8): Feed economic efficiency of goat kids fed different tested diets.

Items	Groups		
	G_1	G_2	G_3
Daily body gain (g/h)	76.07	84.67	90.22
Daily feed intake (g/h) as fed:			
From CFM	480	486	495
From corn silage, CS	876	909	942
From Chufa tubers, CT	0	5	10
Cost of consumed feed, LE/h.	1.463	1.514	1.572
Price of weight gain, LE/h.	2.662	2.963	3.158
Feed cost/kg gain, LE	19.23	17.88	17.42
Feed Economic efficiency,%	1.82	1.96	2.01

Feed economic efficiency was calculated as total output to total input ratio according to the local price during the study

The price of CFM, CS and CT were 2500, 300 and 5250 /Ton , respectively. While,selling price of 1Kg BW of Kids was 35 LE

Feed economic efficiency :

Results of economic return (Table,8) indicated that the feed economic efficiency was noticeably higher (1.82 , 1.96 and 2.01 %) with increasing Chufa tubers levels (0 , 5 and 10 g/h/d) in goats diets (G_1 , G_2 and G_3 , respectively). Similar trend have been reported by Ahmed and El-Kholany(2012) who found a significant increase in economic return (2.02 , 2.35 and 2.56 %) as a result to adding Chufa tubers at levels 5 , 10 and 15 g/head/day vs. 1.77 % of control diet with lactating goats.

CONCLUSION

From forgoing results it could be concluded that addition of Chufa tubers, at the prescribed amount, was more effective in improving most of tested parameters such as nutrients digestion coefficients , feeding values , growth rate and the feed utilization efficiency, which could be reflected on better performance and economic return of growing Zaraibi goats Kids. Moreover, the addition of Chufa tubers had positive effect on most metabolic parameters (rumen and blood) and consequently, animal's health in general. More research work is needed to explain the mode of action of Chufa tubers as a feed additives on the reproductive performance of farm animals .

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الأداء الإنتاجي وقياسات سائل الكرش وصورة الدم لذكور الماعز الزرايبى المغذاه على علائق مضاف لها درنات حب العزيز أثناء فتره النمو.

أحمد عبد الرازق جبر[١] ، محمد إبراهيم أحمد[٢] ، فتحية أحمد إبراهيم[٢] و محمد سعد سليم.[٢]

[١] كلية الزراعة ، جامعة المنصورة ، مصر.

[٢] معهد بحوث الإنتاج الحيواني – مركز البحوث الزراعية – الدقى – الجيزة – مصر.

هدف هذا العمل البحثي هو دراسة تأثير إضافة درنات حب العزيز كإضافات طبيعيه فى العلائق على الهضم وبعض قياسات سائل الكرش وصورة الدم والأداء الإنتاجي لجداء الماعز الزرايبى. ولتحقيق هذا الهدف البحثي تم إستخدام عدد ١٨ ذكر ماعز زرايبى نامى (متوسط وزن ٢١,٣ كجم وعمر ٥-٦ شهور) فى ثلاث مجموعات متساوية (مج١ ، مج٢ ، مج٣) ، وغذيت طبقاً لمقررات NRC لعام ١٩٨١ مع إضافة صفر ، ٥ ، ١٠ جم من درنات حب العزيز لكل عنزه يومياً للمجموعات الثلاثة على التوالى ، وقد استمرت التجربة لمدة ١٨ أسبوع ، وتم إجراء تجربة هضم لتقييم العلائق التجريبية المختبرة.

وقد أظهرت النتائج تحسناً معنوياً في معاملات الهضم مع مجموعتى المعاملة (مج ٢ ، مج٣) مقارنة بالكنترول (مج١) ، وعلاوة على ذلك حدث تحسن معنوي أيضاً فى كل من المركبات المهضومة الكلية والبروتين المهضوم مع إستخدام درنات حب العزيز في مج٢ ، مج٣ مقارنة بالكنترول مج١ . وكذلك حدث تحسن فى كل من معاملات الهضم للعناصر الغذائية والقيمة الغذائية مع زيادة مستوى درنات حب العزيز فى العلائق.

فيما يتعلق بقياسات الكرش فقد لوحظ أن حموضة سائل الكرش سجلت أدنى قيمة لها عند الساعة الرابعة بعد الأكل ، أيضاً لوحظ أن تأثير العلائق المختبرة على حموضة سائل الكرش وأمونيا سائل الكرش كان غير معنوياً عند معظم ساعات أخذ العينة. كذلك لوحظ أن تركيز أمونيا الكرش ينخفض تدريجيا مع زيادة مستوى درنات حب العزيز (صفر ، ٥ ، ١٠ جم/رأس). لكن إرتفعت معنوياً الأحماض الدهنية الطيارة الكلية مع زيادة مستوى المعاملة فى العلائق وذلك عند الساعات ٢ ، ٤ ، ٦ بعد الأكل ، أيضاً حدث إرتفاع فى كلاً من الأسيتات والبروبيونات وانخفضت البيوترات مع مجموعتى المعاملة (مج٢ ، مج٣) مقارنة بالكنترول.

فيما يتعلق بمعدل النمو اليومي فقد سجلت أعلى قيمة مع مج٣ (٩٠.٢٢ جم) ثم مج٢ (٨٤,٦٧جم) وأخيراً سجلت أقل قيمة مع مج١ (٧٦.٠٧ جم) والاختلافات كانت معنوية ، أما بالنسبة لكفاءة التحويل الغذائي محسوبة على أساس المادة الجافة والمركبات المهضومة الكلية والبروتين المهضوم و كانت أفضل مع مج٣ (٨.٥١ ، ٥,٩١ ، ٧٤٣, ،على التوالى) مقارنة بالأخرى ، بالإضافة إلى ذلك تحسنت الكفاءة الاقتصادية تدريجياً (١,٨٢ ، ١,٩٦ ، ٢,٠١ %) مع زيادة مستوى درنات حب العزيز (صفر ، ٥ ، ١٠ جم/رأس) فى علائق الماعز الزرايبى (مج١ ، مج٢ ، مج٣ على التوالى).

يستخلص من هذه الدراسة أن إضافة درنات حب العزيز فى علائق ذكور الماعز الزرايبى كان لها تأثير ايجابي على المأكول اليومي من المادة الجافة وتركيز الأحماض الدهنية الطيارة بالكرش ومعاملات الهضم وكفاءة تحويل الغذاء ، وقد إنعكس ذلك على تحسن معدلات النمو و أداء الحيوان وبالتالي تحقيق منفعة إقتصادية فى قطعان الماعز الزرايبى.