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EFFECT OF UREATED SUGAR BEET PULP ON LACTATING GOAT PERFORMANCE

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ABSTRACT

Forty female Barki goat does were used to investigate the effect of inclusion of sugar beet pulp (SBP) treated with urea at levels of 2, 4 and 6% urea to replace about 30% of common concentrate feed mixture in the diet of goats on lactating goat performance, milk yield and composition, birth and weaning weight. Five experimental diets were formulated: T1 (control): concentrate feed mixture (CFM)+ berseem hay (BH), T2: CFM + untreated SBP+BH, T3: CFM+SBP treated with 2% urea on DM basis+ BH, T4: CFM + SBP treated with 4% urea on DM basis+ BH and T5: CFM + SBP treated with 6% urea on DM basis+ BH. The experiment feeding period lasted for 140 days. At the end of lactation stage a digestibility trial was carried out to study the effect of the experimental diets on digestibility coefficients, rumen parameters, microbial protein, protozoal count, and blood constituents. The obtained results revealed that T5, T4 and T3 increased (P≤0.05) DM, OM, EE, NFE and CP contents, and decreased ash, CF, NDF, ADF, DAL, cellulose and hemicellulose contents as compared to T2 and T1. Urea treatments of SBP increased (P≤0.05) body weight and feed intake. T4 and T5 had the highest (P≤0.05) DM, OM, EE, CP, CF, NFE, NDF, ADF, ADL, cellulose and hemicellulose digestibility coefficients as well as the highest (P≤0.05) TDN and DCP intakes. T4, T5 and T3 improved (P<0.05) nitrogen balance, water balance, rumen fermentations, rumen protozoal count, milk yield and composition, birth and weaning weight. The present study suggests the replacement of dried sugar beet pulp treated with 4% urea by a part of common concentrate feed mixture of lactating goats.

Keywords: Sugar beet pulp, urea treatment, lactating goats, blood, kid performance.

INTRODUCTION

In Egypt there is a gap in animal requirements and the available feeds, so there is an urgent need to search for more available non-conventional and cheaper feed sources, particularly agricultural by-products as sugar beet pulp (SBP). The major limitations of using these agricultural residues as feed are its low palatability, low digestibility, low protein and high fiber content (El-Ashry *et al*. 2003). SBP is a solid vegetable matter that remains after sugar extraction from sliced sugar beets, which has been estimated to comprise 6% dry matter (DM) of the weight of beet root (Talha *et al*. 2002). This by-product has a high content of crude fiber (CF, 17–22%) and low content of crude protein (CP, 8-11%) as reported by Papadomichelakis *et al*. (2004). Although its crude fiber content is high, its digestion coefficient is acceptable due to its low lignin content (El-Ashry *et al*. 2000). Consequently, SBP was considered as an energy source in mixed rations of dairy cattle and sheep (El-Badawi *et al*. 2003; Sherien 2005).

Large areas of several developing countries are cultivated by sugar beets. Therefore, there are huge amounts of SBP without beneficial usage

and might be considered as a byproduct. However, if these poor quality by-products were utilized by improving their digestibility and nutritive value, it might solve part of feed-shortage problems in such countries. Chemical and biological treatments have been tested by various researchers to increase the nutritive value, palatability, DM intake, protein content, and the digestibility of poor quality roughages (Aziz *et al*. 2008; Omer *et al*. 2012). Several chemical treatments including urea treatments aimed to disrupt the lignin carbohydrate complex which has been tested in attempts to improve the accessibility of structural carbohydrates to celluloytic microorganisms; chemical pretreatment appeared to improve more particularly the digestibility of the hemicellulose fraction (Aziz 2009).

The aim of this study was to improve the nutrient value of SBP using chemical treatments (2, 4 and 6% urea) to replace a part of concentrates. Also, the effect of treatments on digestibility, rumen fermentations, ruminal protozoa count, milk yield and composition, blood parameters and performance of lactating goats and their kids were evaluated.

MATERIALS AND METHODS

The field experiments were carried out at Goat Research Unit of the Department of Animal Production at El-Noubaria Experimental Farm, National Research Centre, Noubaria, Egypt.

Five experimental diets were formulated as follow:

T1: Concentrate feed mixture (CFM) + berseem hay (BH) as control diet,
T2: CFM + untreated SBP + BH, T3: CFM + SBP treated with 2% urea on DM basis+ BH, T4: CFM + SBP treated with 4% urea on DM basis + BH and T5: CFM + SBP treated with 6% urea on DM basis+ BH.

The concentrate to roughage ratio was 70: 30%; the ratio of SBP was 30% of CFM.

The experiment lasted for 140 days (one month before kidding and three months as lactation and weaning period). Forty female Barki goat does (about 4 years old and weighing 41±1.5 kg) at the fifth month of pregnancy were randomly divided into five groups of 8 heads in each. Does were fed on the experimental diets for a month before kidding, and after kidding goats were weighed as the initial body weight (31±1.7 kg**)** and fed in the same diets till the end of lactation stage. Goat does were fed their daily diet according to average body weight, which was adjusted continuously every two weeks according to Kearl (1982). The concentrate and roughage were offered twice daily at 7 a.m. and 1 p.m. The offered and the refusals were weighed daily and the goats were weighed every two weeks. Fresh water had excess to the goats twice daily at 7 a.m. and 1 p.m.

At the end of lactation stage, a digestibility trial was carried out to study the effect of feeding the experimental rations on digestibility coefficients, rumen parameters, microbial protein, protozoal count, and some blood costituents. Four does from each group were placed in metabolic cages, weighed at the start and the end of the trial. The trial lasted for 20 days from which the first 15 days were considered as an adaptation and preliminary

period, followed by 5 days as collection period. Over the collection period, daily amount of feed consumed, residuals, feces, urine and drinking water were estimated for each doe, and samples of ruminal liquor and blood were taken.

Urea treatment:

Air-dried SBP was moistened for 40% DM and sprayed with urea solution at levels of 2, 4 and 6% plus 10% molasses from the dry matter then it mixed well and placed in plastic light bags (1.2 m x 0.8 m and 0.4 mm thickness) with capacity of about 50 kg. Each bag was pressed well, covered well by heavy stones and kept closed for 21 days. Thereafter, the bags were shuffled upside-down and mixed well every day to dry in the sun and become acceptable for animals.

Proximate analysis:

The proximate analysis of ration samples was carried out according to the A.O.A.C. (1990) to determine contents of DM, CP, CF and EE. While, NFE content was obtained by the difference. However, NDF, ADF and ADL contents were determined according to the procedures of Van Soest *et al*. (1991). Cellulose and hemicelluloses were calculated by the difference between NDF and ADF for hemicelluloses, ADF and ADL for cellulose.

Rumen liquor parameters:

Rumen liquor samples were obtained at 0, 3 and 6 hours post-feeding. Ruminal pH value was immediately measured with pH meter, while concentrations of ammonia nitrogen, total nitrogen and non-protein nitrogen were determined by the modified semi-micro-kjeldahl digestion method according to A.O.A.C (1990). Concentration of true protein nitrogen was calculated by subtracting. Concentration of total volatile fatty acids (TVFAs) was determined according to Warner (1964). Ruminal microbial protein was estimated as described by Makkar *et al*. (1982).

For classification and determination of ruminal ciliated protozoal count, the filtered rumen liquor were collected at 0, 3 and 6 hours post feeding and stained with 4 times volume of methyl-green formalin saline solution as described by Ogimoto and Imai (1981), then stoked in dark place until examination. After gentle mixing of fixed rumen liquor samples, one drop was poured on hemocytometer slide, covered with a cover slip and examined under a light microscope for identification of genera and species of microorganisms according to the description published by Dehority (1993).

Sampling of blood:

Goats from each treatment were used to obtain 12 ml blood from the jugular vein at zero and 4 hours post-feeding. Blood samples of lambs were left to coagulate at room temperature, then centrifuged at 4000 rpm for 15 min to separate serum and kept it frozen at -20ºC till analyses of concentrations of total proteins (determined by using electronic apparatus), albumin (Doumas and Biggs,1971), globulin (was obtained by subtracting) and urea (Patton and Crouch, 1977). Activity of aspartate aminotransferase (AST) and alanin aminotransferase (ALT) was determined according to Reitman and Frankel (1957).

Sampling and analysis of milk:

Goats were milked twice a day at 8.00 a.m. and 5.00 p.m. during the last three days of each month of lactation period. Milk samples were immediately collected from each animal after morning and evening milkings and milk yield was recorded**.** The sample of each animal represented a mixed sample of constant percentage of the morning and evening yield. Milk samples were analyzed for total solids (TS), fat, total protein (TP), lactose and ash by Bentley 150 infrared milk analyzer (Bentley Instruments, Chaska**,** MN, USA) according to A.O.A.C. (1990) procedures. Solids-not-fat (SNF) was calculated by subtracting fat from total solids percentage. Fat corrected milk (4% fat) was calculated by using the following equation according to Gaines (1928):

FCM = 0.4 M+ 15 F, *Where: M= milk yield (g) and F= fat yield (g).*

Statistical analysis:

Data was statistically analyzed according to statistical analysis system of (SAS, 2000). Data of digestibility coefficients, nitrogen balance and water balance were analyzed by one-way analysis and the model was:

$$Y_{ij} = M + T_i + e_{ij}$$

The used design for rumen fermentations, blood samples, body weight, feed intake and milk yield and composition was two-way analysis and the following model was used:

$$Y_{ij} = \mu + T_i + I_j + T_{Iij} + e_{ij}$$

Where: Y_{ij} = experimental observation, μ = general mean, T_i = effect of experimental diet (i =1:5), I_j = effect of sampling time (j=0, 3 and 6 or 0 and 4), T_{Iij} = effect of interaction of experimental diet and sampling time, and e_{ij} = experimental error.

Separation among means was carried out by using Duncan's multiple test (Duncan, 1955). The overall level for statistical significance was set at $P \leq 0.05$. All values were expressed as statistical means ± standard error of means (SEM)

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RESULTS AND DISCUSSION

Chemical composition and cell wall constituents:

Data represented in Table (1) showed that SBP treated with urea (T3, T4 and T5) enhanced chemical composition and cell wall constituents more than untreated SBP and control. Experimental treatments including T5, T4 and T3 increased DM, EE, NFE and CP contents more than untreated diet (T2). While, the same diets had less Ash, CF, NDF, ADF, ADL, cellulose and hemicellulose contents as compared to untreated diet, except for T4 and T2, which had almost similar contents of cellulose. In addition, urea treatments increased DM, Ash and CP contents as compared to control diet (T1), although, T1 had higher values of OM, EE, CF and NFE more than urea treated diets and untreated diet (T2). Also, T1 had less NDF, ADF, ADL, cellulose and hemicellulose contents as compared to treated and untreated diets.

It is clear that SBP treated with 4 and 6 % urea (T4 and T5) had almost similar chemical composition and cell wall constituents, but treated diets with 4 and 6% urea (T4 and T5, respectively) were better than that treated with 2% urea (T3) in all nutrient percentage.

Results of untreated SBP are in agreement with the results reported by Saleh *et al*. (2001), Talha *et al*. (2002), Abedo *et al*. (2005) and Aziz (2014). Regarding the chemical composition, the increased CF content in untreated diet through partial replacement of CFM by SBP could be attributed to the high content of CF in SBP (17–22%) (Papadomichelakis *et al*. 2004).

Similar results were obtained by Singh *et al*. (1990), who treated wheat straw by 4% urea solution and reported a decreases in CF, NDF, ADF, hemicellulose and lignin contents in urea treated wheat straw. Mohamed (1998) and Koening and Beauchemin (2005) reported that urea supplementation in diets increased CP content and digestibility. Also, Aziz (2009) found that olive tree byproducts treated with 4% urea increased DM, OM, EE and CP contents and decreased CF, NDF, ADF, DAL, cellulose and hemicellulose contents as compared to control group in sheep. Elkholy *et al*. (2009) observed an elevation in CP and reduction in CF, ADF, and NDF contents in corn crop residues treated with 4% urea. Moreover, Okab *et al*. (2012) reported that OM, EE, CF, NDF, ADF, DAL, cellulose and hemicellulose contents were improved in ration containing 50% CFM+50% SPB treated with 4% urea as compared to untreated and control diets.

Table (1): Effect of urea treatments on chemical composition of the experimental diet.

Item	Experimental diet					Feedstuff		
	T1	T2	T3	T4	T5	CFM	Hay	USBP
DM (%)	92.28	89.04	91.5	93.24	93.45	93.60	90.9	90.88
Chemical composition (%):								
OM	92.03	88.73	89.70	91.10	91.26	92.1	88.08	95.36
Ash	7.97	11.27	10.3	8.90	8.74	7.90	11.92	4.64
EE	3.15	2.16	2.55	2.78	2.79	3.12	2.45	1.30
CP	12.20	10.87	13.40	17.00	17.16	12.42	13.78	9.18
CF	14.39	17.91	13.74	12.60	12.48	11.56	24.90	24.64
NFE	62.29	57.79	60.01	58.72	58.83	65.00	46.95	60.24
Cell wall constituents (%):								
NDF	30.98	47.54	43.63	41.54	41.47	31.14	63.29	60.39
ADF	17.82	24.16	22.82	20.05	19.97	17.84	44.79	28.92
ADL	4.87	4.15	3.88	3.20	3.13	5.00	7.27	2.78
Cellulose	13.16	23.38	20.81	23.58	21.50	13.30	18.50	31.47
Hemicell.*	12.95	20.01	18.94	16.85	16.84	12.84	37.52	26.14

T1 (control): Concentrate feed mixture (CFM) + Berseem hay (BH).
T2: CFM + untreated SBP + BH.
T3: CFM + SBP treated with 2% urea on DM basis+ BH.
T4: CFM + SBP treated with 4% urea on DM basis + BH.
T5: CFM + SBP treated with 6% urea on DM basis + BH.
USBP: Untreated SBP. Hemicell.* : Hemicellulose.

Goat performance during kidding:

Data in Table (2) indicated similarity in kidding rate without abortion or stillbirth cases in all groups. Also, number of born kids and twining cases without mortality cases were found after birth in goat kids of all groups.

Table (2): Effect of experimental diet on goat performance during kidding.

Item	Experimental diet				
	T1	T2	T3	T4	T5
Lambing rate (%)	100	100	100	100	100
Number of kids	9	9	9	9	9
Twining rate (%)	12.5	12.5	12.5	12.5	12.5
Mortality	0	0	0	0	0

Body weight and feed intake of does during lactation:

Data in Table (3) showed significant (P≤0.05) effect of the experimental diet on live body weight of goat does, being higher (P≤0.05)in goat group fed SBP treated with 2, 4 and 6% (T4 and T5) as compared to those fed untreated diet (T2) during early, mid and late lactation stages. In this respect, goats fed T4 and T5 showed significantly (P≤0.05) the highest live body weight with insignificant differences between them. Overall mean of live body weight during all lactation stages was had the same trend Overall mean of live body weight increased (P≤0.05) by progressed time of lactation stages in all groups. Data of body weight change during lactation stages indicated that urea treatments (T4 and T5) showed the highest (P≤0.05) live body weight, followed by control group then untreated group, although the difference between T3 and control group was not significant (P≤0.05), also the difference between control and untreated group was not significant.

The increment in body weight might be related to the reported efficient anaerobic rumen fermentation (Mohamed and Abou-Zeina 2008).This result was supported by the results of Aziz (2009), who demonstrated that the greatest body weight change was produced in sheep fed on olive tree byproducts treated with 4% urea compared to control group.

Data in Table (3) indicated significant (P≤0.05) difference in feed intake as g/h/d, g/kg BW and g/kg $BW^{0.75}$), being higher in goats fed urea treated diets than untreated and control diet. At early lactation stage, T3 and T5 had significantly (P≤0.05) increased feed intake (g/h/d) with no significant difference, followed by T4 and control group with no significant (P≤0.05) difference, while T2 had the lowest (P≤0.05) value. At mid lactation stage, T5 had the highest (P≤0.05) value (g/h/d), while the difference among T4, control, T3 and T2 was not significant (P≤0.05). At late lactation stage, T5 was the highest (P≤0.05), followed by T4 and T3, then control and T2, although, the differences were insignificant among T5, T4 and T3 or among T4, T3, T1 and T2.

Overall mean of feed intake showed that T3 had the highest values (g/h/d, g/kg BW and g/ kg $BW^{0.75}$) followed by T5, T4, T1 then T2. Overall mean of feed intake at lactation stages indicated significant (P≤0.05) increase

by progressed stage of lactation. Increasing feed intake may be due to good palatability of urea treated SBP.

The present results were supported by Salman *et al*. (1998), who reported that feed intake significantly (P<0.05) increased by two urea ensiling methods (wet or dried) for corn stalks ration. Also, Galina *et al*. (2004) fed goat kids on corn stubble and alfalfa hay treated with 5% urea, they found that feed intake was increased in treated groups. Aziz (2009) indicated that feed intake was increased in sheep fed on olive tree by-products treated with 4% urea as compared to control group. Moreover, Okab *et al*. (2012) showed that daily feed intake was decreased (P<0.05) in lambs fed on the diet containing untreated SBP as compared to those fed on diet contained SBP treated with 4% urea and control diets. In this way, several studies found an increase in DM intake from sugar beet replacement (Olfaz *et al*. 2005; Omer *et al*. 2013).

Table (3): Effect of experimental diet on body weight and feed intake during lactation period.

Item	Experimental diet					±SEM	Overall mean
	T1	T2	T3	T4	T5		
Live body weight (LBW, kg):							
Early lactation	31.50^{b}	30.83^{c}	31.31^{b}	32.11^{a}	32.20^{a}	0.116	31.59^{c}±0.051
Mid lactation	32.27^{b}	31.75^{c}	32.33^{b}	33.31^{a}	33.27^{a}	0.116	32.59^{b}±0.051
Late lactation	33.53^{b}	32.71^{c}	33.50^{b}	35.15^{a}	35.12^{a}	0.116	34.00^{a}±0.051
Overall mean	32.43^{b}	31.76^{c}	32.38^{b}	33.52^{a}	33.53^{a}	0.067	-
Change in LBW	2.03^{bc}	1.90^{c}	2.21^{b}	3.01^{a}	3.02^{a}	0.096	-
Feed intake (g/h/d):							
Early lactation	293.9^{b}	236.3^{c}	353.4^{a}	277.4^{b}	1319.2^{a}	7.376	296.0^{c}±3.299
Mid lactation	386.4^{b}	375.8^{b}	392.4^{b}	378.4^{b}	1457.2^{a}	7.376	398.0^{b}±3.299
Late lactation	473.6^{b}	465.0^{b}	490.9^{ab}	480.1^{ab}	1502.0^{a}	7.376	482.3^{a}±3.299
Overall mean	384.6^{c}	359.0^{c}	412.3^{a}	378.6^{b}	1426.1^{a}	.259	-
Feed intake (g/kg LBW):							
Early lactation	41.09^{b}	40.10^{c}	43.22^{a}	39.78^{c}	40.97^{b}	0.252	41.03^{c}±0.112
Mid lactation	42.97^{c}	43.33^{b}	43.06^{b}	41.36^{d}	43.80^{a}	0.252	42.90^{b}±0.112
Late lactation	43.96^{c}	44.79^{a}	44.50^{b}	42.11^{e}	42.77^{d}	0.252	43.63^{a}±0.112
Overall mean	42.67^{b}	42.74^{b}	43.59^{a}	41.09^{c}	42.51^{b}	0.145	-
Feed intake (g/ kg $BW^{0.75}$):							
Early lactation	97.86^{b}	94.65^{c}	102.12^{a}	94.70^{c}	97.61^{b}	0.581	97.39^{c}±0.260
Mid lactation	102.97^{b}	102.94^{b}	102.31^{b}	99.21^{c}	105.19^{a}	0.581	102.53^{b}±0.260
Late lactation	106.44^{b}	107.06^{a}	106.67^{b}	102.57^{d}	104.11^{c}	0.581	105.37^{a}±0.260
Overall mean	102.42^{a}	101.55^{b}	103.70^{a}	98.83^{c}	102.30^{a}	0.335	-

Means with different litters within each row or column are significantly different (P≤0.05).

Digestibility coefficients and nutritive values:

Data in Table (4) indicated that urea treatments (T4 and T5) significantly (P<0.05) increased body weight and feed intake of goats as compared to untreated and control groups, followed by T3 and T1 then T2, although the difference between T3 and control group was not significant

(P≤0.05) for body weight. Also, the differences among T4, T3, T1 and T2 were not significant (P≤0.05) for feed intake.

Data in Table (4) indicated significant (P≤0.05) effect of urea treatment on digestibility coefficients of all nutrients and fiber fractions, being significantly (P<0.05) higher for all urea treated diets (T3-T5) than control and USBP diets. However, USBP diet showed significantly (P<0.05) lower digestibility coefficients and fiber fractions than the control diet. T4 and T5 had the highest values with no significant difference followed by T3, while the lowest digestibility coefficients were for untreated SBP then control group. There was no significant (P≤0.05) difference among control and T2 in digestibility coefficient of CP and cellulose. This result indicated that rations containing untreated or ureated SBP had digestibility coefficients in rumen better or near to the digestibility coefficients of ration containing only concentrate feed mixture, this means that partial replacement of concentrate by SBP had good benefits.

Higher nutrients digestibility as a result of urea treatment may be related to the microbial activities which solubilizing carbohydrate esters of phenolic monomers in the cell wall (Khampa *et al*. 2009). The high water holding capacity of dry SBP due to the existence of pectic substances, methyl and carboxyl groups in its molecular structure might be the reason of its better digestion (El-Badawi and El-Kady, 2006). Hall *et al*. (1998) recorded that SBP has a relatively high content of soluble and insoluble NDF, but it can be considered an energy concentrate because both soluble and insoluble NDF are highly digestible. Moreover, Nianogo *et al*. (1997) observed an increase in DM intake and OM digestibility of urea treated rice straw; it is attributed to the chemical changes, which are related to the breaking of the lignin-polysaccharide links, which favors the release of digestible components.

Data in Table (4) showed significant (P≤0.05) effect of the experimental diet on nutritive values. Nutritive value as TDN (g/h/d) was higher in T5 than in other treatments, followed by T4 then control and T3, while the lowest (P≤0.05) value was for untreated group. Nutritive value as TDN (g/kg BW, g/kg $BW^{0.75}$ and % of DMI) had no significant (P≤0.05) differences among T5, T4 and control group, T3 came in the second class, while T2 had the lowest (P≤0.05) values.

Also, urea treatments significantly (P≤0.05) increased the values of DCP (g/h/d, g/kg BW, g/kg $BW^{0.75}$ and % of DMI) more than control and untreated SBP, T5 had the highest (P≤0.05) values of DCP (g/h/d, g/kg BW and g/kg $BW^{0.75}$) followed by T4 then T3, while, T2 had the lowest (P≤0.05) values followed by control (T1). It seems that T4 came in the first class for DCP % of DMI followed by T5.

Table (4): Effect of experimental diet on nutrient digestibility and nutritive value of the experimental rations.

Item	Experimental diet					±SEM
	T1	T2	T3	T4	T5	
Number of animals	4	4	4	4	4	-
Live body weight (kg)	34.03^{b}	33.35^{c}	34.00^{b}	35.65^{a}	35.63^{a}	0.084
Fee intake (g/h/d)	1473.58^{b}	1465.02^{b}	1490.92^{ab}	1480.11^{ab}	1502.02^{a}	7.376
Digestibility coefficient (%):						
DM	79.17^{c}	78.04^{d}	82.84^{b}	86.41^{a}	85.81^{a}	0.349
OM	80.05^{c}	78.97^{d}	83.13^{b}	87.03^{a}	86.79^{a}	0.193
EE	87.50^{c}	86.34^{d}	88.04^{b}	89.80^{a}	89.77^{a}	0.320
CP	79.32^{c}	79.07^{c}	80.95^{b}	84.73^{a}	84.69^{a}	0.230
CF	68.28^{c}	67.38^{d}	71.76^{b}	76.34^{a}	76.24^{a}	0.541
NFE	83.13^{c}	82.45^{d}	84.04^{b}	85.89^{a}	85.56^{a}	0.219
Fiber fractions:						
NDF	74.03^{c}	71.86^{d}	77.64^{b}	79.92^{a}	79.13^{a}	0.343
ADF	62.27^{c}	60.78^{d}	66.81^{b}	70.42^{a}	69.66^{a}	0.333
ADL	56.58^{c}	53.76^{d}	61.89^{b}	65.75^{a}	65.36^{a}	0.265
Cellulose	67.97^{c}	67.09^{c}	71.33^{b}	75.46^{a}	75.13^{a}	0.346
Hemicellulose	78.36^{c}	77.10^{d}	81.34^{b}	85.32^{a}	85.13^{a}	0.329
Nutritive value:						
TDN g/h/d	1259.58^{c}	1124.72^{e}	1212.37^{d}	1263.30^{b}	1268.03^{a}	0.232
TDN g/kg BW	34.28^{a}	30.85^{c}	33.33^{b}	34.44^{a}	34.78^{a}	0.230
TDN g/kg $BW^{0.75}$	84.40^{a}	75.81^{c}	81.87^{b}	84.76^{a}	85.47^{a}	0.425
TDN % of DMI	88.52^{a}	81.41^{c}	84.99^{b}	88.18^{a}	88.18^{a}	0.117
DCP g/h/d	127.38^{d}	106.20^{e}	141.60^{c}	192.41^{b}	194.51^{a}	0.024
DCP g/kg BW	3.46^{d}	2.91^{e}	3.89^{c}	5.24^{b}	5.33^{a}	0.026
DCP g/kg $BW^{0.75}$	8.53^{d}	7.16^{e}	9.56^{c}	12.91^{b}	13.11^{a}	0.047
DCP % of DMI	79.32^{d}	79.08^{e}	80.96^{c}	84.73^{a}	84.69^{b}	0.021

Means with different litters within each row are significantly different (P≤0.05).

Based on the foregoing results, urea treatments especially T5 and T4 increased TDN values more than control and untreated group, while the three urea treatments increased DCP values. These results reflected the values of nutrient digestibility for rations which indicated that urea treatments were more efficient in digestibility of nutrients compared with control and untreated SBP as that the improvement in nutritive values are associated with the increased digestion of fibrous materials and bacterial digestion of cell wall content (Hassan *et al*. 2005).

Similar results were obtained by Aziz (2009), who demonstrated an increase in digestibility coefficients of DM, OM, EE, CP, CF, NDF, ADF, DAL, cellulose and hemicellulose and an increase in TDN and DCP intake in sheep fed on olive tree byproducts treated with 4% urea compared to control and untreated group. Also, Salman *et al*. (2011) showed that 3% urea treatment of sugarcane had increased DM, CP, EE, and ash, while, decreased OM, CF and NFE.

Moreover, Okab *et al*. (2012) found that digestibility coefficients of CP, CF, and EE were decreased (P<0.05) in untreated compared to control diet. Although, the inclusion of treated SBP with 4% urea in the diet of sheep increased the digestibility coefficients of DM, OM and CP in comparison with control diet. However, CF digestibility coefficient was reduced (P<0.05) as compared to control diet. Also, they found that treated SBP diets increased (P<0.05) TDN and DCP intake as compared to untreated and control diets. On the other hand, El-Badawi and El-Kady (2006) noted that digestibility of CP and EE were decreased, while, CF digestibility was extremely higher in sheep fed ration containing 50% SBP sprayed with urea solution 30 g/kg SBP to compare traditional feed mixture. Nutritive value expressed in terms of TDN was higher by about 5% for the 50% ureated SBP more than control. Also, Omer *et al*. (2013) showed that inclusion of SBP in sheep ration insignificantly (P<0.05) improved DM and OM digestibilities, while, it significantly (P<0.05) increased CF digestibility, but, it significantly (P<0.05) decreased EE digestibility. Dietary treatment had no effect on nutritive values (TDN and DCP).

Nitrogen balance:

Data in Table (5) showed that urea treatments (T3, T4 and T5) increased (P≤0.05) nitrogen intake values (g/h/d, g/kg BW and g/kg $BW^{0.75}$) more than control and USBP groups. T5 had the highest (P≤0.05) values, followed by T4 then T3, while the lowest (P≤0.05) values were for untreated group (T2) then and control.

Urea treatments significantly (P≤0.05) increased fecal nitrogen excretion, T5 had the highest (P≤0.05) values of fecal nitrogen excretion (g/h/d, g/kg $BW^{0.75}$ and % of NI), followed by T4 then T3, while the lowest (P≤0.05) value was for untreated group (T2). No significant difference was found among T5, T4, T3 and T1 in values of fecal nitrogen excretion (g/kg BW).

Urinary nitrogen excretion was differed from fecal N, untreated and control groups increased (P≤0.05) urinary N (g/h/d, g/kg BW, g/kg $BW^{0.75}$ and % of NI) more than urea treatments, although, the difference between T1 and T2 except for values of urinary N % of N intake (NI). T4 had the lowest (P≤0.05) values followed by T5 then T3, although the difference between T4 and T5 was not significant (P≤0.05). Total nitrogen excretion values were the same trend of urinary N as that untreated and control groups (T2 and T1) had the highest (P≤0.05) values of (g/h/d, g/kg BW, g/kg $BW^{0.75}$ and % of NI) with no significant (P≤0.05) except for values of total N excretion % of NI, while urea treatments especially T4 had the lowest values followed by T5 then T3, although the difference among the three treatments was not significant (P≤0.05).

It is clear that urea treatments decreased total N excretion, but, it increased (P≤0.05) nitrogen balance (g/h/d, g/kg BW, g/kg $BW^{0.75}$,% of NI and % of DN) more than untreated and control groups, T4 had the highest (P≤0.05) values followed by T5 then T3, although the difference between T4 and T5 was not significant (P≤0.05), while untreated group(T2) had the lowest (P≤0.05) nitrogen balance values followed by control group (T1). It seems that urea treatments for SBP increased (P≤0.05) nitrogen balance by 12.74- 22.03

% of N intake more than untreated SBP, and by 6.62- 16.18 % of N intake more than control.

The superiority in N balance by feeding urea treated SBP might be due to the higher improvement of its OM and CP digestibility or due to the higher utilization of urea N and thus lower total nitrogen excretion or might be related to higher improvement in rumen fermentation.

Similar results were obtained by Mohamed *et al*. (1998) who indicated that N-balance of ureated rice straw (4% urea) had significantly (P<0.05) the highest value than untreated and ammoniated rice straw. El-Badawi *et al*. (2003) found that dietary nitrogen utilization (%N-balance of N-intake) was obviously higher (P<0.05) with feed mixtures containing 50 and 75% SBP. Aziz (2009) demonstrated that the greatest nitrogen balance was produced in sheep fed on olive tree by-products treated with 4% urea compared to control group. Also, Okab *et al*. (2012) reported that total N excretion was increased (P<0.05) in untreated SBP and control diets, while, N balance was greater (P<0.05) in diets containing 50% SBP treated with 4% urea compared to control and untreated diets. Moreover, Omer *et al*. (2013) indicated that N balance expressed as relative to N-Intake or digestible-N was significantly P<0.05) improved with lower (P<0.05) urinary N loss for sheep fed SBP feed mixture.

Table (5): Nitrogen balance for goat groups affected by experimental diet.

Balance	Item	Experimental diet					±SEM
		T1	T2	T3	T4	T5	
Nitrogen intake	g/h/d	25.70^{d}	21.49^{e}	27.98^{c}	36.33^{b}	36.75^{a}	0.005
	g/kg BW	0.700^{d}	0.592^{e}	0.767^{c}	0.992^{b}	1.010^{a}	0.005
	g/ kg $BW^{0.75}$	1.72^{d}	1.44^{e}	1.89^{c}	2.44^{b}	2.47^{a}	0.009
Fecal nitrogen	g/h/d	5.32^{d}	4.50^{e}	5.33^{c}	5.55^{b}	5.62^{a}	0.001
	g/kg BW	0.145^{a}	0.120^{b}	0.147^{a}	0.150^{a}	0.150^{a}	0.002
	g/ kg $BW^{0.75}$	0.355^{d}	0.302^{e}	0.362^{c}	0.370^{b}	0.380^{a}	0.002
	% of N intake	20.68^{d}	20.92^{e}	19.04^{c}	15.27^{b}	15.31^{a}	0.003
Urinary nitrogen	g/h/d	6.39^{a}	6.55^{a}	5.56^{b}	5.12^{c}	5.26^{c}	0.090
	g/kg BW	0.175^{a}	0.180^{a}	0.152^{b}	0.140^{c}	0.142^{c}	0.003
	g/ kg $BW^{0.75}$	0.427^{a}	0.440^{a}	0.375^{b}	0.345^{c}	0.355^{bc}	0.007
	% of N intake	24.86^{b}	30.48^{a}	19.89^{c}	14.11^{d}	14.31^{d}	0.311
Total N excretion	g/h/d	11.71^{a}	11.05^{b}	10.89^{bc}	10.67^{c}	10.88^{bc}	0.090
	g/kg BW	0.320^{a}	0.305^{b}	0.300^{bc}	0.290^{c}	0.300^{bc}	0.003
	g/ kg $BW^{0.75}$	0.782^{a}	0.745^{b}	0.735^{bc}	0.717^{c}	0.735^{bc}	0.007
	% of N intake	45.55^{b}	51.40^{a}	38.93^{c}	29.38^{d}	29.61^{d}	0.311
Nitrogen balance	g/h/d	13.99^{c}	10.44^{d}	17.09^{b}	25.86^{a}	25.66^{a}	0.090
	g/kg BW	0.380^{c}	0.287^{d}	0.470^{b}	0.710^{a}	0.700^{a}	0.004
	g/ kg $BW^{0.75}$	0.935^{d}	0.705^{e}	1.155^{c}	1.745^{a}	1.722^{b}	0.006
	% of N intake	54.44^{c}	48.59^{d}	61.06^{b}	70.62^{a}	70.38^{a}	0.311

Means with different litters within each row are significantly different (P≤0.05).

Water balance:

Data of Table (6) showed significant (P≤0.05) difference in free drinking water and total water intake (ml/h/d or ml/kg $W^{0.82}$). Control and

untreated groups (T1 and T2) increased (P≤0.05) free drinking water more than urea treatments (T3, T4 and T5), although the differences between T1 and T2or among urea treatments were not significant. T4 had the lowest (P≤0.05) values, followed by T5 then T3. Untreated SBP group (T2) had the highest (P≤0.05) value of combined water (ml/h/d or ml/kg $W^{0.82}$), followed by T3, T1 then T5, while the lowest (P≤0.05) value was for T4. Metabolic water (ml/h/d or ml/kg $W^{0.82}$) was significantly (P≤0.05) differed, T5 had the highest (P≤0.05) metabolic water (ml/h/d), followed by T5, T1, T3 and T4, while the lowest (P≤0.05) value was for untreated SBP.

Table (6): Water balance for goat groups affected by experimental diet.

Item	Item		Experimental diet					±SEM
			T1	T2	T3	T4	T5	
Water intake	Free	ml/h/d	3925.0^{a}	3900.0^{a}	3725.0^{ab}	3585.0^{b}	3610.0^{b}	67.27
		ml/kg $W^{0.8}$	263.2^{a}	262.9^{a}	251.5^{ab}	240.6^{b}	187.6^{c}	5.092
	Combined	ml/h/d	109.3^{c}	151.4^{a}	121.3^{b}	96.8^{d}	93.8^{e}	0.148
		ml/kg $W^{0.82}$	7.32^{c}	10.20^{a}	8.18^{b}	6.50^{d}	4.87^{e}	0.040
	Metabolic	ml/h/d	869.1^{c}	776.1^{e}	836.5^{d}	871.7^{b}	874.9^{a}	0.300
		ml/kg $W^{0.82}$	58.2^{a}	52.3^{c}	56.5^{b}	58.5^{a}	45.5^{d}	0.301
	Total	ml/h/d	4903.4^{a}	4827.5^{ab}	4682.8^{bc}	4553.5^{c}	4578.7^{c}	67.30
		ml/kg $W^{0.82}$	328.7^{a}	325.4^{a}	316.2^{ab}	305.6^{b}	238.0^{c}	5.297
Water execration	Urinary water	ml/h/d	578.8^{ab}	590.0^{a}	512.5^{abc}	458.8^{c}	473.8^{bc}	33.78
		ml/kg $W^{0.82}$	38.84^{a}	39.78^{a}	34.60^{ab}	30.78^{bc}	24.62^{c}	2.402
		% of intake	11.80^{ab}	12.22^{a}	9.81^{b}	10.40^{ab}	10.35^{ab}	0.688
	Fecal water:	ml/h/d	87.63^{a}	88.24^{a}	83.81^{b}	82.02^{c}	82.74^{bc}	0.464
		ml/kg $W^{0.82}$	5.87^{a}	5.95^{a}	5.66^{b}	5.50^{c}	4.30^{d}	0.046
		% of intake	1.79	1.82	1.79	1.80	1.80	0.022
	Total water execration	ml/h/d	666.38^{a}	678.24^{a}	596.31^{ab}	540.77^{b}	556.49^{b}	33.85
		ml/kg $W^{0.82}$	44.72^{a}	45.73^{a}	40.26^{ab}	36.29^{bc}	28.92^{c}	2.427
		% of intake	13.59^{b}	14.05^{a}	12.74^{c}	11.87^{d}	12.15^{cd}	0.694
Water balance		ml/h/d	4237.00	4149.22	4086.47	4012.75	4022.25	71.65
		ml/kg $W^{0.82}$	284.00	279.69	275.94	269.26	209.07	5.065
		% of intake	86.40^{b}	85.95^{c}	87.25^{a}	88.12^{a}	87.84^{a}	0.694

Means with different litters within each row or column are significantly different (P≤0.05).

It was found that urinary, fecal and total water execration showed similar trends, untreated group (T2) had the highest (P≤0.05) values, followed by control group (T1), while all urea treatments had the lowest (P≤0.05) values, although the difference among urea treatments was not significant (P≤0.05), T4 had the lowest values followed by T5 then T3. Water balance (ml/h/d and ml/kg $W^{0.82}$) showed insignificant (P≤0.05) differences among treatments, although the data of water balance (% of intake) showed significant (P≤0.05) difference; urea treatments had higher water balance than control and untreated groups, although the differences among urea treatments were not significant (P≤0.05). T4 had the highest (P≤0.05) water balance, followed by T5 then T3, while untreated group (T2) had the lowest water balance followed by control group (T1).

In agreement with the present results, Deyab (1995) and Hassona (1997) showed that the total daily water consumption and water balance was significantly higher in animals fed ureated rice straw than untreated rice straw (control). Also, Aziz (2009) demonstrated that total water intake and water balance (ml/h/d or ml/kg $W^{0.82}$) were higher in sheep fed on olive tree by-products treated with 4% urea.

Rumen parameters:

Ruminal pH value, volatile fatty acids (VFAs) and molar proportion of individual VFAs:

Data in Table (7) showed that urea treatments decreased (P≤0.05) ruminal pH values as compared to control and untreated groups; the lowest (P≤0.05) ruminal pH values were for T4, followed by T5 with no significant difference (P≤0.05) then T3. While, control group (T1) had the highest (P≤0.05) ruminal pH value, followed by untreated group (T2).

Overall means of ruminal pH at different sampling times showed the highest value at zero time (per-feeding), and then it showed a significant decrease (P≤0.05) 3 h post-feeding, then increased with progressed time of feeding 6 h post-feeding.

Urea treatments significantly (P≤0.05) increased total VFAs concentration as compared to untreated and control groups. The highest value was for T4, followed by T5 then T3, although the differences between T4 and T5 or between T5 and T3 were not significant, while the lowest value was for untreated group and control group with no significant difference between them. It is clear that ruminal VFAs concentration increased when ruminal pH value was decreased at different sampling times. This trend may be due to ruminal fermentation by rumen microorganisms (Dawson *et al*. 1990).

A significant differences were detected in molar proportions of ruminal individual VFAs. Urea treatments significantly increased (P≤0.05) molar percentage of acetic, propionic and butyric more than control and untreated group. The highest (P≤0.05) values were for T4, followed by T5 then, although the difference between T4 and T5 was not significant for propionic value. While, the lowest values were for untreated group (T2), followed by control group (T1). Untreated group, followed by T3 then control group significantly (P≤0.05) had higher values of acetic to propionic ratio more than T4 and T5, being the highest (P≤0.05) in T2, while, T4 had the lowest (P≤0.05) value. The differences among T2, T3 and T1 or between T4 and T5 were not significant.

Overall means of total VFAs concentration and molar proportions of acetic, propionic and butyric at different sampling times clearly showed that the lowest values were at zero h (per-feeding) then showed a significant increase (P≤0.05) to reach the highest value 3 h post-feeding then it showed decrease with progressed time of feeding 6 h post-feeding. While, overall mean of A/P at different sampling times was not significant. The increase in TVFAs 3 h post-feeding might be related to the more utilization of dietary energy and positive fermentation in the rumen (Tagari *et al*. 1964). Also, increasing ruminal TVFAs concentration is an indicator for better utilization of dietary carbohydrates (Fadel *et al*.1987).

Table (7): Effect of experimental diet on ruminal pH, volatile fatty acids and molar proportion of individual VFA's.

Item	Time (h)	Experimental diet					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Ruminal pH value	0	7.30	6.77	6.67	6.42	6.42	0.099	6.72^{a}±0.044
	3	6.32	5.95	5.87	5.77	5.87	0.099	5.96^{b}±0.044
	6	6.52	6.37	6.17	5.90	5.97	0.099	6.19^{c}±0.044
Overall mean		6.71^{a}	6.36^{b}	6.24^{bc}	6.03^{d}	6.09^{d}	0.057	-
TVFAs(ml equiv/100 ml R.L)	0	7.93	7.84	8.21	8.56	8.41	0.139	8.19^{c}±0.062
	3	9.75	9.57	11.59	12.14	11.93	0.139	10.99^{a}±0.062
	6	8.97	8.56	10.01	10.18	10.11	0.139	9.57^{b}±0.062
Overall mean		8.88^{c}	8.65^{c}	9.94^{b}	10.29^{a}	10.15^{ab}	0.080	-
Molar proportions of individual VFAs (%):								
Acetic	0	33.20	32.41	35.95	38.44	37.62	0.192	35.52^{c}±0.085
	3	38.88	37.80	41.56	42.68	42.39	0.192	40.66^{a}±0.085
	6	35.87	35.74	38.89	39.94	39.54	0.192	38.00^{b}±0.085
Overall mean		35.99^{d}	35.32^{e}	38.80^{c}	40.35^{a}	39.85^{b}	0.110	-
Propionic	0	17.26	16.94	18.87	21.25	20.48	0.672	18.96^{c}±0.300
	3	21.47	19.18	20.55	26.56	26.41	0.672	22.83^{a}±0.300
	6	19.27	17.75	21.74	23.79	23.54	0.672	21.22^{b}±0.300
Overall mean		19.33^{b}	17.95^{c}	20.39^{b}	23.87^{a}	23.48^{a}	0.388	-
Butyric	0	15.29	15.22	16.38	18.62	18.19	0.205	16.74^{c}±0.091
	3	17.75	17.54	18.82	22.65	22.12	0.205	19.77^{a}±0.091
	6	16.45	15.50	18.92	19.58	19.42	0.205	17.97^{b}±0.091
Overall mean		16.49^{d}	16.09^{e}	18.04^{c}	20.28^{a}	19.91^{b}	0.118	
A/P ratio	0	1.92	1.91	1.90	1.80	1.83	0.091	1.87±0.040
	3	1.81	1.97	2.15	1.60	1.60	0.091	1.82±0.040
	6	1.86	2.01	1.78	1.68	1.68	0.091	1.80±0.040
Overall mean		1.86^{a}	1.96^{a}	1.94^{a}	1.69^{b}	1.70^{b}	0.052	-

Means with different litters within each row or column are significantly different (P≤0.05).

The present results are in agreement with those obtained by Fouad *et al*. (1998), who showed that ruminal pH values of control group was significantly (P<0.05) higher than urea treatment. Also, Bodas *et al*. (2007) found that inclusion of SBP in cereal based diets for fattening lambs seems to enhance the ruminal environment and prevent ruminal acidosis. Also they reported that ruminal pH was significantly (P<0.05) lower in lambs fed on the control concentrate compared to concentrate with SBP. A significant decrease (P<0.05) in total VFAs concentration occurred when SBP was included in the concentrate. Omer *et al*. (2013) indicated that inclusion untreated SBP in sheep ration significantly (P<0.05) increased total VFAs concentration, however it had no significant effect on pH value compared to control ration (CFM).

Total nitrogen, true protein nitrogen, non-protein nitrogen, ammonia nitrogen and microbial protein concentrations:

Urea treatments significantly (P≤0.05) increased total nitrogen, true protein, non-protein nitrogen, ammonia nitrogen and microbial protein

concentrations more than control and untreated group (Table 8). T4 had the highest (P≤0.05) values of total nitrogen, true protein, non-protein nitrogen (NPN) and microbial protein concentrations, followed by T5 then T3, while, the highest (P≤0.05) value of ammonia concentration was for T5, followed by T4 then T3. Untreated group (T2) had the lowest (P≤0.05) values of all parameters, followed by control group (T1).

Data showed insignificant differences among T4, T5 and T3 for total nitrogen value. Also, there was insignificant difference between T4 and T5 for true protein and NPN values. Overall means of TN, TP, NPN, NH3-N and microbial protein concentrations at different sampling times showed that the lowest (P≤0.05) values were at zero h (per-feeding) then significantly (P≤0.05) increased to reach the highest (P≤0.05) values 3 h post-feeding, then it decreased (P≤0.05) with progressed time of feeding 6 h post-feeding.

It is clear that the level of 4% urea (T4) enhanced all rumen parameters concentrations more than level of 6% urea (T5), except that for ammonia nitrogen concentration, it was higher in T5. This is may be due to the highest digestibility of CP and the highest nitrogen balance in T4 more than T5. Also, higher microbial protein concentration in T4 indicated that level of 4% urea was more efficient.

The improvement in rumen parameters by urea treatments may be due to the increase in digestibility coefficients of all nutrients, or may be related to the improvement in microbial population in the rumen which plays an important role in rumen fermentation. The reduction of ammonia nitrogen in the rumen liquor by progressed time of feeding appears to be the result of increased incorporation of ammonia nitrogen into microbial protein and it was considered as a direct result to stimulated microbial activity (Tagari *et al*. 1964).

Silva and Ørskov (1988) reported that feeding SBP might encourage growth of cellulolytic and hemicellulolytic microorganisms and this, in turn, should increase the extent of forage digestion. On the other hand, there was a good efficiency in ruminal protein synthesis when a non protein nitrogen source was in feeds containing rapidly fermentable carbohydrates (Lanza *et al*. 2001). Therefore, use of SBP may have increased ruminal protein synthesis.

The present results are supported by the results of Mousa (2003) fed Baladi male lambs with untreated or ureated barley straw (4% urea) he found that NH_3-N concentrations in all groups increased 3 h post-feeding. Also, Gado *et al*. (2007) reported that the ruminal ammonia nitrogen levels were higher in sheep fed ureated yellow corn or barely grains at early hours after feeding than in those fed diets containing true protein (controls). Moreover, Aziz (2009) demonstrated a decrease in ruminal pH, and an increase in ruminal TVFAs, total nitrogen, true protein, non-protein nitrogen and ammonia nitrogen concentrations in sheep fed on olive tree by-products treated with 4% urea compared to control and untreated group. On the other hand, Omer *et al*. (2013) indicated that inclusion untreated SBP in sheep ration significantly (P<0.05) decreased ammonia nitrogen concentration. Bodas *et al*. (2007) found that no significant differences (P<0.05) were observed in ammonia-N

concentration when untreated SBP was inclusion in cereal based diets for fattening lambs.

Table (8): Effect of experimental diet on total nitrogen, true protein nitrogen, non-protein nitrogen, ammonia nitrogen and microbial protein concentrations (mg/100 ml RL).

Item	Time (h)	Experimental diet					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Total nitrogen	0	97.47	93.44	112.44	114.85	114.20	1.643	106.48^{c}±0.734
	3	122.81	117.66	131.37	134.20	133.51	1.643	127.91^{a}±0.734
	6	112.73	109.07	122.18	124.07	123.58	1.643	118.32^{b}±0.734
Overall mean		111.00^{b}	106.72^{c}	122.00^{a}	124.37^{a}	123.76^{a}	0.948	-
True protein nitrogen	0	37.72	35.73	41.96	48.74	48.18	1.433	42.46^{c}±0.640
	3	44.72	40.63	47.94	53.62	52.84	1.433	47.95^{a}±0.640
	6	40.63	37.14	43.81	50.86	50.70	1.433	44.63^{b}±0.640
Overall mean		41.02^{c}	37.83^{e}	44.57^{b}	51.07^{a}	50.58^{a}	0.827	-
NPN	0	59.75	57.71	66.01	70.48	78.36	2.027	64.01^{c}±0.906
	3	78.09	77.03	80.66	83.43	80.58	2.027	79.96^{a}±0.906
	6	72.10	71.93	72.87	78.36	73.20	2.027	73.69^{b}±0.906
Overall mean		69.98^{c}	68.89^{d}	73.18^{b}	77.42^{a}	77.38^{a}	1.170	-
Ammonia nitrogen	0	30.89	30.48	33.61	37.38	38.90	0.442	34.25^{c}±0.198
	3	36.56	34.58	38.16	43.95	45.20	0.442	39.69^{a}±0.198
	6	33.10	32.20	35.05	39.91	41.81	0.442	36.41^{b}±0.198
Overall mean		33.52^{d}	32.42^{e}	35.61^{c}	40.41^{b}	41.97^{a}	0.255	-
Microbial protein	0	65.62	65.34	70.25	74.86	73.89	0.333	69.99^{c}±0.149
	3	109.16	108.81	113.38	121.22	120.11	0.333	114.54^{a}±0.149
	6	87.47	86.60	93.67	98.04	97.94	0.333	92.74^{b}±0.149
Overall mean		87.41^{d}	86.92^{c}	92.43^{c}	98.04^{a}	97.31^{b}	0.192	-

Means with different litters within each row or column are significantly different (P≤0.05).

Ruminal ciliated protozoa:

The identification of ruminal ciliate protozoa species and their density in the rumen liquor during different sampling times represented in Table (9). Data identified seven genera of ruminal protozoa in ruminal fluid of goats in this study. These genera (genus) are *Entodinum spp.*, *Epidinium ecaudatum, Diplodinum anisacanthum, Ophryoscolox spp., Polyolastron multivesiculatum, Isotrchia spp.* and *Dasytrachia rummantium*. A significant increase (P≤0.05) was found in differential and total numbers of ruminal ciliated protozoa ($x10^4$ cell/ml rumen liquor) with urea treatments more than control and untreated group, except for *Diplodinum spp.* which showed insignificant differences among all treatments. It is clear that T4 had the highest (P≤0.05) density of all genera and total number of ciliated protozoa, followed by T5 then T3, while, the lowest (P≤0.05) values were for T2, followed by T1. The differences among T4, T5 and T3 for *Epidinium spp.*, between T4 and T3 for *Ophryoscolox spp.* and between T5 and T3 for *Polyolastron spp., Dasytrachia spp.* and total count were not significant. Also, the differences between T1 and T2 for *Epidinium spp.*, *Ophryoscolox spp.* and total count, and among all treatments in *Isotrchia spp.* were not significant. These results may be due to the effect of ruminal pH as that ruminal protozoa grow in a wide range of ruminal pH.

It is of interest to note that *Entodinum spp*. showed the highest number among all species. These results are in agreement with those reported by Ivan *et al*. (2000), who observed that *Entodinium* was the most detrimental of ciliated protozoa species.

Table (9): Effect of experimental diet on count of ruminal ciliated protozoa (x10^4 cell /ml rumen liquor).

Item	Time (h)	Experimental diet					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Entodinum spp.	0	5.92	5.62	5.93	6.12	6.03	0.086	5.92^{b}±0.038
	3	5.74	5.42	5.73	5.83	5.86	0.086	5.72^{c}±0.038
	6	6.24	6.02	6.70	8.00	7.05	0.086	6.80^{a}±0.038
Overall mean		5.96^{d}	5.69^{e}	6.12^{c}	6.65^{a}	6.32^{b}	0.049	-
Epidinium spp.	0	0.240	0.239	0.242	0.248	0.239	0.003	0.242^{b}±0.001
	3	0.210	0.205	0.209	0.213	0.211	0.003	0.209^{c}±0.001
	6	0.253	0.253	0.288	0.289	0.282	0.003	0.273^{a}±0.001
Overall mean		0.234^{b}	0.232^{b}	0.246^{a}	0.250^{a}	0.244^{a}	0.002	-
Diplodinum spp.	0	0.201	0.197	0.204	0.215	0.209	11.28	0.205^{b}±5.047
	3	0.162	0.163	0.169	0.175	0.173	11.28	0.176^{c}±5.047
	6	0.249	0.242	0.249	0.256	0.256	11.28	0.250^{a}±5.047
Overall mean		0.204	0.200	0.207	0.216	0.213	6.515	-
Ophryoscolox spp	0	0.242	0.249	0.248	0.253	0.245	0.001	0.247^{b}±0.008
	3	0.209	0.206	0.211	0.210	0.208	0.001	0.209^{c}±0.008
	6	0.282	0.275	0.290	0.291	0.286	0.001	0.285^{a}±0.008
Overall mean		0.244^{b}	0.243^{b}	0.250^{a}	0.251^{a}	0.246^{b}	0.001	-
Polyolastron spp.	0	0.421	0.421	0.404	0.436	0.388	0.005	0.414^{b}±0.032
	3	0.379	0.371	0.396	0.399	0.385	0.005	0.386^{c}±0.032
	6	0.408	0.420	0.459	0.482	0.469	0.005	0.448^{a}±0.032
Overall mean		0.403^{c}	0.404^{c}	0.420^{b}	0.439^{a}	0.414^{b}	0.003	-
Isotrchia spp.	0	0.275	0.279	0.275	0.283	0.270	0.008	0.276^{b}±0.039
	3	0.243	0.244	0.238	0.243	0.236	0.008	0.241^{c}±0.039
	6	0.325	0.323	0.296	0.343	0.344	0.008	0.326^{a}±0.039
Overall mean		0.281^{ab}	0.282^{ab}	0.270^{b}	0.289^{a}	0.283^{ab}	0.005	-
Dasytrachia spp.	0	0.449	0.484	0.503	0.510	0.500	0.007	0.489^{b}±0.035
	3	0.451	0.437	0.458	0.458	0.456	0.007	0.452^{c}±0.035
	6	0.538	0.544	0.551	0.620	0.552	0.007	0.561^{a}±0.035
Overall mean		0.479^{c}	0.488^{c}	0.504^{b}	0.529^{a}	0.503^{b}	0.004	-
Total protozoa count	0	7.75	7.50	7.80	8.07	7.89	11.27	7.80^{b}±5.041
	3	7.40	7.05	7.42	7.52	7.53	11.27	7.39^{c}±5.041
	6	8.30	8.08	8.84	10.28	9.24	11.27	8.95^{a}±5.041
Overall mean		7.81^{c}	7.54^{c}	8.02^{b}	8.62^{a}	8.22^{b}	6.508	-

Means with different litters within each row or column are significantly different (P≤0.05).

In comparison among different sampling times, protozoal counts showed higher values per-feeding, then decreased (P≤0.05) 3 h post-feeding, then showed the highest (P≤0.05) numbers 6 h post-feeding. This trend was

in consistent with that of ruminal pH values, indicating that protozoal count is associated with ruminal pH value.

In the present study, the decreasing of protozoa number 3 h post-feeding may be related to the decreasing of ruminal pH after feeding as a result of increasing TVFAs concentration.

Similar results were obtained by Bhatia *et al*. (1992), who indicated that total protozoa count decreased 3 h after feeding and increased significantly 6 h post-feeding. Also, Aziz (2009) found that feeding sheep on olive tree by-products treated with 4% urea increased total ruminal protozoa count and the deferential number of *Entodinum*, *Isotrchia*, *Dasytrachia*, *Polyolastron*, *Epidinum*, and *Ophryoscolox spps.* as compared to control and untreated group. Moreover, Aziz (2014) reported that inclusion of biologically treated SBP in diets of sheep increased deferential and total ruminal protozoal count ($x10^4$ cell /ml RL).

Blood composition:

A significant (P≤0.05) increase was found in serum total proteins and albumin concentrations with urea treatments than control and untreated group. The highest (P≤0.05) concentrations were recorded for T4, followed by T5 then T3, while, the lowest (P≤0.05) values were recorded for untreated group (T2), followed by control group (T1). The differences between T5 and T3 for total proteins concentration, between T3 and T1 for albumin concentration were not significant. T3 showed the highest globulin concentration, followed by T1 then T2, while the lowest (P≤0.05) concentrations were for T4 and T5. Albumin/globulin ratio increased in T1, T3 and T1 with no significant differences among them, being higher than in T4 and T5 with no significant differences between them (Table 10).

Serum urea concentration significantly (P≤0.05) decreased with urea treatments more than control groups and untreated group, T4 had the lowest concentration, followed by T5 then T3, but the differences among the three treatments were not significant While, the highest concentration was for T2, followed by T1 with insignificant differences between them. The decrease in blood urea concentration in SBP groups might be due to partial reductions in provision of ruminal ammonia for subsequent hepatic conversion to urea (Mojtahedi and Mesgaran, 2011).

It was found that T4 only significantly (P≤0.05) decreased activity of serum AST and ALT as compared to other treatments, which did not differ significantly. As affected by sampling time, all blood parameters 4 h post-feeding was higher (P≤0.05) than pre-feeding values, except for albumin/globulin ratio which was not significant. These results showed that treating SBP with 2, 4 and 6% urea did not cause any lesions in liver and kidney functions of lactating goats.

The present results are supported by the results of Gado *et al*. (2007), who reported that concentration of total proteins, albumin, globulin and AL/GL ratio in sheep fed ureated yellow corn or ureated barely grains (4% urea) were higher comparing with control and untreated groups. Also, Aziz (2009) reported that serum total proteins, albumin, globulin concentrations were higher in sheep fed on olive tree byproducts treated with 4% urea compared to control and untreated group, while serum urea concentration, and activity of

AST and ALT decreased. On the other hand, Okab *et al*. (2012) found that hematological and biochemical parameters values of lambs fed on diets containing SBP treated with 4% urea were decreased (P<0.05) as compared to those fed on control and untreated diets. However, Abedo (2006), Bodas *et al*. (2007) and Mahjoubi *et al*. (2009) noticed insignificant differences between control and untreated SBP groups in any of the blood biochemical parameters studied. Also, Omer *et al*. (2013) and Sorathiya *et al*. (2015) reported that inclusion of untreated SBP in sheep diet significantly (P<0.05) decreased urea blood plasma concentration, however, it had no significant effect on other blood parameters compared to control.

Table (10): Effect of experimental diet on biochemicals and enzyme activity in blood serum of goats.

Item	Time (h)	Experimental diet					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Total proteins (g/dl)	0	8.07	7.86	8.69	8.64	8.72	0.109	8.40^{b}±0.049
	4	8.90	8.28	9.33	10.12	9.44	0.109	9.21^{a}±0.049
Overall mean		8.48^{c}	8.07^{d}	9.01^{b}	9.38^{a}	9.08^{b}	0.077	-
Albumin (g/dl)	0	4.40	3.88	4.42	5.39	5.65	0.105	4.75^{b}±0.047
	4	4.68	4.53	5.09	6.30	5.42	0.105	5.20^{a}±0.047
Overall mean		4.54^{c}	4.20^{d}	4.75^{c}	5.85^{a}	5.54^{b}	0.074	-
Globulin (g/dl)	0	3.67	3.98	4.27	3.25	3.06	0.119	3.64^{b}±0.053
	4	4.21	3.75	4.23	3.81	4.01	0.119	4.00^{a}±0.053
Overall mean		3.94^{b}	3.87^{b}	4.25^{a}	3.53^{c}	3.54^{c}	0.084	-
AL/GL ratio	0	1.20	0.99	1.04	1.67	1.88	0.073	1.35±0.032
	4	1.11	1.21	1.20	1.65	1.35	0.073	1.30±0.032
Overall mean		1.15^{b}	1.10^{b}	1.12^{b}	1.66^{a}	1.61^{a}	0.051	-
Urea (mg/dl)	0	30.17	32.06	24.22	22.71	23.71	1.24	26.57^{b}±0.555
	4	39.16	37.34	29.45	28.46	27.83	1.24	32.45^{a}±0.555
Overall mean		34.67^{a}	34.70^{a}	26.84^{b}	25.59^{b}	25.77^{b}	0.878	-
AST (U/L)	0	22.59	23.49	22.77	20.76	22.19	0.519	22.36^{b}±0.232
	4	25.52	26.11	23.83	23.46	23.81	0.519	24.55^{a}±0.232
Overall mean		24.06^{ab}	24.80^{a}	23.30^{b}	22.11^{c}	23.00^{b}	0.367	-
ALT (U/L)	0	4.47	4.55	4.52	4.33	4.71	0.330	4.51^{b}±0.147
	4	5.95	6.31	5.98	4.91	5.91	0.330	5.81^{a}±0.147
Overall mean		5.21^{ab}	5.43^{a}	5.25^{ab}	4.62^{b}	5.31^{ab}	0.233	-

Means with different litters within each row or column are significantly different (P≤0.05)**.**

Milk yield and composition:

Data in Table (11) showed that urea treatments significantly (P≤0.05) increased milk yield, 4% fat corrected milk and milk composition more than control and untreated group. T4 had the highest (P≤0.05) values of milk yield, 4% fat corrected milk, and percentages of total solid, fat, solids not fat, total proteins, lactose and ash, followed by T5 then T3, while T2 and T1 had the lowest (P≤0.05) values. The difference among T4, T5 and T3 was significant

(P≤0.05), while the difference in ash content was not significant. Also, the differences between T2 and T1 were not significant for all values.

It is clear that, milk yield, 4% fat corrected milk and milk composition significantly (P≤0.05) increased by progressed stage of lactation. Only fat percentage increased (P≤0.05) at mid lactation stage then it decreased (P≤0.05) to reach the lowest value at late lactation stage. Total proteins concentration showed insignificant differences by progressed stage of lactation. Ash content decreased by progressed stage of lactation, but the differences between mid and late lactation was not significant.

These results have clearly demonstrated that sugar beet feeding to lactating goats did not have any adverse effects on milk production or milk composition. The increase in milk production by urea treatment may be attributed to the increase in feed intake in ureated treatments or may be due to the improvement in nutrient digestibility especially CP, CF and it components and the improvement in rumen fermentation especially VFAs concentration. Also, the increase in milk yield was attributed to the increase in molar proportion of acetic in the rumen, and to the increase in serum total proteins and albumin concentration, which reflect the better nutritional management. The decrease of milk fat content by progressed stage of lactation may be attributed to the increase of milk yield because there is a negative relationship between milk fat percentage and milk yield. The increase in milk production might be due higher water and sugar content of sugar beet (Niazi *et al*., 2000). The increase in milk lactose might be due to the high concentration of NDF, especially pectin in sugar beet. Further, pectin fermentation produces less lactate and a higher ratio of acetate to propionate without affecting cellulose and emicelluloses digestion (Abedo 2006).

Similar results were obtained by Wanapat *et al*. (2000), who found that the combination of ureated rice straw and whole sugar cane at the ratio of 50:50 enhanced both DM intake (P<0.05), milk yield, and milk fat and protein percentages. Man and Wiktorsson (2001) reported that milk protein was not different but milk fat increased in lactating cows fed fresh rice straw treated by urea. Sanh *et al*. (2002) indicated that urea treatment for rice straw increased milk yield, however, milk composition did not change. Al-Busadah (2008) indicated that milk yield, percent of water, fat, total solids, solid not fat, casein, pH and ash significantly (P< 0.05) differed in milk collected from goats fed urea-treated rice straw as compared to control.

Wanapat *et al*. (2013) reported that urea-calcium hydroxide treated rice straw significantly (P<0.05) increased milk yield and milk composition of lactating dairy cows. Also, Sorathiya *et al*. (2015) found that milk yield, milk fat percentage and 4% FCM were increased slightly in buffaloes fed sugar beets; however, they were similar to control, in percentages of SNF, proteins and lactose.

Table (11): Effect of experimental treatments on milk yield and composition during different lactation periods:

Item	Stage	Experimental diet					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Milk yield (ml/h/d)	Early	898.1	896.3	940.0	982.5	968.1	11.71	937.00^{c}±5.239
	Mid	907.5	903.1	941.9	1015.6	999.4	11.71	953.50^{b}±5.239
	Late	1002.5	1000.0	1111.9	1234.4	1187.5	11.71	1107.3^{a}±5.239
Overall mean		936.0^{d}	933.1^{d}	997.9^{c}	1077.5^{a}	1051.7^{b}	6.763	-
4% FCM (ml/h/d)	Early	838.5	833.2	890.1	947.7	918.7	11.02	885.7^{c}±4.932
	Mid	848.6	843.3	893.4	983.3	955.1	11.02	904.7^{b}±4.932
	Late	923.6	918.8	1033.1	1174.5	1113.3	11.02	1032.6^{a}±4.932
Overall mean		870.2^{d}	865.1^{d}	938.8^{c}	1035.2^{a}	995.7^{b}	6.367	-
Milk composition (%):								
Total solids	Early	12.34	12.31	12.48	12.99	12.48	0.026	12.52^{c}±0.011
	Mid	12.42	12.39	12.53	12.98	12.76	0.026	12.62^{b}±0.011
	Late	12.47	12.44	12.56	13.06	12.71	0.026	12.65^{a}±0.011
Overall mean		12.41^{d}	12.38^{d}	12.53^{c}	13.01^{a}	12.65^{b}	0.015	-
Fat	Early	3.55	3.53	3.64	3.76	3.66	0.013	3.63^{b}±0.006
	Mid	3.56	3.55	3.65	3.78	3.70	0.013	3.65^{a}±0.006
	Late	3.47	3.45	3.52	3.67	3.58	0.013	3.54^{c}±0.006
Overall mean		3.53^{d}	3.51^{d}	3.61^{c}	3.74^{a}	3.64^{b}	0.008	-
Solids not fat	Early	8.78	8.78	8.84	9.23	8.82	0.028	8.89^{c}±0.012
	Mid	8.85	8.83	8.88	9.19	9.06	0.028	8.96^{b}±0.012
	Late	9.00	8.98	9.03	9.38	9.13	0.028	9.10^{a}±0.012
Overall mean		8.88^{d}	8.86^{d}	8.92^{c}	9.27^{a}	9.00^{b}	0.016	-
Total protein	Early	3.77	3.78	3.90	4.02	3.94	0.008	3.88±0.003
	Mid	3.77	3.77	3.88	3.99	3.91	0.008	3.86±0.003
	Late	3.77	3.75	3.89	4.018	3.94	0.008	3.87±0.003
Overall mean		3.77^{d}	3.77^{d}	3.89^{c}	4.01^{a}	3.93^{b}	0.004	-
Lactose	Early	3.946	3.93	4.26	4.39	4.30	0.022	4.16^{c}±0.010
	Mid	4.23	4.22	4.43	4.53	4.50	0.022	4.38^{b}±0.010
	Late	4.41	4.40	4.63	4.82	4.71	0.022	4.59^{a}±0.010
Overall mean		4.19^{d}	4.18^{d}	4.44^{c}	4.58^{a}	4.50^{b}	0.012	-
Ash	Early	0.984	0.984	1.037	1.045	1.043	0.004	1.019^{a}±0.002
	Mid	0.982	0.981	1.007	1.015	1.008	0.004	0.998^{b}±0.002
	Late	0.976	0.970	1.007	1.014	1.009	0.004	0.995^{b}±0.002
Overall mean		0.981^{b}	0.978^{b}	1.01^{a}	1.02^{a}	1.02^{a}	0.002	-

Means with different litters within each row or column are significantly different (P≤0.05).

Kid performance:

Data indicated that urea treatments of goat does significantly increased (P≤0.05) its birth weight more than control and untreated group. The highest (P≤0.05) birth weight was for T4, followed by T5 then T3 with insignificant differences between T4 and T5, while the lowest (P≤0.05) birth weight was for untreated group, followed by control with insignificant differences. It seems that the body weight of kids during the first, second and third months (weaning weight) showed the same trend, but urea treatments had the highest (P≤0.05) birth weights.

Data of growth rate and overall mean of growth rate indicated that T4 had the highest values, followed by T5 then T3 with insignificant differences, except for the first month, while the lowest (P≤0.05) values were for untreated group, followed by control with insignificant differences in all values. These results of body weight and growth rate reflect the better nutritional management for goat dams fed SBP ureated with 2, 4 and 6%. The increase of body weight and growth rate in kids of goats fed ureated SBP can be fairly attributed to the higher feed intake than those fed CFM.

Table (12): Effect of feeding goat does the experimental diets on body weight and growth rate of their kids.

Item	Experimental diet					±SEM
	T1	T2	T3	T4	T5	
Body weight (kg) :						
Birth weight	2.47^{bc}	2.36^{c}	2.50^{b}	2.66^{a}	2.62^{a}	0.041
1st month	5.27^{c}	5.16^{c}	5.48^{b}	5.91^{a}	5.72^{a}	0.067
2nd month	8.82^{c}	8.80^{c}	9.09^{b}	9.39^{a}	9.32^{a}	0.057
Weaning weight	11.97^{c}	11.88^{c}	12.39^{b}	12.69^{a}	12.58^{ab}	0.077
Growth rate (g/h/d):						
1st month	93.44^{c}	93.22^{c}	93.88^{c}	113.52^{a}	103.33^{b}	2.931
2nd month	118.22	121.40	120.29	116.10	119.92	119.92
3rd month	104.99^{ab}	102.77^{b}	110.00^{a}	110.00^{a}	108.51^{a}	1.839
Overall mean	105.55^{c}	105.80^{c}	108.06^{bc}	113.20^{a}	110.59^{ab}	0.990

Means with different litters within each row or column are significantly different (P≤0.05).

These results were supported by those obtained by El-Badawi and El-Kady (2006), who noted that inclusion of SBP sprayed with urea solution at a level of 30 g/kg and replaced at 50% of the common CFM increased average daily gain by about 30%. Also, Gado *et al*. (2007) and Aziz (2009) reported an increase in body weight, average daily gain (ADG) and growth rate in sheep fed diets treated with 4% urea. Moreover, Okab *et al*. (2012) indicated that diet containing SBP treated with 4% urea improved (P<0.05) final body weight (FBW) and ADG of lambs. However, FBW and ADG decreased (P<0.05) in lambs fed on untreated diet compared to control diet. On the other hand, Bodas *et al*. (2007) and Omer *et al*. (2013) reported that inclusion of untreated SBP in sheep diet had no significant effect (P<0.05) on FBW, total body weight gain, and ADG.

CONCLUSION

It is clear that treating SBP at a level of 4% urea (T4) enhanced digestibility coefficients of all nutrients, fiber fractions, nitrogen balance, rumen parameters concentrations especially microbial protein concentration, ruminal protozoa count, serum total proteins and albumin, and milk yield and composition more than those treated at levels of 2 or 6% urea (T3 and T5, respectively). Therefore, the present study suggests the replacement of dried sugar beet pulp treated with 4% urea by a part of common concentrate feed mixture of lactating goats.

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تأثير تفل بنجر السكر المعامل باليوريا على أداء الماعز الحلابة

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تمت هذه الدراسة على عدد ٤٥ من أناث الماعز البرقى لدراسة تأثير تفل بنجر السكر المعامل ب ٢، ٤و ٦% يوريا ليحل محل ٣٠ % من مخلوط المركزات الشائع فى علائق الماعز على آداء الماعز الحلابة - محصول - تركيب اللبن - وزن الميلاد والفطام. تم تصميم خمس علائق يجريبيه كالتالى: معاملة (١): مخلوط مركزات + دريس برسيم (مقارنة). معاملة (٢): مخلوط مركزات+ تفل بنجر السكر غير معامل + دريس برسيم. معاملة (٣): مخلوط مركزات+ تفل بنجر السكر معامل ب ٢% يوريا (على أساس المادة الجافة) + دريس برسيم. معاملة (٤): مخلوط مركزات+ تفل بنجر السكر معامل ب ٤% يوريا (على أساس المادة الجافة) + دريس برسيم. معاملة (٥): مخلوط مركزات+ تفل بنجر السكر معامل ب ٦% يوريا (على أساس المادة الجافة) + دريس برسيم. أستمرت التجربة لمدة 140 يوم. وفى نهاية مرحلة الحليب تم اجراء تجربة هضم لدراسة تأثير التغذية بالعلائق التجربية على معاملات الهضم ، تخمرات الكرش، البروتين الميكروبى، بروتوزوا الكرش ومكونات الدم. أظهرت النتائج المتحصل عليها أن المعاملات الخامسة والرابعة والثالثة أدت إلى زيادة محتوى كلا من المادة الجافة، المادة العضوية، الدهن، المستخلص الخالى من الدهن والبروتين الخام، بينما أدت إلى نقص محتوى كل من الألياف الخام ومكوناتها، السليلوز والهيميسليلوز مقارنة بالمجموعة الأولى والثانية. وأظهرت المجموعة الرابعة والخامسة أعلى معاملات هضم لكل من المادة الجافة، المادة العضوية، الدهن، المستخلص الخالى من الدهن، البروتين الخام، الألياف الخام ومكوناتها، السليلوز والهيميسليلوز، كما أظهرت المجموعة الرابعة والخامسة أيضاً أعلى قيمة للمواد الكلية المهضومة والبروتين الخام المهضوم. أدت المعاملات الرابعة والخامسة والثالثة، على التوالى إلى تحسن معنوى فى ميزان النيتروجين والماء وتخمرات الكرش وأعداد بروتوزوا الكرش ومحصول ومكونات اللبن ووزن الميلاد والفطام. و يتضح مما سبق أن معاملة تفل بنجر السكر باليوريا (٣%) له تأثير ملحوظ على أداء الماعز الحلابة و صغارها.