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RESPONSE OF BALADI GOATS TO DIETS CONTAINING DIFFERENT LEVELS OF CITRUS BY-PRODUCT.

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SUMMARY

Twenty one male Baladi goats aged 8 months with an average body weight of 19.1 ± 0.6 kg were used in an experiment that lasted 98 days to investigate the response of Baladi goats to diets containing different levels of sun dried citrus by-products. The control diet (R_1) contained 50% yellow corn while, in the other two experimental diets (R_2 and R_3) yellow corn was replaced by citrus by-product (CBP) at 25 and 50% levels of the yellow corn, respectively. The goats were divided into three groups of seven animals each. Animals were fed according to NRC (1981) allowances. Bean straw (BS) as a roughage source was offered to all groups (200g/h/day). The concentrate: roughage ratio was (80:20). Experimental rations were almost iso caloric and iso nitrogenous. Replacement of yellow corn by CBP did not alter neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), hemicellulose and cellulose contents of the experimental rations. Citrus by-product containing diets had no significant effect ($P>0.05$) on water intake. Feeding goats on diet containing CBP significantly increased ($P<0.05$) ruminal pH as compared with control ration (R_1) while caused insignificant decreasing ($P>0.05$) in ruminal ammonia nitrogen (NH_3–N) and significantly decreased ($P<0.05$) in total volatile fatty acids (TVFA's) before feeding. On the other hand, goats that received R_3 diet insignificantly increased ($P<0.05$) ruminal pH concentrations, but significantly decreased ($P<0.05$) NH_3–N and TVF's at 3 hrs post feeding. No significant differences ($P>0.05$) were obtained in growth rate. However average daily gain (ADG) improved with replacement of yellow corn by CBP. The average daily gain was 50, 58 and 55 g/d for the three experimental groups, respectively. Replacement of corn grain by CBP in goat rations improved ADG, feed efficiency and decreased daily feeding cost, consequently improved relative economical efficiency.

***Keywords:** goats, citrus by-product, growth performance, rumen fermentation.*

INTRODUCTION

Animal ration formulations depending on corn grain as a main source of energy, while corn grain is expensive which increase the costs of animal rations. So, it must search for cheap sources of energy to be alternative for grains.

Increase disposal costs in many parts of the world have increased interest in utilization of by-product feedstuffs as alternative feeds for ruminants (Bampidis and Robinson, 2006).

There are many options to overcome the shortage of feed for livestock; one of them is the use of Agro-Industrial By-Products (AIBP). AIBP refer to the by-products which one derived from the industry due to processing of main products. They are less fibrous, more concentrated, highly nutritious and less costly as compared to crop residues (Aguilera, 1989).

Egypt is one of the major producers and exporters of citrus fruits. For the some time, the food industry has shown a special interest in finding uses for citrus industry by-products. During the citrus juice extraction process, thousands of tons of the by-products are produced. These are mainly used for animal feeds. Citrus by-product is seasonally available and the supply peaks during the winter months and it can be used as an alternative source of corn grain.

Citrus pulp is the residue of peel, pulp and seeds that remain after the juice extraction from the fruit. The high moisture content of citrus pulp may limit consumption of the diet and prevent the storage, although citrus pulp is an energy-rich with high metabolizable energy content and could be used as a source of energy in ruminant feeding (Osman *et al.*, 2007a & 2007b).

Citrus pulp consists of 60-65% peel, 30-35% pulp, and 0-10% seeds. On average, citrus pulp represents 60% of the fresh weight of orange, with a mean dry matter content of 19.7% (Pascual and Carmona, 1980a).

The nutrient content of citrus pulp is approximately 90.0 to 94.2% dry matter, 6.0 to 16.67 % crude protein, 12.0 to 16.58% crude fiber, 3.2 to 17.70% ether extract, 3.9 to 7.3% ash ,55.73 to 70.1% nitrogen free extract, 74.0 to 80% Total digestible nutrient,1.19 to 1.90% Ca, 0.12 to 0.57% P, 0.17% Mg, 0.79% to 1.10% K ,0.09% Na, 9 ppm, Mn, 151 ppm Fe, 11 ppm Zn and 8 ppm Cu. Also, nutrient composition of the citrus pulp varied only slightly from year to year (NRC, 1988; NRC, 2001 and Osman *et al.*, 2007a).

It is noticeable that the price of cereal grains (i.e. yellow corn) is unstable and it keep raising in the local market so, the main objective of this study was to make a good cheap rations for ruminant animals and to study the effect of partial replacing yellow corn by CBP on performance, rumen fermentation, water consumption and economical evaluation of male Baladi goats.

MATERIALS AND METHODS

Feeding trial:

Experimental animals:

Twenty one male Baladi goats aged 8 months with an average body weight of 19.1 ± 0.6 kg were divided into three experimental groups, each of 7 animals. Animals were weighed weekly before feeding at 8.00 am to calculate the average daily gain.

Feeds and feeding:

Fresh citrus by-product composed of peel, pulp and seeds were taken from Food Industrial Unit, Agricultural Banha Secondary School, Qulybiya government. This by-product was collected and left to sun-dried for 10 days. Then sun-dried citrus by product was milled in grinding machine to fine particle size and used in formulating three concentrate feed mixtures.

The feeding trial lasted for 14 weeks (98 days). Animals were individually fed the experimental rations to cover the requirements for TDN and digestible crude protein for growing goats according to NRC (1981). Feed allowances were adjusted biweekly according to their body weight changes. Bean straw (BS) as roughage source was offered to all groups in the rate of 200g/h/day.

Experimental groups were randomly assigned to receive one of the three experimental rations in which citrus by-product (CBP) replaced 0, 25 or 50% of the yellow corn. Animals were fed on concentrate feed mixtures (CFM_1, CFM_2 and CFM_3) at 8.00 am, while BS was offered at 1.00 pm. Control ration (R_1) was not contained CBP, while R_2 and R_3 was replaced 25% and 50% of yellow corn in the control ration by CBP, respectively. Animals were raised under hygienic and managerial conditions. Fresh water was available at all time. Feed intake, body weight changes of the animals and water consumption were weekly recorded during the experimental period. Composition of concentrate feed mixtures are presented in Table (1).

Rumen fluid:

At the end of the feeding trial rumen fluid samples were collected from four animals for each group, by using stomach tube to determine ruminal pH, ruminal ammonia nitrogen and ruminal total volatile fatty acids concentrations. Samples were collected before offering the morning diet and 3 hrs post feeding. Samples were filtered through four layers of cheesecloth.

Table (1): Composition of the concentrate feed mixture (CFM).

Item	Concentrate feed mixture		
	CFM_1	CFM_2	CFM_3
1- Composition (%)			
Yellow corn	50.00	37.50	25.00
CBP	------	12.50	25.00
Soybean meal	15.00	15.00	15.00
Undecorticated cotton seed meal	15.00	15.00	15.00
Wheat bran	17.00	17.00	17.00
Limestone	1.50	1.50	1.50
Sodium Chloride	1.00	1.00	1.00
Vitamins and minerals mixture*	0.50	0.50	0.50

* Each 3 kg Vitamins and Mineral mixture contains: Vit. A 12500000 IU, Vit. D_3 2500000 IU, Vit. E 10,000 mg, Manganese 80000 mg, Zinc 60,000 mg, Iron 50000 mg, Copper 20000 mg, Iodine 5000mg, Cobalt 1000 mg and carrier ($CaCo_3$) add to 3000g. (Produced by Agri-Vet company)

Analytical procedures:

Representative samples of ingredients and experimental rations were analyzed for DM, CP, CF, EE, and Ash according to A.O.A.C (1995) methods. Nitrogen free extract (NFE) was calculated by differences. Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined in ingredients and experimental diets according to Goering and Van Soest (1970). Ruminal pH was immediately determined using digital pH meter. Ruminal ammonia nitrogen (NH_3-N) concentrations were determined applying NH_3 diffusion technique using Kjeldahle distillation method according to A.O.A.C (1995). Ruminal total volatile fatty acids (TVFA's) concentrations were determined by steam distillation according to Kromann *et al.* (1967).

Total digestible nutrients (TDN) and digestible crude protein (DCP) were calculated according to Abou-Raya (1967)

Gross energy (GE), Mcal/Kg DM) was calculated according to Blaxter (1968). Each g CP = 5.65 kcal, g EE = 9.40 kcal and g (CF & NFE) = 4.15 kcal.

Digestible energy (DE), Mcal was calculated according to NRC (1975). Where, DE (Mcal) = TDN, kg x 0.004409.

Economical evaluation (feed cost of one kg gain)

The relation between feed costs and gain was calculated for the different experimental groups. The general equation by which the costs of one kg of live body weight gain was calculated as follow:

The cost for one kg gain = Total cost LE of feed intake/Total gain (kg).

The ingredients cost based on January 2007 prices were 1250 LE/Ton for yellow corn, 200 LE/Ton for CBP, 1750 LE/Ton for soybean meal, 1400 LE/Ton for undecorticated cotton seed meal, 930 LE/Ton for wheat bran, 70 LE/Ton for limestone, 150 LE/Ton for salt (sodium chloride), 2000 LE/Ton for mineral and vitamins mixture and 350 LE/Ton for bean straw (BS). The cost of different concentrate feed mixtures (CFM) were 1268 LE/Ton for CFM_1, 1137 LE/Ton for CFM_2 and 1006 LE/Ton for CFM_3, respectively.

Statistical analysis

Data collected were subjected to statistical analysis as one way analysis of variance according to Snedecor and Cochran (1984). Duncan's Multiple Range Test Duncan, (1955) was used to separate means when the dietary treatment effect was significant according to the following model:

$$Y_{ij} = \mu + C_i + e_{ij}$$

Where:

Y_{ij} = Observation.

μ = Overall mean.

C_i = Effect of dietary citrus by-product (CBP) levels for i = 1 – 3, 1 = No CBP (Control),
2 = CBP was replaced 25% from yellow corn percentage in the control diet and
3 = CBP was replaced 50% from yellow corn percentage in the control diet.

e_{ij} = The experimental error.

RESULTS AND DISCUSSIONS

Composition, chemical analysis and cell wall constituents

Chemical analysis and cell wall constituents of feed ingredients are shown in Table (2). Citrus by-product (CBP) contained 11.75% CP, 11.31% CF, 6.31% EE, 55.03% NFE, 15.60% Ash, 37.73% NDF, 24.96% ADF, 2.92 ADL, 12.77% hemicellulose and 22.04% cellulose.

Table (2): Chemical analysis and cell wall constituents of feed ingredients.

Item	Yellow corn	CBP	Soybean meal	Undecorticated cotton seed meal	Wheat bran	Bean straw
Dry matter	88.39	91.79	89.78	92.83	89.32	90.69
Chemical analysis (%) on DM basis:						
Orgaaic matter	98.60	84.40	92.97	94.90	94.98	90.31
Crude protein	9.27	11.75	44.0	27.31	14.36	9.12
Crude fiber	2.27	11.31	3.90	19.29	8.53	43.52
Ether extract	4.01	6.31	2.82	10.33	3.94	0.61
Nitrogen free	83.05	55.03	42.25	37.97	68.15	37.06
extract	1.40	15.60	7.03	5.10	5.02	9.69
Ash						
Cell wall constituents (%):						
NDF	32.63	37.73	35.18	50.63	44.21	66.39
ADF	22.45	24.96	26.72	36.18	32.16	47.43
ADL	2.13	2.92	6.84	20.46	4.05	10.25
Hemicellulose	10.18	12.77	8.46	14.45	12.05	18.96
Cellulose	20.32	22.04	19.88	15.72	28.11	37.18

NDF, neutral detergent fiber; ADF, acid detergent fiber; ADL, acid detergent lignin
Hemicellulose = NDF – ADF.
Cellulose = ADF – ADL.
CBP: sun dried citrus by-product

Citrus by-product (CBP) used in this experiment was reasonably comparable in chemical composition to that reported for citrus pulp by authors world-wide (Gad *et al.*, 1998; Nouel and Combellas 1999; Aregheore, 2000; Chapman *et al.*, 2000; Arthington *et al.*, 2002; Blezinger, 2002; Bueno *et al.*, 2002; Peacock and Kirk, 2003; Rossi, 2004; Villarreal *et al.*, 2006 and Osman *et al.*, 2007a). They noted that, citrus pulp contained 90.0 to 94.2% dry matter, 93.7 to 95.00 organic matters, 6.0 to 16.67 % crude protein, 12.0 to 17.70% crude fiber, 3.2 to 11.71% ether extract, 3.9 to 7.3% ash, 55.73 to 70.1% nitrogen free extract.

Some variation in the chemical composition of dried citrus pulp can be expected because of variation in production site, citrus variety, proportion of seeds & peel and manufacturing processes used (Arthington *et al.*, 2002).

Chemical analysis and cell wall constituents of the different concentrate feed mixtures (CFM_1, $_2$ and $_3$) are presented in Table (3), while chemical analysis, cell wall constituents and the calculated nutritive values of the different rations are presented in Table (4). Experimental rations were almost iso caloric and iso nitrogenous.

Table (3): Chemical analysis and cell wall constituents of the concentrate feed mixtures.

	Concentrate feed mixture		
Item	**CFM_1**	**CFM_2**	**CFM_3**
Dry matter	89.68	90.10	90.53
Chemical analysis on DM basis			
Organic matter	93.63	91.85	90.08
Crude protein	17.78	18.09	18.40
Crude fiber	6.07	7.19	8.33
Ether extract	4.65	4.93	5.22
Nitrogen free extract	65.13	61.64	58.13
Ash	6.37	8.15	9.92
3- Cell wall constituents (%)			
NDF	36.71	37.35	37.98
ADF	26.14	26.45	26.76
ADL	5.86	5.96	6.05
Hemicellulose	10.57	10.90	11.22
Cellulose	20.28	20.49	20.71

NDF, neutral detergent fiber; ADF, acid detergent fiber; ADL, acid detergent lignin
Hemicellulose = NDF – ADF. Cellulose = ADF – ADL.

Feed intake:

Daily dry matter and nutrient intakes by the experimental kids during the experimental period are shown in Table (5). The DMI for the experimental groups from concentrate feed mixtures were similar. The amounts were 717g, 717g and 720g for the CFM_1, CFM_2 and CFM_3, respectively.

Difference in dry matter intake, Total digestible nutrient intake expressed as g/day, g/kg $W^{0.75}$ or kg /100 kg BW ; crude protein intake (CPI) and digestible crude protein intake (DCPI) as g/day, g/kg $W^{0.75}$ or g/100 kg BW were not significant among the dietary treatments. Inclusion CBP in the diet had no significant effect on feed intake by the experimental groups which indicate that, the CBP had no adverse effect on palatability.

These results confirm those of Lanza (1984) when partial or total substitution of corn or barley grain by dried orange pulp (DOP) or dried lemon pulp (DLP) in the concentrates fed to Friesian dairy cattle. The intake of a ration fed to Awasi lambs containing dried citrus pulp (DCP) was reported to be the same as that containing corn grain up to 400g DCP/kg DM, but declined at higher levels (Bhattacharya and Harb, 1973). Replacement of cereal grains by orange pulp in lamb fattening diets based on faba bean did not affect dry matter intake (Lanza *et al.*, 2001). Bueno *et al.* (2002) replaced corn with dehydrated citrus pulp (DCP) at levels 0, 33, 66 and 100% in Saanen kid diets. They noted that, feed intake showed a quadratic effect ($P<0.05$) with the increasing levels of replacement.

Table (4): Composition, chemical analysis, cell wall constituents and calculated the nutritive values of the different rations.

Item	Experimental rations		
	R_1	R_2	R_3
Composition (%) of the experimental rations:			
Concentrate feed mixture	80.00	80.00	80.00
Bean straw	20.00	20.00	20.00
Chemical analysis (%):			
Dry matter	89.88	90.22	90.56
Chemical analysis on DM basis:			
Organic matter	92.96	91.54	90.12
Crude protein	16.04	16.29	16.54
Crude fiber	13.56	14.45	15.36
Ether extract	3.84	4.06	4.30
Nitrogen free extract	59.52	56.74	53.92
Ash	7.04	8.46	9.88
Cell wall constituents (%)			
NDF	42.65	43.16	43.66
ADF	30.40	30.65	30.90
ADL	6.74	6.82	6.89
Hemicellulose	12.25	12.51	12.76
Cellulose	23.66	23.83	24.01
Calculated nutritive values:			
TDN%	69.50	68.91	68.30
DCP%	10.50	10.52	10.54
GE (Mcal/kg DM)	4.300	4.256	4.263
DE (Mcal)	3.064	3.038	3.011

NDF, neutral detergent fiber; ADF, acid detergent fiber; ADL, acid detergent lignin

Hemicellulose = NDF – ADF.

Cellulose = ADF – ADL.

***Water intake*:**

Water intake by the experimental groups is presented in Table (6). Replacement of yellow corn by citrus by-product (CBP) in goat rations at 25 and 50% lead to non significant effect in water intake.

Table (5): Dry matter, energy and nutrient intakes by the experimental groups.

Item	Experimental rations			S.E.M
	R_1	R_2	R_3	
Av. Body weight, kg*	21.54	21.89	21.77	0.53
Metabolic body size**	10.00	10.12	10.08	0.18
DM intake: g / day as				
CFM	717	717	720	11.70
Bean straw	181	181	181	-----
Dry matter intake (DMI):				
g/day	898	898	901	11.70
g/kgW $^{0.75}$	89.8	88.7	89.4	1.17
kg/100 kg BW	4.17	4.10	4.14	0.05
Total digestible nutrient intake (TDNI):				
g/day	624	619	615	8.11
g/kgW $^{0.75}$	62.4	61.2	61.0	0.81
kg/100 kg BW	2.90	2.83	2.82	0.04
Crude protein intake (CPI):				
g/day	144	146	149	1.97
g/kgW $^{0.75}$	9.40	14.43	14.78	0.20
g/100 kg BW	669	667	684	9.12
Digestible crude protein intake (DCPI):				
g/day	94	95	95	1.23
g/kgW $^{0.75}$	9.40	9.40	9.42	0.12
g/100 kg BW	4.36	4.36	4.36	5.56

* Av. Body weight, kg = Initial weight – Final weight / 2.
** Metabolic body size = kg $W^{0.75}$.
S.E.M., standard error of the mean.
BW, body weight.

Water intake values by the experimental groups were 1864, 1752 and 1826 ml/h/day for R_1, R_2 and R_3, respectively. Feeding kids on diets containing CBP insignificant decreased (P>0.05) daily water intake by about 6% and 2% for R_2 and R_3 in comparison with R_1. On the other hand, daily water intake was increased by 4.1% for R_3 compared with R_2. The effect of dietary treatment on water intake was not related to change in dry matter intake which was almost constant but it was specific effect may be related to high ash content of the CBP. Effect of added CBP in goat rations on water consumption needs more investigations.

Table (6): Water intake by the experimental groups.

Item	Experimental rations			
	R_1	R_2	R_3	S.E.M
Av. Body weight, kg*	21.54	21.89	21.77	0.53
Metabolic body size**	10.00	10.12	10.08	0.18
Dry matter intake, g	898	898	901	11.74
Water intake as:				
ml/h/ day	1864	1752	1826	83.01
ml/kg $W^{0.75}$	186	173	181	8.32
L/100 kg BW	8.655	8.003	8.387	0.38
L/kg DM intake	2.076	1.951	2.027	0.09

* Av. Body weight, kg = Initial weight – Final weight / 2.
** Metabolic body size = kg $W^{0.75}$.
S.E.M., standard error of the mean. BW., body weight.

Rumen fermentation:

Rumen fluid parameter results are presented in Table (7). Feeding goats on diet containing CBP significantly increased ($P<0.05$) ruminal pH as compared with control ration (R_1) while caused insignificant decreasing ($P>0.05$) in ruminal ammonia nitrogen (NH_3–N) and significantly decreased ($P<0.05$) in total volatile fatty acids (TVFA's) before feeding. On the other hand, goats that received R_3 diet insignificantly increased ($P<0.05$) ruminal pH concentrations, but significantly decreased ($P<0.05$) NH_3–N and TVF's at 3 hrs post feeding.

Table (7): Effect of feeding experimental rations on rumen fluid parameters of the experimental groups.

Item	Experimental rations			
	R_1	R_2	R_3	S.E.M
pH				
0hrs	6.37^{b}	6.60^{a}	6.60^{a}	0.45
3hrs	5.37^{ab}	5.23^{b}	5.70^{a}	0.096
NH_3–N (mg/dl)				
0hrs				
3hrs	26.27	25.25	23.72	0.83
	35.25^{a}	33.08^{ab}	30.27^{b}	0.87
TVFA's (meq./dl)				
0hrs	7.90^{a}	4.40^{b}	4.63^{b}	0.65
3hrs	8.07^{a}	6.83^{ab}	5.97^{b}	0.38

a and b: Means in the same row having different superscripts differ significantly at level ($P<0.05$).
S.E.M., standard error of the mean. NH_3-N, ruminal ammonia nitrogen. TVF's, total volatile fatty acids.

Increasing level of CBP in the diet lead to decrease NH_3–N and TVFA's concentrations gradually. Ruminal pH values were decreased after feeding while NH_3–N and TVFA's concentrations were increased at 3hrs post feeding. Ruminal pH values ranged from 6.37 to 6.60, NH_3–N concentrations ranged from 23.72 to 26.27 mg/dl and TVFA's ranged from 4.40 to 7.90 meq./dl before feeding. While ruminal pH values ranged from

5.23 to 5.70, NH_3–N concentrations ranged from 30.27 to 35.25 mg/dl and TVFA's ranged from 5.97 to 8.07 meq./dl after feeding.

The reduction of ammonia–N in the rumen liquor appears to be the result of increased incorporation of ammonia–N into microbial protein and it was considered as a direct result to stimulate microbial activity. Addition of more fermentable carbohydrate to ruminant rations causes a decrease in rumen ammonia probably due to a greater uptake of ammonia by rumen microorganisms in support of enhanced microbial growth (Tagari *et al.*, 1964). However Pinzon and Wing (1976) stated that increasing citrus pulp from 0% to 19%, 38%, or 55% in the diets resulted in a reduction in ruminal pH from 6.85 to 6.65, 6.61, and 6.51.

Dried citrus pulp, even at a high dietary proportion, creates favorable condition for cellulolysis in the rumen and has a positive effect on N supply to the intestine (Ben-Ghedalia *et al.*, 1989). Ruminal pH declined with increasing dried citrus pulp at levels up to 820g/kg DM (Schaibly and Wing, 1974).

The rate of VFA's production may in this situation exceed the rate of VFA's absorption through the rumen epithelium and the VFA's concentration in the rumen juice is increased (Van't Klooster, 1986).

All treatments in our experiment displayed a drop in rumen pH after feeding; the relative magnitude of the drop was the same across treatments. Moreover, average pH values were approximately 6.4 or greater, well in excess of the suggested threshold (6.2) for maintenance of optimal ruminal microbial synthesis and fiber degradation (Mould and Ørskov, 1983; Russell *et al.*, 1992; Pitt *et al.*, 1996 and Villarreal *et al.*, 2006).

Growth performance:

Data of growth performance of the experimental groups is presented in Table (8). The results showed that, values of final weight, body weight gain, average daily gain (ADG), relative gain and feed efficiency (g.gain/g. intake) were not significant. However, increasing the level of sun dried citrus by-product tended to increase final weight, gain, ADG and feed efficiency in comparison with control diet (R_1). The values of average daily gain were 50, 58 and 55 g/day for R_1, R_2 and R_3, respectively. Feeding kids on R_2 ration improved ADG by 16% compared to the control diet (R_1) and by 5.5% in comparison with R_3. While, R_3 increased ADG by about 10% compared with the control diet (R_1). Lanza *et al.* (2001) fed lambs carob pulp and orange pulp in replacement of cereal grains on diets based on faba bean without affecting final live weight, average daily weight gain, dry matter intake and feed conversion. Also, Peacock and Kirk (2003) noted that there were no significant differences in gain for steers fed citrus pulp, corn feed meal and ground snapped corn when combined with adequate protein and other essential nutrients in a ration for young growing steers. Lanza (1984) also reported that half substitution of corn grain by dried orange pulp concentrates fed to Friesian heifers, from 6 to 18 month, did not negatively affect body weight.

Experimental kids that fed R_2 improved feed efficiency (g.gain/g. intake) by 116% compared with R_1 (100%). On the other hand, R_3 increased feed efficiency by 109.5% in comparison with the control ration (100%). Growing lambs at an average weight of 15 Kg fed on diets containing 0,15,30,45 and 60% citrus pulp in the concentrate and 10-15% alfalfa hay, daily gain and feed efficiency were not altered significantly up to 30% incorporation of citrus pulp, but if higher quantities were added the animal response was poorer (Pascual and Carmona, 1980b). No differences occurred between treatments in body weight gain or feed conversion ratio when replacing corn grain with dried citrus pulp in diets containing various concentrate levels and fed to bulls (Henrique *et al.*, 1998). On the other hand Bueno *et al.* (2002) studied the effect of replacing corn with dehydrated citrus pulp (DCP) in growing Saanen kid diets at levels 0, 33, 66 and 100%. They noted that, daily gain and feed conversion showed a quadratic effect ($P<0.05$) with the increasing levels of replacement. Replacing around 40% of corn by DCP can attain the best performance for growing kids.

Table (8): Growth performance of the experimental groups.

Item	Experimental rations			S.E.M
	R_1	R_2	R_3	
No. of kids	7	7	7	----
Initial weight, kg	19.08	19.04	19.06	0.56
Final weight, kg	24.00	24.74	24.48	0.59
Gain, kg	4.92	5.70	5.24	0.31
Experimental duration, days	98	98	98	----
ADG, g / day	50	58	55	3.09
Relative gain (% of initial weight)*	25.8	29.9	28.4	1.79
Feed intake, g as:				
Dry matter	898	898	901	11.70
Total digestible nutrient	624	619	615	8.11
Crude protein	144	146	149	1.97
Digestible crude protein	94	95	95	1.23
Feed efficiency (kg gain/kg intake) of				
Dry matter	0.0557	0.0646	0.0610	0.003
Total digestible nutrient	0.0801	0.0937	0.0894	0.005
Crude protein	0.3472	0.3973	0.3691	0.02
Digestible crude protein	0.5319	0.6105	0.5789	0.03

* Relative gain (% of initial weight) = Gain / initial weight x 100.
S.E.M., standard error of the mean.

Economical evaluation:

Economical efficiency was represented by daily profit over feed cost. The costs were based on average prices of year 2007 for feeds and live body weight. Total feeding cost, profit above feeding cost and feed cost L.E/kg gain are shown in Table (9). Total daily feeding costs of experimental rations were decreased by 9.26% for R_2 ration while decreased by 19.44% for R_3 ration in comparison with the control (R_1). Meanwhile, daily profit above feeding cost and feed cost L.E/kg gain for rations containing CBP (R_2 and R_3) were better compared with the control (R_1).

CONCLUSION

From these results, it can be concluded that sun-dried citrus pulp can be replaced yellow corn in goat rations without any adverse effect on gain or rumen fermentation. Also, using sun-dried citrus pulp will facilitate the farmers for economical and profitable farming, because feeding cost will reduce which is approximately 25 percent of the total cost of production. However, more information is needed concerning the level that is best to use in goat rations formulation.

Table (9): Economical evaluation for the experimental rations.

Item	Experimental rations		
	R_1	R_1	R_1
Daily feed intake, kg of:			
Concentrate feed mixture (CFM), kg	0.800	0.800	0.795
Bean straw (BS), kg	0.200	0.200	0.200
Daily feeding cost (L.E/d)*:			
CFM	1.01	0.91	0.80
BS	0.07	0.07	0.07
Total feeding cost	1.08	0.98	0.87
Average daily gain, kg	0.050	0.058	0.055
Price of daily gain **	1.10	1.28	1.21
Daily profit above feeding cost (LE)	0.02	0.30	0.34
Feed cost L.E/Kg gain	21.60	16.90	15.82

* Based on prices of year 2007.
** Price of one kg live body weight equals 22 LE (2007).
L.E., Egyptian pound.

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استجابة الماعز البلدية لعلائق تحتوى على مستويات مختلفة من مخلف عصر البرتقال

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استخدم فى هذه الدراسة إحدى وعشرون ذكر ماعز بلدى عمر ٨ شهور ومتوسط وزن ١٩.١ + ٠.٦ كجم والتى قسمت إلى ثلاثة مجاميع تجريبية متساوية تحتوى كل مجموعة سبعة جداء لدراسة استجابة الماعز البلدية لعلائق تحتوى على مستويات مختلفة من مخلفات عصر البرتقال وتم تكوين الثلاثة علائق التجريبية كما يلى:

العليقة الأولى(R1) : لم تحتوى على مخلفات عصر البرتقال (عليقة الكنترول).

العليقة الثانية(R2) : تم استبدال ٢٥٪ من الذرة الصفراء فى عليقة الكنترول بمخلفات عصر البرتقال.

العليقة الثالثة(R3) : تم استبدال ٥٠٪ من الذرة الصفراء فى عليقة الكنترول بمخلفات بمخلفات عصر البرتقال.

واستمرت تجربة التغذية لمدة ١٤ اسبوع (٩٨ يوم) وغذيت المجاميع التجريبية طبقاً للمقررات الغذائية للـ NRC (1981) بالإضافة إلى تقديم تبن الفول البلدى لكل الحيوانات التجريبية بمعدل (٢٠٠جم/راس/يوم) وكانت نسبة العليقة المركزة:العليقة الخشنة (٨٠:٢٠٪) تقريباً وكانت العلائق متشابهة تقريباً فى محتواها من البروتين والطاقة.

وأظهرت النتائج ما يلى:

- لم يتأثر معدل الغذاء المأكول من المادة الجافة والمركبات الغذائية الأخرى معنوياً (عند مستوى ٠.٠٥) باستبدال الذرة الصفراء بمخلفات عصر البرتقال فى علائق الماعز، كما لوحظ أن معدل الغذاء المأكول اليومى لمختلف المجاميع التجريبية كان فى نفس المدى تقريبا.
- لم يتأثر معدل استهلاك ماء الشرب معنوياً.
- تغذية الماعز على العليقة (R3) المحتوية على المستوى العالى من مخلفات عصر البرتقال إلى زيادة معنوية (عند مستوى ٠.٠٥) فى درجة حموضة الكرش pH مقارنةً بعليقة الكنترول (R1). بينما انخفضً تركيز امونيا الكرش إنخفاض غير معنوى فى حين انخفض الأحماض الدهنية الطيارة إنخفاضاً معنويا وذلك قبل تقديم الغذاء.
- لوحظ أن اخذ العينات بعد ٣ ساعات بعد تقديم الغذاء قد أدى إلى انخفاض درجة الحموضة pH فى حين أدى إلى زيادة فى تركيزامونيا الكرش Ruminal NH3-N والأحماض الدهنية الطيارة الكلية TVFA's لسائل الكرش.
- لم يكن هناك اختلاف معنوى لمعدل النمو ومع هذا فإن معدل النمو تحسن باستبدال الذرة بمخلفات عصر البرتقال المجففة شمسياً وكان معدل النمو ٥٠ ، ٥٨ ، ٥٥ جم/يوم للعلائق الجريبية R1, R2 and R3 على التوالى.
- اظهرت النتائج تحسن غير معنوى فى الكفاءة الغذائية المقدرة على أساس (جم نمو/ جم مأكول) من المادة الجافة، المركبات المهضومة الكلية، البروتين الخام، البروتين الخام المهضوم باستبدال الذرة بمخلفات عصر البرتقال المجففة شمسياً.
- أظهرت النتائج انخفاض التكلفة الغذائية مع تحسن النمو والكفاءة الغذائية وانخفاض تكلفة التغذية اليومية وبالتالى تحسن الكفاءة الأقتصادية.