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GROWTH PERFORMANCE OF GROWING BALADI GOATS FED DIETS CONTAINING DIFFERENT LEVELS OF SUNDRIED PEEL POTATO WASTE.

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SUMMARY

Twenty one male Baladi goats with an average body weight of (11.217 ± 0.341 kg) and aged 6 months were divided into three similar experimental groups, each of 7 kids to study the effect of partial replacing yellow corn with peel potato waste (PPW) on performance of growing Baladi goats. Experimental rations contained PPW to replace 0% PPW (R_1), 25% PPW (R_2) and 50% PPW (R_3) of yellow corn. Feeding trial lasted 15 WKS (105 days). Animals were fed according to NRC allowances. Peanut vines hay (PVH) as a roughage source was offered to all animals at level (200g/h/day), the concentrate:roughage ratio was (72:28%). Experimental rations were almost iso caloric and iso nitrogenous. The results showed that, daily dry matter and nutrient intakes were not significant affect ($P>0.05$) by replacement yellow corn with peel potato waste in growing goat rations. Feed intake by the different groups were in the same range. Feeding growing kids on diets containing PPW caused insignificantly increase ($P>0.05$) water intake by 5% for (R_2) and by 16% for (R_3) compared with the control ration (R_1). Also, water intake was increased ($P>0.05$) by 11% for R_3 compared with R_2. Feeding growing kids on PPW containing diets was significantly increased ($P<0.05$) ruminal pH and Total volatile fatty acids (TVFA's) concentration but, significantly decreased ($P<0.05$) ruminal ammonia nitrogen (NH_3-N) concentrations. Sampling time at 3hrs post feeding significantly decreased ($P<0.05$) ruminal pH while, significantly increased ($P<0.05$) ruminal NH_3-N and TVFA's concentrations. No significant interaction was found between dietary treatments (PPW levels) and sampling time (PxS) on ruminal pH, but significant interaction (PxS) was observed for ruminal ammonia and total volatile fatty acids concentrations. Feeding kids on diets replaced 25% of yellow corn by PPW (R_2) improved average daily gain (ADG) by about 23% while, 50% PPW (R_3) decreased ADG by about 4% compared with the control ration (R_1). Feed efficiency (g.gain/g.intake) of 25% PPW diet (R_2) was improved by 20% and 27% when it compared with the control diet (R_1) and 50% PPW (R_3), respectively, while R_3 decreased feed efficiency by 5.4% compared with the control diet (R_1). Feeding growing kids on diets containing PPW caused net revenu equals 61.5% and 18.5% for (R_2 and R_3), respectively compared with the control diet (R_1). Replacement of corn by PPW in goat rations improved ADG, feed efficiency and decreased daily feeding cost, consequantly improved relative economical efficiency.

***Keywords** : Peel potato waste, Baladi goats, rumen fermentation, performance,*

INTRODUCTION

Animal feeds are in adequate shortage and expensive, it become necessary to use the agricultural by–products as compensatory feeds for feeding animals.

Encouraging results obtained from using by–product in animal diets could participate in reducing the shortage of animal feeds and subsequently increase meat production.

Agriculture by–products like potato processing (PPW) have chemical analysis close to yellow corn composition and can play an important role to cover some nutrient requirements of the animal (Lardy and Anderson, 2001 and Radunz *et al.*, 2003).

Potato waste is the product remaining after potatoes have been processed to produce frozen potato products for human consumption. The product can include peelings, cull potatoes, reject french fries and other potato products. Due to differences in processing plants, moisture levels can vary considerable from plant to plant (75 to 85 % moisture). The high water content limits transportation distance to local areas surrounding the processing plants. Potato waste is equal in energy to grains on a dry matter basis. However, it is low in protein and vitamin A. the starch in potato waste is fermented rapidly, limiting inclusion levels due to problems such as acidosis and bloat. Due to the wet nature of the product, spoilage can be a concern, especially during the summer (lardy and Anderson, 2001).

The nutritive value of potato waste as feed for livestock was evaluated by many authors, crude protein and fiber contents of potato wastes vary greatly depending on processing methods and range between 4.00 to 10.30% and 1.60 to 17.50%, respectively (Onwubuemeli *et al.*, 1985 and Duynisveld and Charmley, 2002).

Potatoes are primarily a source of energy, on a 100% DM basis it have 81– 82% TDN and only about 10% protein. The crude protein is in the form of non protein nitrogen and only 60% of the total may be digestible (Boyles, 2006).

Because of potatoes very low fiber content, it should not be considered a forage substitue but rather should be thought of as a high moisture grain. Potatoes are quite low in protein content and when fed in high amounts without protein supplementation will not give good animal perfprmance or feed efficiency. The higher protein requirements (as a percentage of diet) of lighter cattle make protein supplementation especially important for light cattle fed potato diets (Snowdon,2006). Potato products can be economical substitute for grains (Shane Murphy, 1997).

The main objective of this study was to make a good cheap rations for growing ruminant animals and to investigate the effect of partial replacing yellow corn by peel potato waste (PPW) on performance, rumen fermentation, water consumption and economical evaluation of Baladi goats.

MATERIALS AND METHODS

Feeding trial:

Experimental animals:

Twenty one Baladi goats with an average body weight of 11.217 ± 0.341 kg and aged 6 months were divided into three experimental groups, each of 7 animals. Animals were weighted in the morning before drinking and feeding (fasting 16 hours) at the beginning of the trial and biweekly for each animal till the end of the experimental feeding lasting for an experimental period of 105 days.

Feeds and feeding:

The feeding trial lasted for 15 weeks (105 days). Animals were individually fed the experimental rations to cover the requirements for TDN and protein for growing goats according to NRC (1981) and feed allowance was adjusted biweekly according to their body weight changes. Peanut viens hay (PVH) as roughage source was offered to all animals at level (200g/h/day). Experimental animals were divided into three similar groups and randomly assigned to receive one of the three experimental rations in which peel potato waste (PPW) replaced either 0, 25 or 50% of yellow corn. Concentrate feed mixture (CFM) was offered at 8.00 am while, PVH was offered at 13.00 pm. Control ration (R_1) was not contained PPW, while R_2 and R_3 was replaced 25% and 50% of yellow corn in the control ration, respectively. Animals were raised under hygienic and under managerial conditions. Fresh water was available at all time. Feed intake, body weight changes of the kids and water consumption were weekly recorded during the experimental period. Chemical composition and cell wall constituents (%) of ingredients, CFM and experimental rations are presented in Tables (1, 2 and 3).

Rumen fluid:

Rumen fluid samples were collected from four kids for each group, at the end of the feeding trial by using stomach tube. Samples were collected before offering the morning diet and after 3 hrs post feeding. Samples were filtered through four layers of cheesecloth .

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. TDN (total digestible nutrient) and DCP (digestible crude protein) were calculated according to Abou–Raya (1967).

Neutrall 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). Hemicellulose was calculated as the difference between NDF and ADF, while cellulose was calculated as the difference between ADF and ADL. 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).

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 wich 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 ingredient cost according to year 2006 prices were 1250 (LE)/Ton for yellow corn, 100 (LE)/Ton for peel potato waste (PPW), 1750 (LE)/Ton for soybean meal, 930 (LE)/Ton for wheat bran, 70 (LE)/Ton for limestone, 150 (LE)/Ton for feeding salt (sodium chloride), 2000 (LE)/Ton for mineral and vitamins mixture and 450 (LE)/Ton for peanut vines hay (PVH). The cost of different concentrate feed mixtures (CFM) were 1271 (LE)/Ton for

CFM_1, 1098 (LE)/Ton for CFM_2 and 926 (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 1):

$Y_{ij} = \mu + P_i + e_{ij}$ (model 1).

On the other hand, ruminal parameters data were subjected to statistical analysis as two factors factorial analysis of variance according to the following (model 2):

$Y_{ijk} = \mu + P_i + S_j + (PS)_{ij} + e_{ijk}$ (model 2).

Where:

Y_{ijk} = Observation.

μ = Overall mean.

P_i = Effect of dietary PPW levels for i = 1–3, 1 = No PP (Control), 2 = PPW was replaced 25% from yellow corn percentage in the control diet and 3 = PPW was replaced 50% from yellow corn percentage in the control diet.

e_{ij} = The experimental error (model 1).

S_j = Effect of sampling time for j = 1–2, 1 = before feeding, 2 = 3hrs post feeding.

$(PS)_{ij}$ = The interaction of PPW level x sampling time.

e_{ijk} = The experimental error (model 2).

RESULTS AND DISCUSSION

Composition, chemical analysis and cell wall constituens:

Chemical analysis and cell wall constituents of feed ingredients are shown in Table (1). Peel potato waste (PPW) contained 14.59% CP, 5.10% CF, 1.38% EE, 74.58% NFE, 4.35% Ash, 41% NDF, 6.30% ADF, 3.80 % ADL, 34.70%, hemicellulose 2.50% cellulose and 38.68% NFC. These results are in the same trend with those found by Gado *et al.* (1998), who found that NDF, ADF and ADL for potato waste were 41.5, 6.4 and 3.9%, respectively. Also, These results in agreement with those obtained by Onwubuemeli *et al.* (1985); Scott *et al.* (1989); Duynisveld and Charmley (2002) and Boyles (2006), they recorded that CP ranged between 4% to 10.3%, CF ranged between 1.6% to 17.5% and TDN ranged between 78% to 82%, respectively.

Composition, chemical analysis and cell wall constituens of the concentrate feed mixture (CFM) and the experimental rations are presented in Tables (2 and 3). Pell potato waste replaced 0%, 25% and 50% of yellow corn. Concentrate: roughage ratio was (72:28%) approximately. Experimetal rations were almost iso caloric and iso nitrogenous, rations were containing 16.47, 16.50 and 16.93% CP for R_1, R_2 and R_3, respectively. The corresponding ether extract contents were 3.40, 3.52 and 3.62% for the same three experimental rations. Replacement yellow corn by peel potato waste in the rations increased hemicellulose content while, decreased cellulose content of experimental rations. Nutritive values (TDN, DCP, GE and DE) were in the same trend for the different experimental rations.

Table (1): Chemical analysis and cell wall constituents of feed ingredients.

Item	Yellow corn	Peel potato Waste (PPW)	Soybean meal	Wheat bran	Peanut vines hay (PVH)
Dry matter	88.39	89.67	89.78	89.32	91.56
Chemical analysis (%) on DM basis					
Crude protein	9.27	14.59	44.33	14.36	12.85
Crude fiber	2.27	5.10	3.90	8.53	24.78
Ether extract	4.01	1.38	2.82	3.94	2.04
Nitrogen free extract	83.05	74.58	41.92	68.15	46.22
Ash	1.40	4.35	7.03	5.02	14.11
Cell wall constituents (%)					
NDF	32.63	41.00	35.18	44.21	47.30
ADF	22.45	6.30	26.72	32.16	32.50
ADL	2.13	3.80	6.84	4.05	5.77
Hemicellulose	10.18	34.70	8.46	12.05	14.80
Cellulose	20.32	2.50	19.88	28.11	26.73
NFC*	52.69	38.68	10.64	32.47	23.71

NDF= Neutral detergent fiber. ADF= Acid detergent fiber. ADL= Acid detergent lignin.
Hemicellulose = NDF – ADF. Cellulose = ADF - ADL.
NFC* : Non fibrous carbohydrates, calculated according to Calsamiglia *et al.* (1995) using the following equation: NFC= 100 – {CP + EE + Ash + NDF}.

Feed intake:

Daily dry matter and nutrient intakes by the experimental group kids during 105 days experimental period are shown in Table (4). The mean values of daily concentrate feed mixture (CFM) intake was not significant (P>0.05) affect among the three experimental group kids and it was in the same range (477g, 489g and 485g) for the CFM_1, CFM_2 and CFM_3, respectively. The present results might indicate that, the peel potato waste (PPW) had no adverse effect on platability.

Dry matter intake (DMI) and Total digestible nutrient intake (TDNI) as g /day, g /kg $W^{0.75}$ or kg/100 kg BW ; gross energy intake (GEI) and digestible energy intake (DEI) as Mcal/day, Mcal/kg $W^{0.75}$ or Mcal/100 kg BW and 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 (P>0.05) differ among the dietary treatments. These results were agreement with those obtained by Heinemann and Dyer, 1972; Heinemann *et al.*, 1978 and Sauter *et al.*, 1980. They found that using alkali–peeled potato by–product with cattle up to 40% of a high concentrate diets (DM basis) did not affect intake, however, addition of 50% or more had a negative affect. On the other hand, Stanhope *et al.* (1980) recorded decreasing in dry matter intake as level of potato–processing residue increased from 0 to 60% of the diet DM in barley–based finishing diets of beef cattle. Replacement corn with potato processing by product in beef finishing diets linear declines (P<0.05) in dry matter intake was obtained by Duynisveld *et al.* (2004). On the other hand, Nelson *et al.* (2000) reported increased dry matter intake with a 10% addition of ensiled potato pieces, in corn–based diets with 7%.

Table (2): Composition, chemical analysis and cell wall constituents of the concentrate feed mixtures.

Item	CFM_1	CFM_2	CFM_3
Composition (%)			
Yellow corn	60.00	45.00	30.00
Peel potato waste (PPW)	----	15.00	30.00
Soybean meal	20.00	20.00	20.00
Wheat bran	17.00	17.00	17.00
Limestone	1.50	1.50	1.50
Sodium Cholride	1.00	1.00	1.00
Vit. and mineral mixture*	0.50	0.50	0.50
Chemical analysis (%)			
Dry matter	89.02	89.22	89.41
Chemical analysis on DM basis			
Crude protein	16.87	17.67	18.47
Crude fiber	3.59	4.02	4.44
Ether extract	3.64	3.24	2.84
Nitrogen free extract	71.80	70.78	79.61
Ash	3.10	4.29	4.64
Cell wall constituents (%)			
NDF	34.14	35.39	36.65
ADF	24.28	21.86	19.44
ADL	3.34	3.59	3.84
Hemicellulose	9.86	13.53	17.21
Cellulose	20.94	18.27	15.60

* Each 3 kg vitamins and mineral mixture contains: Vit. A 12000000 IU, Vit. D3 2200000 IU, Vit. E 10,000 mg, Vit. K_3 2000 mg, Vit. B_1 1000 mg, Vit. B_2 5000 mg, Vit. B_6 1500 mg, Vit. B_{12} 10 mg, Pantothenic acid 10 mg, Niacin 30000 mg, Folic acid 1000 mg, Biotin 50 mg, Choline 300000 mg, Manganese 60000 mg, Zinc 50,000 mg, Copper 10000 mg, Iron 30000 mg, Iodine 100 mg, Selenium 100 mg, Cobalt 100 mg, CaCo3 to 3000 g.

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 group kids is presented in Table (5). The results showed that, replacement of yellow corn by PPW in growing kid rations at 25 and 50% from yellow corn in control ration lead to non significant incresing (P>0.05) in water intake which calculated as ml/h/day, ml/kg$W^{0.75}$, L/100 kg BW and L/kg DM intake, respectively.

Increasing level of replacing PPW in the diet gradually increased (P<0.05) water intake. Water intake values by the experimental group kids were 812, 851 and 941 ml / h /day for R_1, R_2 and R_3, respectively. Feeding kids on diets containing PPW increased (P>0.05) daily water intake by about 5% and 16% for R_2 and R_3 incomparison with R_1, respectively. On the other hand, daily water intake increased by 11% 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 peel potato waste. Effect of added peel potato waste in goat rations on water consumption needs more investigations. Holzer *et al.* (1975) reported that total water consumption increased as dietary moisture increased for 10 to 75%.

Table (3): Composition, chemical analysis, cell wall constituents and nutritive values of the experimental rations.

Item	Experimental rations		
	R_1	R_2	R_3
Composition (%) of the experimental rations			
Concentrate feed mixture	72.7	72.77	72.60
Peanut vines hay	27.73	27.23	27.40
Chemical analysis (%)			
Dry matter	89.72	89.86	90.00
Chemical analysis on DM basis			
Crude protein	16.47	16.50	16.93
Crude fiber	9.46	9.68	9.81
Ether extract	3.40	3.52	3.62
Nitrogen free extract	64.52	63.34	62.40
Ash	6.15	6.96	7.24
Cell wall constituents (%)			
NDF	37.79	38.63	39.57
ADF	26.56	24.76	23.03
ADL	4.01	4.18	4.37
Hemicellulose	11.23	13.87	16.54
Cellulose	22.55	20.58	18.66
Nutritve values			
TDN %	65.74	65.36	64.99
DCP %	10.41	10.63	10.85
GE (Mcal/kg DM)	4.322	4.294	4.294
DE (Mcal)	2.90	2.88	2.87

NDF= Neutral detergent fiber; ADF= Acid detergent fiber; ADL= Acid detergent lignin

Hemicellulose = NDF – ADF Cellulose = ADF - ADL

TDN(total digestible nutrient) and DCP (digestible crude protein) were calculated according to Abou – Raya (1967).

GE: Gross energy (kcal/kg DM) was calculated according to Blaxter (1986). Each g CP = 5.65 kcal, g EE = 9.40 kcal and g (CF & NFE) = 4.15 kcal.

Digestible energy: DE (M. cal) was calculated according to NRC (1975). Where

DE (Mcal) = TDN, kg * 0.004409

Table (4): Dry matter, energy and nutrient intakes by the experimental kids.

Item	Experimental rations			SEM
	R_1	R_2	R_3	
Av. Body weight, kg*	15.00	15.78	14.78	0.54
Metabolic body size**	7.62	7.92	7.54	0.20
Feed intake: g/day as				
CFM	477	489	485	13.03
Peanut viens hay	183	183	183	--
Dry matter:				
g/day	660	672	668	13.03
g/kgW $^{0.75}$	86.60	84.80	88.60	1.72
kg/100 kg BW	4.40	4.26	4.52	0.09
Gross energy:				
Mcal/day	2.85	2.89	2.87	0.05
Mcal/kg W $^{0.75}$	0.37	0.36	0.38	0.01
Mcal/100 kg BW	19.00	18.31	19.42	0.36
Digestible energy:				
Mcal/day	1.19	1.94	1.91	0.04
Mcal/kg W $^{0.75}$	0.25	0.24	0.25	0.01
Mcal/100 kg BW	12.74	12.30	12.93	0.25
Total digestible nutrient:				
g/day	434	439	434	8.51
g/kg W $^{0.75}$	56.96	55.43	57.56	1.12
kg/100 kg BW	2.89	2.78	2.94	0.06
Crude protein:				
g/day	109	111	113	4.24
g/kg W $^{0.75}$	14.30	14.02	14.99	0.30
g/100 kg BW	727	703	765	15.30
Digestible crude protein:				
g/day	69	71	72	1.49
g/kg W $^{0.75}$	9.06	8.96	9.55	0.19
g/100 kg BW	460	450	487	10.08

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

Rumen fermentation:

Rumen fluid parameter results are presented in Table (6). Feeding kids on PPW containing diets significatly increased ($P<0.05$) ruminal pH, and ruminal total volatile fatty acids (TVFA's) concentrations, while significantly decreased ($P>0.05$) ruminal ammonia nitrogen (NH_3–N) concentrations. Ruminal pH values ranged from 6.50 to 6.76, NH_3–N concentrations ranged fom 26.39 to 28.24 mg/dl and TVFA's ranged from 4.49 to 5.02 meq./dl. The reduction of ammonia–N in the rumen liquor appear to be the result of increased incorporation of ammonia–N into microbial protein and it was cosidered as a direct result to stimulated microbial activity. While, incresing TVFA's might be related to the more utilization of dietary energy and positive fermentation in the rumen. Addition of more fermentable carbohydrate to ruminant rations causes a decrease in rumen ammonia (Tagari *et al.,* 1964) propably due to a greater uptakc of ammonia by rumen microorganisms in support of enhanced microbial growth. However, the lower VFA's concentration and low densities ruminococus and cellulolytic bacteria of high potato rations contrasts with such an effect. Feeding Baladi goats on diets replaced 0,25,50 or 100% of concentrate feed mixture by potato waste had no significant effect on ruminal pH,Total VFA's and ammonia–N concentrations (Gado *et al.*,1998). Also, Onwubuemeli *et al.* (1985) found that Total VFA's concentrations were lower at higher intakes of potato waste and pH was increased. Intake of large quantities of fast fermentable carbohydrates such as starch and sugars and/or lackof physical structure of the feed cause a disturbance in the ecosystem. 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).

Sampling time was significant effect on rumen fluid parameters. Peel potato waste (PPW) containing diets significantly decreased ($P<0.05$) ruminal pH at 3 hrs post feeding compared with before feeding. However, it was significantly increased ($P<0.05$) NH_3-N and TVF's concentrations at 3 hrs post feeding compared with before feeding. These results were not agreement with those found by Onwubuemeli *et al.* (1985) who, studied the effect of sampling time at (0 hrs, 2hrs, 4hrs and 8hrs) on rumen fermentation of diets containing 0,10,20 and 30% potato processing waste (PPW) fed to dairy cattle. They suggested that, the higher percentages of dietary PPW decreased ($P<0.05$) rumen ammonia concentrations, which peaked 2 hrs post feeding. Also, the same authors observed that TVFA's concentration was decreased while, pH value was increased at 4 hrs post feeding.

No significant interaction was found between dietary treatments (PPW levels) and sampling time (PxS) on ruminal pH, but significant interaction (PxS) was observed for ruminal ammonia (NH_3–N) and total volatile fatty acids (TVFA's) concentrations (Table 7). Ruminal pH value, NH_3–N and TVFA's concentrations ranged from 6.17 to 7.00 ; 21.68 to 32.38 mg/dl and 3.07 to 6.83 meq./dl for ruminal pH, Nh_3–N and TVFA's, respectively. Radunz *et al.* (2003) noted that, there were no (time x treatment) interactions for any ruminal characteristics.

Table (5): Water intake by the experimental kids.

Item	Experimental rations			SEM
	R_1	R_2	R_3	
Av. Body weight, kg*	15.00	15.78	14.78	0.54
Metabolic body size**	7.62	7.92	7.54	0.20
Dry matter intake, g	660	672	668	13.03
Water intake as:				
ml/h/day	812	851	941	51.12
ml/kg $W^{0.75}$	107	107	125	6.66
L/100 kg BW	5.41	5.39	6.37	0.34
L/kg DM intake	1.230	1.266	1.409	0.08

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

Table (6): Mean effects of dietary treatments on rumen fluid parameters of the experimental group kids.

Item	Experimental rations			SEM	Sampling time		SEM
	R_1	R_2	R_3		Before feeding	3hrs post feeding	
pH	6.50^b	6.72^a	6.76^a	0.08	6.93^a	6.39^b	0.08
NH_3–N (mg/dl)	28.24^a	26.98^b	26.39^c	1.09	22.77^b	31.64^a	1.09
TVFA's (meq./dl)	4.49^b	4.59^b	5.02^a	0.36	3.31^b	6.08^a	0.36

a b and *c*: Means in the same raw witin each treatment having different superscripts differ significantly at level ($P<0.05$).
SEM = Standard error of the mean.

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

Item	Sampling time						SEM
	Before feeding			3 hrs. post feeding			
	R_1	R_2	R_3	R_1	R_2	R_3	
pH	6.83^a	6.97^a	7.00^a	6.17^c	6.47^b	6.53^b	0.08
NH_3–N (mg/dl)	24.09^d	22.50^e	21.68^f	32.38^a	31.82^b	31.10^c	1.09
TVFA's (meq./dl)	3.07^d	3.67^c	3.20^{cd}	5.90^b	5.50^b	6.83^a	0.36

a,b,c,d,e and *f* : Means in the same raw having different superscripts differ significantly at level ($P<0.05$).

Growth performance:

Growth performance of the experimental group kids is presented in Table (8). The results showed that, final weight, body weight gain, average daily gain (ADG), relative gain and feed efficiency (g.gain/g.intake) were not significant ($P>0.05$). However, PPW containing diet replaced 25% of yellow corn (R_2) tended to increase final weight, gain, ADG and feed efficiency which calculated as (g.gain/g.intake) of DM, TDN, CP and DCP in comparison with control diet (R_1) or PPW containing diet that replaced 50% of yellow corn (R_3). The values of average daily gain was 71, 87 and 68 g/day for R_1, R_2 and R_3, respectively.

Feeding kids on the experimental ration (R_2) improved ADG by 23% compared with the control diet (R_1) and by 28% incomparison with ration containing PPW replace 50% of yellow corn (R_3). While, R_3 decreased ADG by about 4% compared with the control diet (R_1).

Experimental kids that fed PPW containing diet which replaced 25% of yellow corn (R_2) improved feed efficiency (g.gain/g.intake) by 20% and 27% compared with R_1 and R_3, respectively. On the other hand, R_3 non significantly decreased ($P>0.05$) feed efficiency by 5.4% incomparison with the control ration (R_1). These results were agreement with those found by Makkar *et al.* (1984) who found that ADG and feed efficiency were better in buffalo calves fed 6 kg potato waste than control animals, also Buga *et al.* (1987) reported that steers fed 5 kg raw potatoes had higher ADG than control group. but steers fed 10 kg potatoes had the lowest ADG values. Morever, Bernes (1996) fed lactating goats 1.5 kg washed whole potatoes that cause mean milk yields 3.5 kg with potatoes and 3.2 without. Moreover goats given potatoes gained 13 g / day, whereas the other lost 12 g/day. Also, Nelson *et al.* (2000) reported increased ADG with a 10% addition of ensiled potato pieces in corn based diet with 7% roughage. While, Radunz *et al.* (2003) recorded that, increasing PPW decreased ADG and feed efficiency from 0 to 30% and then increased at 40% (quadratic;$P<0.01$) when they used potato processing waste (PPW) from frozen potato products industry in high–grain beef cattle finishing diets. Also, Sauter et al. (1980) noted a 17% decrease in ADG and 5% decrease in efficiency with inclusionof 50% potato by-product as compared with 25% potato by-product in barley–based diets. On the other hand, Duynisveld *et al.* (2004) attributed that, the replacement of corn with potato processing by–product (PPB) in beef cattle rations did not affect ($P>0.05$) average daily gain and improved ($P<0.05$) feed conversion efficiency.

Table (8): Growth performance of the experimental group kids

Item	Experimental rations			SEM
	R_1	R_2	R_3	
No. of kids	7	7	7	--
Initial weight, kg	11.250	11.200	11.200	0.34
Final weight, kg	18.750	20.350	18.350	0.80
Gain, kg	7.500	9.150	7.150	0.59
Experimental duration, days	105	105	105	---
ADG, g/day	71	87	68	5.61
Relative gain (% of initial weight)*	67	80	64	4.74
Feed intake, g:				
Dry matter	660	672	668	13.03
Total digestible nutrient	434	439	434	8.51
Crude protein	109	111	113	4.24
Digestible crude protein	69	71	72	1.49
Feed efficiency (g.gain /g.intake) of				
Dry matter	0.1076	0.1295	0.1018	0.008
Total digestible nutrient	0.1636	0.1982	0.1567	0.013
Crude protein	0.6514	0.7838	0.6018	0.051
Digestible crude protein	1.0290	1.2254	0.9444	0.079

* Relative gain (% of initial weight) = Gain /initial weight x 100.
SEM = 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 2006 for feeds and live body weight. Feeding costs and profit above feeding costs are shown in Table (9).

Feeding PPW containing diets rplaced yellow corn at 0% (R_1), 25% (R_2) and 50% (R_3). Total daily feeding costs of experimental rations was decreased by 10.4% for (R_2) while decreased by 23.4% for (R_3) in comparison with the control diet (R_1). Meanwhile, average daily gain, daily profit above feeding cost and relative economical efficiency for R_2 were better in comparison with the control diet (R_1) and the diet which rplaced yellow corn at 50% (R_3).

In this study feeding growing Baladi goats on PPW containing diets replaced yellow corn at 25% increased the average daily gain by 23% but ADG was decreased by 4.2%

when kids fed on PPW containing diet replaced 50% of yellow corn (R_3) compared to the control diet (R_1). Feeding kids on PPW replaced yellow corn caused net revenu equals 61.5% and 18.5% for R_2 and R_3, respectively compared with control diet (R_1).

Potato products can be economical substitute for grains (Shane Murphy, 1997).

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

Item	Experimental rations		
	R_1	R_2	R_3
Daily feed intake(air dried ingredients), kg of:			
Concentrate feed mixture (CFM), kg	0.536	0.548	0.542
Peanut vines hay (PVH), kg	0.200	0.200	0.200
Daily feeding cost (LE/d)*			
CFM	0.68	0.60	0.50
PVH	0.09	0.09	0.09
Total feeding cost	0.77	0.6+	0.59
Average daily gain, kg	0.071	0.087	0.068
Price of daily gain **	1.42	1.74	1.36
Daily profit above feeding cost (LE)	0.65	1.05	0.77
Relative economical efficiency, %	100	161.5	118.5

* Based on prices of year 2006.

** Price of one kg live body weight equals 20 LE (2006).

CONCLUSION

From this study, it is recommended for using peel potato waste (PPW) as a source of energy in goat rations instead of corn grain. Peel potato waste can be successfily fed to growing kids without any advers effect on performance and it can be economical substitute for grain. Optimal inculusion of PPW in goat rations may depend on the cost of transportation and other dietary ingredients.

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أداء النمو للماعز البلدية النامية المغذاه على علائق تحتوى مستويات مختلفة من مخلفات تقشير البطاطس المجففة شمسياً

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أستخدم فى هذه الدراسة إحدى وعشرون ذكر ماعز بلدى متوسط وزنها ١١,٢١٧ ± ٠,٣٤١ كجم والتى قسمت إلى ثلاثة مجاميع تجريبية متساوية تحتوى كل مجموعة سبعة جداء بهدف دراسة تأثير الإحلال الجزئى للذرة الصفراء بمخلفات تقشير البطاطس على أداء الماعز البلدية النامية وتم تكوين الثلاثة علائق التجريبية كما يلى:

العليقة الأولى(R1) : لم تحتوى على مخلفات تقشير البطاطس (عليقة الكنترول).

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

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

واستمرت تجربة التغذية لمدة ١٥ أسبوع (١٠٥ يوم) وغذيت المجاميع التجريبية طبقاً للمقرارات الغذائية للـ NRC بالإضافة إلى تقديم عرش الفول السودانى لكل الحيوانات التجريبية بمعدل (٢٠٠جم/رأس/يوم) وكانت نسبة العليقة المركزة:العليقة الخشنة (٧٢:٢٨٪) 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 تقشير البطاطس فى علائق الماعز النامية، كما لوحظ أن معدل الغذاء المأكول اليومى لمختلف المجاميع التجريبية كان فى نفس المدى تقريبا.
- أدت تغذية الجداء على العلائق المحتوية على مخلفات تقشير البطاطس إلى زيادة غير معنوية فى استهلاك ماء الشرب بمقدار ٥٪ للمجموعة الثانية ، ١٦٪ للمجموعة الثالثة مقارنة بمجموعة الكنترول فى حين لوحظ أن استهلاك ماء الشرب قد ذاد بمقدار ١١٪ للمجموعة الثالثة مقارنة بالمجموعة الثانية.
- أدت المعاملات الغذائية إلى زيادة معنوية (عند مستوى ٠,٠٥) فى تركيز درجة الحموضة pH

والأحماض الدهنية الطيارة الكلية TVFA's لسائل الكرش ولكنها أدت إلى انخفاض معنوى عند نفس المستوى فى تركيز أمونيا سائل الكرش.

- تأثرت قياسات التخمرات فى سائل الكرش بزمن أخذ العينات ، فقد لوحظ ان أخذ العينات بعد ٣ ساعات بعد تقديم الغذاء قد أدى إلى انخفاض معنوى (عند مستوى ٠.٠٥) لدرجة الحموضة pH فى حين أدى إلى زيادة معنوية عند نفس المستوى فى تركيز ,NH_3-N الأمونيا والأحماض الدهنية الطيارة الكلية TVFA's لسائل الكرش.
- لم يلاحظ تأثير للتداخل بين المعاملات الغذائية وزمن أخذ العينات (PxS) على درجة حموضة سائل الكرش ولكن لوحظ تأثير للتداخل على تركيز الأمونيا والأحماض الدهنية الطيارة الكلية فى سائل الكرش.
- تحسن معدل النمو اليومى بمقدار ٢٣٪ عند استبدال ٢٥٪ من الذرة الصفراء فى عليقة الكنترول بمخلفات تقشير البطاطس (المجموعة الثانية) قابله انخفاض فى معدل النمو اليومى بمقدار ٤٪ عند استبدال ٥٠٪ من الذرة الصفراء فى عليقة الكنترول بمخلفات تقشير البطاطس (المجموعة الثالثة).
- تحسنت الكفاءة الغذائية للمجموعة الثانية بمقدار ٢٠٪ وبمقدار ٢٧٪ للمجموعة الثالثة مقارنة بمجموعة الكنترول.
- تحسن العائد الأقتصادى بمقدار ٦١.٥٪، ١٨.٥٪ للمجموعة الثانية والثالثة على التوالى مقارنة بمجموعة الكنترول.
- وتشير النتائج بصفة عامة إلى أن استبدال الذرة الصفراء بمخلفات تقشير البطاطس فى علائق الماعز النامية قد أدت إلى تحسين فى معدل النمو اليومى والكفاءة الغذائية كما أدت إلى خفض التكلفة الغذائية وبالتالى تحسين الكفاءة الأقتصادية.