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EFFECT OF BIOLOGICALLY TREATED SUGAR BEET PULP ON LACTATING GOAT PERFORMANCE

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ABSTRACT

This study amid to investigate the effect of using sugar beet pulp (SBP) untreated or treated with biological treatments to replace about 30% of common concentrate feed mixture of goat diets. *In vitro* experiment was carried out to study the effect of control, treated and untreated SBP on nutrients disappearance. Experimental diets included T1: Concentrate feed mixture (CFM) + Berseem hay (BH) (control). T2: CFM + untreated SBP + BH. T3: CFM + SBP treated with *Sacharomyces cerevisiae* + BH. T4: CFM + SBP treated with *Clostridium cellulovorans* + BH. T5: CFM + SBP treated with *Trichoderma harzianum* + BH. Thirty five female Barki goats (about 4 years old and weighing 30±1.5 kg) were randomly divided into five groups fed the experimental diets. The experimental period lasted 270 day to study the effect treatments on goat doe performance during pregnancy and lactation stages and their kids performance until weaning. A digestibility trial was carried out at the third month of pregnancy. The results revealed that biological treatments significantly (P≤0.05) increased body weight and feed intake. Also, biological treatments significantly (P≤0.05) improved chemical composition, digestibility coefficients, nitrogen balance, water balance, rumen fermentations, milk yield and composition, birth and weaning weight. It could be concluded that, inclusion of untreated or biologically treated SBP to replace 30% of common concentrate feed mixture of during pregnancy and lactation stages had remarkable improved influence on goat performance.

Keywords: Sugar beet pulp, biological treatment, goat performance.

INTRODUCTION

In Egypt, there is an acute shortage of conventional feedstuffs for feeding livestock. The big feed gap between the requirements and the available sources forced the planners and nutritionists to look for non-conventional resources which had no competition with human such as agricultural, agro-industrial and organic wastes. Encouraging results obtained from using by-products in animal diets could help in reducing the shortage of animal feeds and subsequently increase milk and meat production. However, the nutritive value of the agricultural by-products like sugar beet pulp can be enhanced through their biological treatment and this way can play an important role to meet nutrient requirements of the animals. In the recent years, cultivation of sugar beet in Egypt increased because its water requirement is less than sugar cane. Therefore, the quantity of sugar beet pulp (SBP) also increased now and in the future. Agriculture Economics (2000) reported that the quantity of SBP in Egypt was 173326 ton, could supply 155993 ton of dry matter, 113150 ton of TDN and 6708 ton of DCP. Now the annual amounts of SBP about 385686 ton (Statistics of Ministry of Agriculture, 2011).

Several authors concluded that although 85% of the nitrogenous substances of dried SBP are presented in the form of true protein, its digestibility is lower than that of maize or barley grains (Boucque et al. 1976). The impact of feeding dried SBP on rumen fermentation was investigated by many invistigators (Chikunya *et al*. 1996; Molina *et al*. 2000 and Aziz, 2014), however, the results did not show clear trend and they were contradictory. On the other hand, the effect of feeding SBP on microbial population in rumen, and yield and composition of milk was poorly studied. Therefore, the present study aims to improve the nutrient value of SBP using biological treatments to replace a part of concentrates and evaluate the effect of these treatments on goat performance during pregnancy and lactation stages. Also, nutrient disappearance and digestibility, rumen fermentation, milk yield and composition and blood composition were studied as affected by treatments.

MATERIALS AND METHODS

The experimental work was carried out at Goat Research Unit of the Department of Animal Production at El-Noubaria Experimental Farm, National Research Centre, Noubaria, Egypt.

***In vitro* experiment:**

This experiment was designed to study the effect of control, untreated and biologically treated SBP (yeast, bacteria and fungi) on *in vitro* nutrient disappearance. Five experiments were carried out as follow:

T1: Concentrate feed mixture (CFM) + Berseem hay (BH, control). T2: CFM + untreated SBP + BH. T3: CFM + SBP treated with *Sacharomyces cerevisiae* + BH. T4: CFM + SBP treated with *Clostridium cellulovorans* + BH. T5: CFM + SBP treated with *Trichoderma harzianum* + BH. Ratio of CFM to SBP and BH was 40:30:30% in all treatments.

Ruminal contents were collected, two hours post feeding from seven male goats fed CFM and good quality berseem hay. Collected rumen liquid was kept warm in plastic Jug (35-37 ºC), strained through two layers of cheese cloth and mixed with urea-buffer under the lab conditions for *in vitro* studies. The ruminal fluid was incubated with the samples of the five treatments, two tubes as replicates for each sample were incubated for 24 hours to estimate disappearance of dry matter, organic matter and other nutrients according to the methods described by Terry *et al*. (1969), modified by Norris (1976).

Pregnancy, digestibility and lactation trials:

Three experiments lasted for 270 days (a month before mating, pregnancy, lactation and weaning). The objective of this experiment was to study the effect of feeding control, untreated and treated SBP with yeast or bacteria or fungi on goat does performance during pregnancy. Does were fed on the experimental diets for one month before being pregnant and also during pregnancy and lactation. Thirty five female Barki goats (about 4 years old and 30±1.5 kg live body weight) were randomly divided into five groups of 7 animals in each.

At the third month of pregnancy, a digestibility trial was carried out to study the effect of feeding the experimental diets on digestibility coefficients,

rumen fermentation parameters, protozoal count, and some blood constituents. Four goats 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 animal.

After parturition, goats were fed on the same treatments until the weaning at 12^{th} week to study the effect of treatments on milk yield and composition and kids performance.

The biological treatments:

Sacharomyces cerevisiae, *Clostridium cellulovorans* and *Trichoderma harzianum*, were obtained from the Microbial Genetic Department, National Research Center, Dokki, Cairo, Egypt. The microorganisms were maintained on agar medium composed of (g/l) yeast extract, 3.0; malt extract, 30; peptone, 5.0; sucrose 20 and agar 20. Spore suspension of microorganisms was prepared and used to inoculate a sterilized liquid medium containing (g/l) 4% molasses, 0.4% urea, 0.2% KH_2 PO_4 and 0.03 Mg $SO_4.7H_2O$ and incubated for 7 days.

Air-dried SBP moistened for 60% was treated with biological treatments at a ratio of 150 ml media to 100 kg ration plus 10% molasses from the dry matter. The treated SBP was put on plastic sheets (150 × 225 cm) and incubated in a room (3×3 meters) maintained at 27-30 ºC for 7 days. Moisture was kept at 60%. After the incubation period, the fermented SBP was air dried to 6% moisture then packed and stored.

Proximate chemical analysis:

The proximate chemical analysis of diet samples was carried out according to the A.O.A.C. (1990) for to determine of DM, CP, CF, EE and NFE. However, percentages of NDF, ADF and ADL were determined according to the procedures of Van Soest *et al*. (1991). Percentages of 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, 4 and 8 hours post feeding. Ruminal pH 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). Amount of ruminal microbial protein was estimated as described by Makkar et al. (1982).

For classification and determination of ruminal ciliate protozoal count, the filtered rumen liquor were collected at 0, 4 and 8 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 according to the description published by Dehority (1993).

Blood sampling:

Goats from each treatment were used to obtain 12 ml blood from the jugular vein at zero and 4 hours post-feeding. Blood samples were left to coagulate at room temperature, then centrifuged at 4000 rpm for 15 min to separate serum, which was kept frozen at -20 ºC till determination of concentration of total proteins (using electronic apparatus), albumin (Doumas and Biggs,1971), globulin (by subtracting) and urea (Patton and Crouch, 1977). Also, activity of aspartate aminotransferase (AST) and alanin aminotransferase (ALT) was determined in blood serum (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 yield was recorded and milk samples were immediately taken from each animal after morning and evening milkings to chemical analysis. 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, fat, total protein 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 = 0.4M+ 15 F, Where: M= milk yield (g) and F= fat yield (g).

Statistical analysis:

Data were statistically analyzed according to statistical analysis system of SAS (2000). Data of nutrient disappearance, 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 samples was two-way analysis and the following model was used: $\boldsymbol{Y_{ij} = \mu + T_i + l_j + Tl_{ij} + e_{ij}}$.

Where: Y_{ij} = experimental observation, μ = general mean,

T_i = effect of treatment (i =1:5), l_j = effect of sampling time (j=0, 4, 6)

Tl_{ij}= effect of interaction between treatment and sampling time.

e_{ij} = experimental error.

The significant differences among means was carried out by using Duncan's multiple test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition and cell wall constituents:

Data represented in Table (1) showed that biological treatments of SBP enhanced chemical composition and cell wall constituents as compared to untreated SBP and control. In this respect, T3, T4 and T5 increased DM and CP compared with T1 (control) and T2 (untreated). The highest DM was for

T3, while the lowest one was for T2. The highest CP content was for T3, followed by T5 and T4, respectively. While, the lowest CP content was for T2 and T1. Also, contents of OM, EE and NFE were higher in treated diets than untreated diet, although they were less than that of control diet. Treatment of SBP with yeast, bacteria and fungi decreased contents of CF, NDF, ADF, ADL, cellulose and hemicelluloses as compared to untreated diet (T2), although they were more than control group (T1). The lowest values were for T3, followed by T5 and T4, while the highest values were for T2.

Data of untreated SBP are in agreement with the results reported by El-Ashry et al. (2000), Saleh et al. (2001) and Talha et al. (2002). Similar results were obtained by Abedo *et al*. (2005), who found that treating SBP with *Trichoderma ressei* increased the CP content from 9.94 to 19.37%, while it decreased NDF and hemicellulose. Also, Aziz (2014) reported that biological treatment of SBP with *Sacharomyces cerevisiae*, *Cellulomonas cellulasea* and *Trichoderma viride* individual or combined led to increase CP content and decreased CF and OM contents.

Table (1): Chemical composition of the experimental diets and different feedstuffs.

Item	Ration					Feedstuff		
	T1	T2	T3	T4	T5	CFM	Hay	Untreated SBP
DM (%)	92.32	89.04	93.38	92.7	92.7	93.7	91.02	91.05
Chemical composition (%):								
OM	91.92	88.70	91.7	90.5	90.9	92.04	88.00	95.5
Ash	8.08	11.30	8.30	9.50	9.10	7.96	12.00	4.50
EE	3.20	2.20	2.80	2.62	2.72	3.20	2.51	1.23
CP	12.23	10.92	17.42	16.43	16.74	12.52	13.86	9.31
CF	14.42	17.94	12.15	13.90	13.46	11.62	24.98	24.51
NFE	62.07	57.64	59.33	57.55	57.98	64.70	46.65	60.45
Cell wall constituents (%):								
NDF	31.04	47.64	40.74	41.63	41.58	31.30	63.40	60.50
ADF	17.86	24.20	19.76	21.40	20.91	17.96	45.00	29.10
ADL	4.93	4.20	3.42	4.10	3.91	5.10	7.42	2.90
Cellulose	13.18	23.44	20.98	20.23	20.67	13.34	18.40	31.40
Hemicellulose	12.93	20.00	16.34	17.30	17.00	12.86	37.58	26.20

T1: Concentrate feed mixture (CFM) + Berseem hay (BH) (control). T2: CFM + untreated SBP + BH. T3: CFM + SBP treated with *Sacharomyces cerevisiae* + BH. T4: CFM + SBP treated with *Clostridium cellulovorans* + BH. T5: CFM + SBP treated with *Trichoderma harzianum* + BH.

***In vitro* experiment:**

Nutrient disappearance:

Data presented in Table (2) revealed significant (P≤0.05) effect of treatment on *in vitro* of disappearance of all nutrients and cell wall constituents (NDF, ADF, ADL, cellulose and hemicellulose). Yeast treatment (T3) showed the highest values of nutrient disappearance, followed by fungal treatment (T5) and *bacterial* treatment (T4), respectively, while the lowest values were for untreated diet (T2) and control (T1) diets. However, there was no significant difference between T4 and control (T1) diets in the disappearance values of CF, ADL and hemicellulose.

Similar results were obtained by Aziz (2014), who found an increase in nutrient disappearance and cell wall constituents *in vitro* in treated SBP with fungi, bacterial, yeast or yeast combined with fungi or bacteria. The best disappearance values were obtained for yeast combined with fungi.

Table (2): Effect of biological treatments on chemical composition, nutrient disappearance during *in vitro* experiment:

Item	Treatment					±SEM
	T1	T2	T3	T4	T5	
DM (%)	66.87^{bc}	62.25^{c}	81.82^{a}	66.84^{bc}	70.20^{b}	1.337
Chemical composition (%):						
OM	65.00^{d}	65.45^{d}	85.15^{a}	71.75^{c}	73.70^{b}	0.323
EE	53.27^{c}	56.50^{c}	80.63^{a}	63.63^{b}	63.98^{b}	1.096
CP	79.25^{c}	78.20^{c}	91.31^{a}	84.57^{b}	85.37^{b}	0.445
CF	70.07^{c}	61.55^{d}	86.27^{a}	71.19^{c}	75.07^{b}	0.715
NFE	59.77^{e}	65.34^{d}	83.30^{a}	67.91^{c}	70.15^{b}	0.246
Cell wall constituents (%):						
NDF	68.25^{c}	65.75^{d}	82.08^{a}	76.51^{b}	77.20^{b}	0.319
ADF	75.98^{d}	69.85^{e}	88.39^{a}	77.57^{c}	80.30^{b}	0.295
ADL	53.80^{c}	53.85^{c}	87.12^{a}	66.56^{c}	70.23^{b}	0.552
Cellulose	61.70^{d}	59.69^{e}	86.23^{a}	72.14^{c}	74.63^{b}	0.299
Hemicellulose	77.85^{c}	72.97^{d}	88.72^{a}	78.50^{c}	82.40^{b}	0.338

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

Pregnancy trial:

Body weight and feed intake:

Data in Table (3) showed insignificant effect of treatment on body weight before breeding, however diet containing biologically treated SBP significantly (P≤0.05) increased body weight of goats during early and late pregnancy stages. At early pregnancy stage, T3 had the highest body weight, although the differences between T4, T5 and T1 were not significant (P≤0.05 while the lowest weights were for untreated SBP (T2). At late pregnancy stage, there was no significant among the three biological treatments T3, T4, T5, but they were significantly (P≤0.05) higher than T2 and T1. Overall mean of live body weight was the highest in T3 (36.05 kg), followed by T4 (35.93 kg) and T5 (35.89 kg) with no significant difference, while untreated group (T2) had the lowest body weight (35.07 kg), followed by control group (35.57 kg). Data also showed significant (P≤0.05) difference among treatments in total weight gain, being the highest in all treated groups with no significant (P≤0.05) difference, followed by control group then T2; the values were 10.38, 10.32, 10.25, 9.62 and 9.07 kg/h for T3, T4, T5, T2 and T1, respectively. These results indicated better nutritional management prevailed during different physiological stages, proving that biologically treated SBP have potentiality to incorporate into feed mixture for ruminant.

Similar results were obtained by El-Shabrawy et al. (2012), who reported that addition of *Sacharomyces cerevisiae* to ration contained berseem hay and concentrate feed mixture increased body weight gain (g/h/d) of growing calves as compared to controls. Also, El- Bana et al. (2014)

found that body weight and total gain increased in Barki lambs fed sugar beet pulp untreated or treated with fibrolytic enzymes.

Table (3): Effect of biological treatments on body weight and feed intake of goat does during pregnancy period.

Item	Treatments					±SEM	Overall mean
	T1	T2	T3	T4	T5		
Live body weight (kg):							
Initial	29.45	29.54	29.52	29.35	29.42	0.269	
Before breeding	30.20	30.05	30.32	30.25	30.24	0.063	30.21^{c}±0.028
Early pregnancy	36.68^{b}	36.02^{c}	37.11^{a}	36.97^{b}	36.94^{b}	0.063	36.74^{b}±0.028
Late pregnancy	39.82^{b}	39.12^{c}	40.71^{a}	40.58^{a}	40.50^{a}	0.063	40.15^{a}±0.028
Overall mean	35.57^{c}	35.07^{d}	36.05^{a}	35.93^{b}	35.89^{b}	0.036	
Total weight gain (kg/h)	9.62^{b}	9.07^{c}	10.38^{a}	10.32^{a}	10.25^{a}	0.102	
Feed intake:							
g/h/d:							
Before breeding	1190.57^{d}	1117.37^{e}	1235.78^{a}	1217.28^{c}	1225.23^{b}	2.217	1197.25^{c}±0.991
Early pregnancy	1423.22^{b}	1383.94^{d}	1432.57^{a}	1424.11^{b}	1416.62^{c}	2.217	1416.09^{b}±0.991
Late pregnancy	1690.70^{b}	1652.92^{c}	1701.70^{a}	1703.11^{a}	1686.27^{b}	2.217	1686.94^{a}±0.991
Overall mean	1434.83^{d}	1384.75^{e}	1456.68^{a}	1448.17^{b}	1442.71^{c}		
g/kg BW:							
Before breeding	39.43^{b}	37.18^{c}	40.76^{a}	40.24^{a}	40.52^{a}	0.089	39.63^{b}±0.039
Early pregnancy	38.80	38.41	38.60	38.52	38.35	0.089	38.54^{c}±0.039
Late pregnancy	42.45^{a}	42.25^{a}	41.80^{b}	41.96^{b}	41.64^{b}	0.089	42.02^{a}±0.039
Overall mean	40.23^{b}	39.28^{c}	40.38^{a}	40.24^{ab}	40.17^{b}	0.051	
g/ kg $BW^{0.75}$:							
Before breeding	92.44^{d}	87.06^{e}	95.64^{a}	94.37^{c}	95.02^{b}	0.174	92.90^{c}±0.077
Early pregnancy	95.49^{a}	94.11^{c}	95.28^{ab}	94.98^{b}	94.55^{b}	0.174	94.88^{b}±0.077
Late pregnancy	106.65^{a}	105.66^{b}	105.58^{b}	105.92^{b}	105.04^{c}	0.174	105.77^{a}±0.077
Overall mean	98.19^{b}	95.61^{c}	98.83^{a}	98.42^{b}	98.20^{b}	0.100	

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

Results presented in Table (3) indicated significant (P≤0.05) increase in feed intake (g/h/d, g/kg BW and g/ kg $BW^{0.75}$) of goat does as affected by biological SBP treatments, being more than untreated SBP and control groups. At early pregnancy stage, T3 had the highest (P≤0.05) feed intake (g/h/d), followed by T4 and T1 with no significant (P≤0.05) difference, followed by T5 and T2. At late pregnancy stage, there was no significant (P≤0.05) differences in feed intake between each of T4 and T3, as well as between T1 and T5, while T2 was the lowest one.

Overall mean of feed intake was affected significantly (P≤0.05) by biological treatments, being the highest for yeast treatment (T3), followed by bacteria treatment (T4), fungi treatment (T5), control group (T1) and untreated SBP (T2), respectively. The values were 1456.68, 1448.17, 1442.71, and 1384.75 g/h/d, respectively. The overall mean of pregnancy stages indicated that feed intake significantly (P≤0.05) increased in late pregnancy stage more than early pregnancy stage and before breeding. Generally the present result is accompanied with an increase in body weight. These results are in agreement with those obtained by Kholif *et al*. (2005) and Aziz (2009), who reported that biological treatments slightly increased DMI. While, Aziz (2014) found different results when fed biologically treated SBP diets were fed to adult sheep. The biological treatments decreased

(P≤0.05) feed intake compared to untreated SBP and control groups although it increased body weight in adult sheep.

Digestibility trial:

Digestibility coefficients and nutritive values:

Data in Table (4) indicated significant (P≤0.05) difference in digestibility coefficients of all nutrients, fiber fractions and nutritive values. It is of interest to observe that digestibility coefficients of treatments showed the same trend of *in vitro* nutrients disappearance. Biological SBP treatment in T3 significantly (P<0.05) increased DM, OM, EE, CP, CF, NFE, NDF, ADF, ADL, cellulose and hemicellulose digestibility coefficients more than other treatments, followed by T5 and T4, while the lowest digestibility coefficients were obtained for untreated SBP and control group. There was no significant (P≤0.05) difference among T4, control and T2 in digestibility coefficient of EE, and also between T4 and control group in NFE digestibility coefficient. There was no significant (P≤0.05) difference between control group (T1) and untreated group (T2) in the digestibility coefficients of DM, EE, CP, CF and hemicelluloses. These results indicated that the digestibility of untreated SBP in the rumen is good and near to the digestibility of concentrate and this means that partial replacement of concentrate by SBP had good benefits on animal nutrition.

The observed higher nutrient digestibilities as a result of yeast treatment could be related to the microbial activities which solubilizing of carbohydrate esters of phenolic monomers in the cell wall (Khampa et al. 2009).

Data also showed significant (P≤0.05) difference in nutritive values among the experimental groups, being the highest as TDN (g/h/d, g/kg BW, g/kg $BW^{0.75}$ and % of DMI) for yeast group (T3), followed by control group, while the difference between T5 and T4 was slight, and the lowest values were for untreated group (T2). The values were 88.90, 88.55, 87.41, 86.93 and 81.42% as TDN of DMI for T3, T1, T5, T4 and T2, respectively.

Nutritive values as DCP (g/h/d, g/kg BW, g/kg $BW^{0.75}$ and % of DMI) had different trend from TDN as that all biological treatments significantly (P≤0.05) increased the values of DCP more than control and untreated SBP, T3 followed by T5 then T4 had the highest (P≤0.05) values of DCP (g/h/d, g/kg BW, g/kg $BW^{0.75}$ and % of DMI), while, untreated SBP (T2) had the lowest (P≤0.05) values followed by control (T1), being 92.15, 86.19, 84.68, 80.32 and 78.40 DCP % of DMI, respectively.

These results of nutritive values indicated that biological treatments increased TDN and DCP and this reflected the values of nutrient digestibility for rations which indicated that biological treatments were more efficient in digestibility of nutrients compared with control and untreated SBP. In accordance with the present results, Hassan et al. (2005) reported improvement in nutritive values, which are associated with the increased digestion in fibrous materials particularly hemicellulose in addition to the increased bacterial digestion of cell wall content. Also, Allam *et al*., (2006) reported that treated SBP with *Trichoderma viride* and *Sacharomyces cerevisiae* increased DM, OM, CF and fiber fraction (NDF, ADF, cellulose and ADL) digestibility, while CP and EE digestibility was not significantly differed.

Gaafar et al. (2009) found that the digestibilities of CP,CF, DM, OM, EE and total digestible nutrients (TDN) values increased significantly (P≤0.05) with yeast treatment in lactating buffaloes.

Table (4): Effect of biological treatments on nutrient digestibility, fiber fractions and nutritive value of the experimental rations.

Item	Treatment					±SEM
	T1	T2	T3	T4	T5	
Number of animals	4	4	4	4	4	
Digestibility %:						
DM	78.72^{c}	78.04^{c}	85.81^{a}	82.59^{b}	83.22^{b}	0.365
OM	79.77^{d}	78.97^{e}	86.79^{a}	82.10^{c}	83.29^{b}	0.207
EE	86.88^{c}	86.34^{c}	90.29^{a}	87.66^{bc}	88.85^{b}	0.459
CP	80.30^{c}	80.23^{c}	92.14^{a}	84.68^{b}	86.19^{b}	0.932
CF	67.15^{d}	66.10^{d}	75.91^{a}	70.86^{c}	72.72^{b}	0.586
NFE	82.71^{c}	81.41^{d}	86.06^{a}	83.52^{bc}	84.38^{b}	0.339
Fiber fractions:						
NDF	76.56^{c}	72.41^{d}	82.43^{a}	78.89^{b}	80.17^{b}	0.588
ADF	63.49^{c}	61.03^{d}	74.07^{a}	69.88^{b}	71.09^{b}	0.509
ADL	57.31^{c}	54.26^{d}	69.30^{a}	64.72^{b}	65.74^{b}	0.726
Cellulose	69.94^{d}	68.55^{e}	79.29^{a}	73.18^{c}	74.52^{b}	0.387
Hemicellulose	79.37^{c}	78.72^{c}	88.74^{a}	83.16^{b}	84.51^{b}	0.594
Nutritive value:						
TDN g/h/d	1260.45^{b}	1128.09^{e}	1273.35^{a}	1236.13^{d}	1238.99^{c}	0.241
TDN g/kg BW	34.23^{a}	31.55^{c}	34.42^{a}	33.39^{b}	33.65^{ab}	0.246
TDN g/kg $BW^{0.75}$	84.33^{a}	77.16^{c}	84.89^{a}	82.36^{b}	82.88^{b}	0.455
TDN % of DMI	88.55^{b}	81.42^{e}	88.90^{a}	86.93^{d}	87.41^{c}	0.100
DCP g/h/d	129.08^{d}	105.60^{e}	214.70^{a}	183.40^{c}	189.57^{b}	0.031
DCP g/kg BW	3.50^{d}	2.95^{e}	5.80^{a}	4.95^{c}	5.15^{b}	0.034
DCP g/kg $BW^{0.75}$	8.63^{d}	7.22^{e}	14.31^{a}	12.22^{c}	12.68^{b}	0.063
DCP % of DMI	80.32^{d}	78.40^{e}	92.15^{a}	84.68^{c}	86.19^{b}	0.030

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

Moreover, El-Shabrawy et al. (2012) reported an increase in DM and CP digestbilities, nutritive values as TDN and DCP with *Sacharomyces cerevisiae* treatment more than control group in growing calves fed berseem hay and concentrate feed mixture. Also, Kassab and Mohammed (2013) indicated that dried yeast treatment with 4 and 8 g/h/d improved digestibility coefficients of DM, OM, EE, CP, CF and NFE, and also improved nutritive values as TDN and DCP. Also, Aziz (2014) found an increase in biologically treated SBP with fungi, bacterial, yeast or yeast combined with fungi or bacteria. Treatment with combined of *Sacharomyces cerevisiae* and *Trichoderma viride* was more efficient in digestibility coefficient of nutrients and nutritive values (TDN and DCP). On the other hand, Boguhn (2009) found that digestibility coefficient did not differ among treatments when SBP was inclusion in maize based rations for dairy cows. Finaly, El- Bana et al. (2014) reported non significant difference in digestibility coefficient among experimental groups when fed SBP untreated or treated with fibrolytic enzymes for lambs.

Nitrogen balance:

Data in Table (5) showed that biological treatments increased (P≤0.05) nitrogen intake (NI) and digested nitrogen (DN) values more than control and untreated SBP groups. In this respect, T3 had the highest (P≤0.05) values of NI and DN (g/h/d, g/kg BW and g/kg $BW^{0.75}$) followed by T5 and T4, while the lowest values were for untreated group (T2) and control, being 92.15, 86.19, 84.68, 80.32 and 78.40 g DN/h/d for T3, T5, T4, T1 and T2, respectively.

Table (5): Nitrogen balance of goat groups as affected by experimental treatments.

Balance	Item	Treatment					±SEM
		T1	T2	T3	T4	T5	
Nitrogen intake	g/h/d	25.71^{d}	21.55^{e}	37.28^{a}	34.65^{c}	35.19^{b}	0.001
	g/kg BW	0.697^{c}	0.602^{d}	1.01^{a}	0.937^{b}	0.955^{b}	0.006
	g/ kg $BW^{0.75}$	1.72^{d}	1.47^{e}	2.48^{a}	2.30^{c}	2.35^{b}	0.011
Digested nitrogen	g/h/d	20.65^{d}	16.90^{e}	34.35^{a}	29.34^{c}	30.33^{b}	0.007
	g/kg BW	0.560^{d}	0.472^{e}	0.930^{a}	0.795^{c}	0.822^{b}	0.005
	g/ kg $BW^{0.75}$	1.382^{d}	1.152^{e}	2.290^{a}	1.952^{c}	2.032^{b}	0.010
	% of N intake	80.32^{d}	78.40^{e}	92.15^{a}	84.68^{c}	86.19^{b}	0.009
Fecal nitrogen	g/h/d	5.06^{b}	4.66^{d}	2.93^{e}	5.31^{a}	4.86^{c}	0.006
	g/kg BW	0.137^{b}	0.130^{c}	0.080^{d}	0.142^{a}	0.130^{c}	0.003
	g/ kg $BW^{0.75}$	0.337^{b}	0.320^{d}	0.197^{e}	0.355^{a}	0.325^{c}	0.002
	% of N intake	19.68^{b}	21.60^{a}	7.85^{e}	15.32^{c}	13.81^{d}	0.003
Urinary nitrogen	g/h/d	6.21^{ab}	6.41^{a}	5.01^{c}	5.80^{b}	5.73^{b}	0.198
	g/kg BW	0.170^{ab}	0.180^{a}	0.135^{c}	0.155^{b}	0.157^{b}	0.006
	g/ kg $BW^{0.75}$	0.417^{ab}	0.437^{a}	0.332^{c}	0.387^{b}	0.382^{b}	0.012
	% of N intake	24.15^{b}	29.74^{a}	13.45^{d}	16.75^{c}	16.29^{c}	0.647
Total N excretion	g/h/d	11.27^{a}	11.07^{ab}	7.94^{c}	11.11^{ab}	10.59^{b}	0.198
	g/kg BW	0.305^{a}	0.310^{a}	0.212^{c}	0.300^{ab}	0.287^{b}	0.005
	g/ kg $BW^{0.75}$	0.752^{a}	0.755^{a}	0.532^{c}	0.740^{ab}	0.710^{b}	0.011
	% of N intake	43.83^{b}	51.34^{a}	21.30^{d}	32.07^{c}	30.10^{c}	0.647
Nitrogen balance	g/h/d	14.44^{d}	10.49^{e}	29.33^{a}	23.53^{c}	24.59^{b}	0.198
	g/kg BW	0.392^{d}	0.292^{e}	0.792^{a}	0.635^{c}	0.667^{b}	0.008
	g/ kg $BW^{0.75}$	0.967^{d}	0.717^{e}	1.955^{a}	1.570^{c}	1.647^{b}	0.018
	% of N intake	56.16^{c}	48.65^{d}	78.69^{a}	67.92^{b}	69.89^{b}	0.647
	% of digested N	69.93^{c}	62.06^{d}	85.40^{a}	80.20^{b}	81.09^{b}	0.772

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

There was a significant difference among treatments for fecal nitrogen excretion. The highest values (P<0.05) were recorded for bacterial treatment (T4), followed by control (T1), while the lowest (P≤0.05) values were for yeast treatment (T3). Values of fungal treatment (T5) and untreated SBP (T2) were nearly similar. On the other hand, biological treatments decreased (P≤0.05) percentage of fecal N excretion NI and the lowest (P≤0.05) value was for T3, followed by T5 and T3, while the highest (P≤0.05) value was for untreated SBP (T2), followed by control group (T1). Also, biological treatments decreased (P≤0.05) urinary N more than control and untreated group. The lowest (P≤0.05) value was for T3, followed by T5 and T4 with no significant (P≤0.05) difference between them, while the highest (P≤0.05) urinary N was for untreated (T2), followed by control group (T1) with no significant (P≤0.05)

difference between them. It is clear that untreated SBP and control group had the highest (P≤0.05) fecal and urinary nitrogen excretion, because they had the highest (P≤0.05) total nitrogen excretion values among all treatments, being 51.34 and 43.83% of NI, respectively. While, the lowest (P≤0.05) total N excretion was for T3, followed by T4 and T5, being 21.30, 32.07 and 30.10, respectively.

These results reflected in an increase (P≤0.05) in nitrogen balance (g/h/d, g/kg BW, g/kg $BW^{0.75}$,% of NI and % of DN) in all treatments as compared to untreated SBP and control group, being the highest (P≤0.05) for T3, followed by T5 and T4 without significant difference between them, while untreated SBP had the lowest (P≤0.05) value, followed by control group, being 78.69, 69.89, 67.92, 56.16 and 48.65% of NI for T3, T5, T4, T1 and T2, respectively.

The improvement observed in nitrogen balance by biological treatments was a result of less nitrogen excretion or may be related to increasing rumen fermentation. Similar results were obtained by Allam *et al*. (2006) and Aziz (2009), who found an increase in nitrogen balance and NB/IN by treating SBP with *Trichoderma viride* and *Sacharomyces cerevisiae.* Also, Aziz (2014) found an increase in nitrogen balance by biologically treatment of SBP with fungi, bacterial, yeast or yeast combined with fungi or bacteria.

Water balance:

Data in Table (6) showed significant (P≤0.05) difference in free drinking water and total water intake (ml/h/d or ml/Kg $W^{0.82}$) between control (the highest values) and T3 (the lowest values), while the differences among T2, T4 and T5 were not significant (P≤0.05), but did not differed significantly from control and T3. Results showed that the biological treatments decreased combined water (ml/h/d or ml/Kg $W^{0.82}$) especially T3, followed by T5 and T4 with no significant (P≤0.05) difference between them, while untreated SBP had the lowest (P≤0.05) combined water, followed by control group. Metabolic water (ml/h/d or ml/Kg $W^{0.82}$) was the highest in T3, followed by control group, then T5 and T4, while the lowest (P≤0.05) value was for untreated SBP.

Urinary, fecal and total water execration showed the same trend, being the highest (P≤0.05) in T2, followed by control group (T1), while biological treatments had the lowest (P≤0.05) values, although the difference among treatments was not significant (P≤0.05), being the lowest in T3. The difference among treatments in water balance was not significant (P≤0.05), although the data of water balance (% of intake) showed significant (P≤0.05) difference as that T3 had the highest (P≤0.05) water balance and untreated group (T2) had the lowest value, the difference among T5, T4 and control group was not significant (P≤0.05). The values were 89.69, 89.11, 88.83, 87.00 and 85.94 for T3, T5, T4, T1 and T2, respectively.

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

Balance	Item		Treatment					±SEM
			T1	T2	T3	T4	T5	
Water intake	Free	ml/h/d	4000.00^{a}	3900.00^{ab}	3675.00^{b}	3832.50^{ab}	3810.00^{ab}	72.829
		ml/kg W$^{0.82}$	207.78^{a}	202.89^{a}	190.28^{b}	198.33^{a}	202.70^{a}	3.619
	Combined	ml/h/d	109.31^{b}	151.84^{a}	94.82^{d}	103.81^{c}	103.46^{c}	0.145
		ml/kg W$^{0.82}$	5.68^{b}	8.08^{a}	4.91^{d}	5.37^{c}	5.37^{c}	0.033
	Metabolic	ml/h/d	869.71^{b}	778.38^{e}	878.61^{a}	852.93^{d}	854.90^{c}	0.260
		ml/kg W$^{0.82}$	45.20^{ab}	41.44^{d}	45.49^{a}	44.13^{c}	44.43^{bc}	0.266
	Total	ml/h/d	4979.02^{a}	4830.22^{ab}	4648.43^{b}	4789.23^{ab}	4768.36^{ab}	72.81
		ml/-g W$^{0.82}$	258.67^{a}	257.21^{ab}	240.69^{c}	247.84^{bc}	247.80^{bc}	3.129
Water execration	Urinary water	ml/h/d	562.25^{ab}	590.75^{a}	397.50^{b}	450.00^{ab}	433.75^{ab}	56.307
		ml/kg W$^{0.82}$	29.22^{a}	31.45^{ab}	23.29^{ab}	22.43^{ab}	20.65^{b}	2.959
		% of intake	11.24^{ab}	12.23^{a}	9.68^{ab}	9.05^{b}	8.34^{c}	1.076
	Fecal water:	ml/h/d	87.26^{ab}	88.16^{a}	81.74^{c}	84.84^{abc}	83.59^{bc}	0.076
		ml/kg W$^{0.82}$	4.53^{ab}	4.69^{a}	4.23^{c}	4.39^{bc}	4.34^{bc}	0.076
		% of intake	1.75	1.82	1.75	1.77	1.75	0.038
	Total water execration	ml/h/d	649.51^{ab}	678.91^{a}	479.24^{b}	534.84^{ab}	517.34^{ab}	56.90
		ml/kg W$^{0.82}$	33.75^{ab}	36.15^{a}	24.80^{b}	27.66^{ab}	26.89^{ab}	2.992
		% of intake	12.99^{ab}	14.05^{a}	10.31^{b}	11.16^{ab}	10.88^{ab}	1.107
Water balance		ml/h/d	4329.50	4151.30	4169.19	4254.39	4251.02	77.35
		ml/kg W$^{0.82}$	224.91	221.06	215.88	220.17	220.91	3.521
		% of intake	87.00^{ab}	85.94^{b}	89.69^{a}	88.83^{ab}	89.11^{ab}	1.107

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

In agreement with the present results, Fayed *et al*. (2008) and Aziz (2009) found that biological treatments improved water balance (ml/h/d) more than control and untreated group. Also, Aziz (2014) found an improvement in water balance with SBP biologically treated with fungi, bacterial, yeast or yeast combined with fungi or bacteria.

Rumen parameters:

Ruminal pH, concentration of VFAs and molar proportion of individual VFAs:

Data in Table (7) showed that biological treatments decreased (P≤0.05) ruminal pH values as compared to control and untreated group, being the lowest (P≤0.05) for T3 (6048) during different sampling times, followed by T5 (6.60) and T4 (6.64) with no significant difference between them. Control group (T1) had the highest (P≤0.05) ruminal pH value, followed by untreated SBP (T2). Overall mean of ruminal pH at the different sampling times clearly showed the highest value per-feeding (7.19), then it showed a significant (P≤0.05) decrease 4 h post-feeding (6.34), then increased with progressed time 8 h post-feeding (6.56). The trend of change in ruminal pH may be related to ruminal fermentation process by rumen microorganisms. The present results are in agreement with those obtained by El-Ashry et al. (1997), who reported that the minimum pH values were observed 3 h post-feeding with fungal (*P. funiculisms*) treated rice straw.

In addition, data indicated significant (P≤0.05) increase in total VFAs concentration, as that by biological treatments more than untreated SBP and control groups, T3 came in the first class (9.39 mEquiv./100 ml), followed by

T5 (9.10 mEquiv./100 ml) and T4 (8.99 mEquiv./100 ml) with no significant (P<0.05) difference between them, while the lowest value was recorded for untreated group (7.74 mEquiv./100 ml) and control group (7.97 mEquiv./100 ml) with no significant (P≤0.05) difference between them.

The present results are in agreement with those obtained by El-Ashry et al. (1997) reported that the maximum concentration of total VFAs was observed 3 h post-feeding. Also, Kholif et al. (2005) showed that values of ruminal total VFAs increased significantly (P<0.05) with dietary treatment of *Trichoderma viride,* followed by *Saccharomyces cerevisiae* compared with untreated control. El-Shabrawy et al. (2012) reported that pH values and total VFAs concentrations were significantly (P≤0.05) higher at all sampling times (0, 3 and 6 h post feeding) with growing crossbread Frisian male calves fed supplemented ration by *Sacharomyces cerevisiae*.

Table (7): Effect of experimental treatments at different sampling time on ruminal pH, volatile fatty acids and molar proportion of individual VFA's (%):

Item	Time(h)	Treatment					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Ruminal pH value	0	7.60	7.17	6.97	7.12	7.07	0.054	7.19^{a}±0.024
	4	6.67	6.35	6.17	6.25	6.25	0.054	6.34^{c}±0.024
	8	6.87	6.62	6.30	6.55	6.47	0.054	6.56^{b}±0.024
Overall mean		7.05^{a}	7.05^{b}	6.48^{d}	6.64^{bc}	6.60^{c}	0.0316	
TVFAs (ml equiv/100 ml R.L)	0	6.97	6.84	7.67	7.27	7.42	0.146	7.23^{c}±0.065
	4	8.92	8.69	11.26	10.75	10.81	0.146	10.08^{a}±0.065
	8	8.02	7.70	9.25	8.95	9.06	0.146	8.59^{b}±0.065
Overall mean		7.97^{c}	7.74^{c}	9.39^{a}	8.99^{b}	9.10^{b}	0.084	
Molar proportions of individual VFAs (%):								
Acetic	0	32.61	31.92	37.89	35.31	35.57	0.273	34.66^{c}±0.122
	4	38.35	37.18	42.15	41.03	41.16	0.273	39.97^{a}±0.122
	8	35.35	35.25	39.58	38.40	38.48	0.273	37.41^{b}±0.122
Overall mean		35.44^{c}	34.78^{d}	39.87^{a}	38.25^{b}	38.40^{b}	0.158	
Propionic	0	16.85	16.48	20.83	18.35	18.72	0.129	18.24^{c}±0.057
	4	21.05	18.77	26.11	22.68	23.02	0.129	22.32^{a}±0.057
	8	18.80	17.29	23.40	21.25	21.35	0.129	20.41^{b}±0.057
Overall mean		18.90^{d}	17.51^{e}	23.44^{a}	20.76^{c}	21.03^{b}	0.074	
Butyric	0	14.70	14.63	18.14	15.85	16.32	0.239	15.93^{c}±0.107
	4	17.26	16.96	22.03	18.32	19.01	0.239	18.72^{a}±0.107
	8	15.55	15.05	19.22	18.43	18.69	0.239	17.39^{b}±0.107
Overall mean		15.83^{d}	15.55^{d}	19.79^{a}	17.54^{c}	17.54^{b}	0.138	
A/P ratio	0	1.93	1.93	1.82	1.92	1.89	0.018	1.90^{a}±0.008
	4	1.82	1.98	1.61	1.81	1.79	0.018	1.80^{c}±0.008
	8	1.88	2.04	1.69	1.81	1.80	0.018	1.84^{b}±0.008
Overall mean		1.87^{b}	1.98^{a}	1.70^{d}	1.84^{bc}	1.83^{c}	0.0109	

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

Data indicated that biological treatments significantly (P≤0.05) increased molar percentage of acetic, propionic and butyric more than control and untreated SBP, being significantly (P<0.05) higher in T3 than in T5 and T4 for acetic, propionic and butyric, although the difference betweenT5 and T4 was not significant for acetic value, while the lowest values were recorded

for untreated SBP (T2) and control group (T1), although the difference between them was not significant for butyric value. Overall mean of total VFAs concentration and molar proportions of acetic, propionic and butyric at different sampling times clearly showed that the lowest value per-feeding then showed a significant increase (P≤0.05) to reach the highest value 4 h post-feeding then it showed decrease with progressed time 8 h post-feeding.

It is of interest to show that the trend of change in total VFAs concentration was differed from ruminal pH values, as that total VFAs increased with decreasing pH value at different sampling times. Fouad (1991) concluded that the ruminal pH value in general decreased with increasing the total VFAs concentration in lamb rumen. The reduction in ruminal pH values by increasing total VFAs concentration in biologically supplemented goat groups may be due to the fermentation process of feed or increase in cellulolytic ruminal bacterial numbers (Dawson et al. 1990).

As for the acetic to propionic ratio, the values showed significant decrease (P≤0.05) in biological treatments more than untreated and control groups. Untreated SBP (T2) had the highest (P≤0.05) value, followed by control group (T1), while the lowest (P≤0.05) value was recorded for T3, followed T5 and T4, although the difference between each of T4 and T5 or between T4 and control group was slight. Overall mean of acetic /propionic ratio at different sampling times showed the same trend of ruminal pH.

The present results are in agreement with those obtained by Aziz (2014), who reported that biological treatment of SBP with fungi, bacteria, yeast or yeast combined with fungi or bacteria decreased (P≤0.05) ruminal pH values, increased (P≤0.05) total VFAs concentration and molar proportions of acetic, propionic and butyric more than untreated SBP and control, especially treatment with combined of *Sacharomyces cerevisiae* and *Trichoderma viride*. On the other hand, El-Shabrawy et al. (2012) reported non significant (P≤0.05) difference in molar proportions of acetic, propionic, isobutyric and butyric acids between group fed control ration and group fed control ration supplemented with *Sacharomyces cerevisiae*.

The present data indicated that biological treatments of SBP increased propionate production and decreased acetic /propionic ratio which also means an increase in propionate production, this increase in pregnancy period is favorable as that propionate acts a very important role as a major precursor of hepatic gluconeogensis also propionate is a major precursor of meet which in turn help in emperyo growth during pregnancy period.

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

Data in Table (8) indicated that biological treatments significantly (P≤0.05) increased total nitrogen (TN), true protein (TP), non-protein nitrogen (NPN), ammonia nitrogen (NH3-N) and microbial protein (MP) concentrations more than control and untreated SBP. There were insignificant differences in TN and NPN among biological treatments (T3, T5 and T4). Also, there was no significant (P≤0.05) difference in NH3-N between T5 and T4. All parameters were the highest (P≤0.05) in T3, while, T2 had the lowest (P≤0.05) values among all treatments, although the difference between

control and untreated SBP was not significant (P≤0.05) for true protein and NPN values.

The overall means of TN, TP, NPN, NH3-N and MP concentrations at different sampling times showed the lowest (P≤0.05) values per-feeding, then significantly (P≤0.05) increased to reach the highest values 4 h post-feeding, then decreased (P≤0.05) with progressed time of feeding 8 h post-feeding.

Table (8): Effect of biological treatments on total nitrogen, true protein nitrogen, non-protein nitrogen, ammonia nitrogen and microbial protein concentrations (mg/100 ml R.L):

Item	Time (h)	Treatment					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Total nitrogen	0	95.68	91.48	112.89	110.54	110.90	1.958	104.30^{c}±0.875
	4	119.02	114.92	132.25	129.14	129.95	1.958	125.06^{a}±0.875
	8	110.02	106.92	122.38	120.21	120.95	1.958	116.10^{b}±0.875
Overall mean		108.24^{b}	104.44^{c}	122.51^{a}	119.96^{a}	120.60^{a}	1.130	
True protein nitrogen	0	36.04	33.93	47.01	40.22	40.94	1.938	39.63^{c}±0.867
	4	42.65	38.84	51.62	45.02	46.58	1.938	44.94^{a}±0.867
	8	38.86	35.35	49.09	42.16	42.74	1.938	41.64^{b}±0.867
Overall mean		39.18^{c}	36.04^{c}	49.24^{a}	42.46^{b}	43.42^{b}	1.119	
NPN	0	59.64	57.55	65.88	70.32	69.95	2.552	64.67^{c}±1.141
	4	76.37	76.08	80.62	84.12	83.37	2.552	80.11^{a}±1.141
	8	71.15	71.57	73.29	78.04	78.21	2.552	74.45^{b}±1.141
Overall mean		69.05^{bc}	68.40^{c}	73.26^{a}	77.49^{a}	77.17^{a}	1.473	
Ammonia nitrogen	0	29.04	28.42	35.51	31.81	32.17	0.396	31.39^{c}±0.177
	4	34.62	32.80	41.97	36.26	37.24	0.396	36.58^{a}±0.177
	8	31.16	30.36	38.14	33.21	33.82	0.396	33.34^{b}±0.177
Overall mean		31.60^{c}	30.53^{d}	38.54^{a}	33.76^{b}	34.41^{b}	0.229	
Microbial protein	0	63.76	63.40	72.65	68.28	69.17	0.303	67.45^{c}±0.135
	4	107.28	106.95	119.22	111.58	114.25	0.303	111.85^{a}±0.135
	8	85.51	84.60	96.13	91.78	92.13	0.303	90.03^{b}±0.135
Overall mean		85.51^{d}	84.98^{e}	96.00^{a}	90.54^{c}	91.85^{b}	0.175	

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

Increasing TN, TP, NPN, NH3-N and MP concentrations may be due to the increase in CP content and decrease in fiber content, which led to the increase in digestibility coefficients of all nutrients, or may be due to the improvement in microbial population in the rumen which plays an important role in rumen fermentation. Coleman (1980) reported that an increased rumen NH3-N concentration is often associated with the presence of protozoa. Also, microbial protein plays an important role as it analyzed in the abomasum and small intestine by enzymes to produce free amino acids which absorbed in the small intestine and used by the animal in production of meet or milk (Aziz 2009). Moreover, Beever and Siddons (1986) reported that microbial protein synthesized in the rumen accounts for between 50 and 90% of the protein entering the small intestine in ruminants. All these increases are important for pregnancy and lactation periods to produce more milk.

In addition, the present results are supported by the results of El-Sayed et al. (2002) conducting a digestibility trial using Baladi goats fed cotton stalks

supplemented with *Trichoderma viride* and/or yeast (*S. cervevisiae*); they found that ruminal NH3-N concentration, TN, NPN and TP nitrogen were significantly higher for goats fed biologically treated cotton stalks than control. Also, Kholif et al. (2005) indicated that values of rumen NPN increased significantly (P<0.05) with *Trichoderma viride* and *Saccharomyces cerevisiae* compared with control. Also, Aziz, (2014) reported that biological treatment of SBP with fungi, bacteria, yeast or yeast combined with fungi or bacteria increased (P≤0.05) TN, TP, NPN, NH3-N and MP more than untreated SBP and control. Moreover, many authors reported an improvement in rumen fermentation of animals by using biolobical treatments (Aziz 2004, 2009; El-Shabrawy et al. 2012; Kassab and Mohammed 2013).

Ruminal ciliate protozoa:

Data in Table (9) represented the identification of ruminal ciliate protozoa species and their density in the rumen liquor during different sampling times. Seven genera of ruminal protozoa were identified in ruminal fluid of goats in this study. These generas (genus) are *Entodinum spp*., *Epidinium ecaudatum, Diplodinum anisacanthum, Ophryoscolox spp., Polypolastron multivesiculatum, Isotrchia spp.* and *Dasytrachia rummantium*. Results clearly showed that biological treatments significantly (P≤0.05) increased differential and total numbers of ruminal ciliate protozoa ($x10^4$ cell/ml rumen liquor) more than control and untreated SBP, except *Isotrchia spp.,* which showed non significant (P≤0.05) difference among treatments. T3 increased (P≤0.05) number of *Entodinum spp*. and *Dasytrachia spp*. more than other treatments, while, T5 increased (P≤0.05) *Epidinium spp., Diplodinum spp., Ophryoscolox spp.* and *Polyplastron spp*., while T4 came in the third class of biological treatments. The least (P≤0.05) differential numbers of ruminal ciliate protozoa were for untreated SBP (T2), followed by control group (T1), although, there was non significant (P≤0.05) difference between T2 and T1 for the values of *Epidinium spp., Ophryoscolox spp. Polyplastron spp*. and *Dasytrachia spp*. It is clear that, *Entodinum spp*. was the highest number among all differential kinds of species, while, *Diplodinum spp*. was the lowest one. This result is in agreement with results obtained by Franzolin and Deharty (1996), who observed that *Entodinium* constituted approximately 90% of the total protozoal numbers. Also, Ivan *et al*. (2000) reported that *Entodinium* was the most detrimental of ciliate protozoa species.

Data also showed significant (P≤0.05) difference in total number of ruminal ciliate protozoa, being the highest (P≤0.05) for T3, followed by T5 and T4, while, the lowest (P≤0.05) value was for untreated SBP followed by control, being 7.91, 7.91, 7.37, 7.01 and 6.88 for T3, T5, T4, T1 and T2 $x10^4$ cell/ml rumen liquor, respectively. Comparison among different sampling times indicated that protozoa counts showed higher count per-feeding, then decreased (P≤0.05) 4 h post feeding, then showed the highest (P≤0.05) count 8 h post-feeding.

The values obtained in this study are considered as normal level in rumen (Hungate, 1966). It is of interest to show that the trend of change in protozoal counts at different sampling times is associated with the trend of change in ruminal pH value, as protozoal count is increased when ruminal pH

value increased. The environment of rumen become more suitable for protozoa growth, and protozoal count decreased when ruminal pH value become more acidosis.

Table (9): Effect of biological treatments on ruminal ciliate protozoa (x10^4 cell /ml rumen liquor):

Item	Time (h)	Treatment					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Entodinum spp.	0	5.33	5.22	5.75	5.59	5.75	0.056	5.53^{b}±0.025
	4	5.22	5.11	5.44	5.42	5.51	0.056	5.34^{c}±0.025
	8	5.84	5.69	7.54	6.32	6.02	0.056	6.28^{a}±0.025
Overall mean		5.46^{c}	5.34^{d}	6.24^{a}	5.78^{b}	5.76^{b}	0.032	
Epidinium spp.	0	0.189	0.184	0.196	0.191	0.197	0.002	0.191^{b}±0.001
	4	0.157	0.155	0.163	0.157	0.161	0.002	0.158^{c}±0.001
	8	0.203	0.201	0.238	0.235	0.260	0.002	0.227^{a}±0.001
Overall mean		0.183^{c}	0.180^{c}	0.199^{b}	0.194^{b}	0.206^{a}	0.001	
Diplodinum spp.	0	0.152	0.147	0.163	0.157	0.163	0.002	0.156^{b}±0.001
	4	0.115	0.112	0.124	0.121	0.122	0.002	0.119^{c}±0.001
	8	0.198	0.192	0.205	0.201	0.225	0.002	0.204^{a}±0.001
Overall mean		0.155^{d}	0.150^{e}	0.164^{b}	0.160^{c}	0.170^{a}	0.001	
Ophryoscolox spp	0	0.188	0.197	0.199	0.195	0.200	0.001	0.196^{b}±0.008
	4	0.155	0.154	0.163	0.161	0.161	0.001	0.159^{c}±0.008
	8	0.229	0.225	0.239	0.237	0.320	0.001	0.250^{a}±0.008
Overall mean		0.191^{c}	0.192^{c}	0.200^{b}	0.198^{b}	0.227^{a}	0.001	
Polyplastron spp.	0	0.366	0.368	0.381	0.351	0.419	0.006	0.377^{b}±0.002
	4	0.326	0.317	0.342	0.342	0.343	0.006	0.334^{c}±0.002
	8	0.357	0.368	0.433	0.406	0.564	0.006	0.426^{a}±0.002
Overall mean		0.349^{d}	0.351^{d}	0.385^{b}	0.366^{c}	0.442^{a}	0.003	
Isotrchia spp.	0	0.228	0.227	0.231	0.222	0.231	0.004	0.228^{b}±0.002
	4	0.191	0.191	0.192	0.186	0.193	0.004	0.191^{c}±0.002
	8	0.271	0.270	0.289	0.283	0.272	0.004	0.277^{a}±0.002
Overall mean		0.230	0.229	0.237	0.230	0.232	0.002	
Dasytrachia spp.	0	0.405	0.425	0.453	0.443	0.453	0.008	0.436^{b}±0.003
	4	0.402	0.383	0.403	0.401	0.407	0.008	0.399^{c}±0.003
	8	0.496	0.496	0.578	0.499	0.503	0.008	0.514^{a}±0.003
Overall mean		0.434^{c}	0.434^{c}	0.478^{a}	0.448^{bc}	0.454^{b}	0.004	
Total protozoa count	0	6.86	6.76	7.38	7.15	7.41	0.067	7.11^{b}±0.030
	4	6.56	6.42	6.83	6.79	6.90	0.067	6.70^{c}±0.030
	8	7.60	7.44	9.52	8.18	8.16	0.067	8.18^{a}±0.030
Overall mean		7.01^{d}	6.88^{e}	7.91^{a}	7.37^{c}	7.49^{b}	0.039	

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

Similar results were obtained by Aziz (2004, 2009), who reported that addition of *Sacharomyces cerevisiae* to diets increased count and density of ruminal protozoa more than control. Also, Kholif and Aziz (2014) indicated that ruminal protozoa numbers increased with rations treated with fibrolytic enzymes. Moreover, Aziz (2014) found that biological treatment of SBP with fungi, bacteria, yeast or yeast combined with fungi or bacteria increased total and differential numbers of ruminal protozoa more than untreated SBP and control, especially treatment with combined of *Sacharomyces cerevisiae* and *Trichoderma viride*.

Blood composition:

Data in Table (10) indicated that biological treatments significantly (P≤0.05) increased (P≤0.05) serum total proteins and albumin concentration (g/dl) more than control and untreated SBP. Although, the difference among biological treatments was not significant (P≤0.05), T3 had the highest (P≤0.05) values, followed by T5 and T4, while the lowest (P≤0.05) values were obtained for T2, followed by T1 with no significant (P≤0.05) difference between them. It was found that T4 and T1 came in the first class for globulin values (g/dl) with no significant difference (P≤0.05), while T2 followed by T3 and T5 came in the second class with no significant difference. Data also indicated that T3 followed by T5 had the highest (P≤0.05) albumin/globulin ratio with no significant difference (P≤0.05), while T4 and T1 followed by T2 had the lowest (P≤0.05) values with no significant difference (P≤0.05).

Table (10): Effect of biological treatments on blood biochemical concentration and enzyme activity of AST and ALT.

Item	Time (h)	Treatment					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Total proteins (g/dl)	0	7.92	7.69	8.44	8.87	8.64	0.245	8.31^{b}±0.109
	4	8.72	8.10	9.79	9.00	9.41	0.245	9.00^{a}±0.109
Overall mean		8.32^{b}	7.89^{b}	9.11^{a}	8.93^{a}	9.02^{a}	0.173	
Albumin (g/dl)	0	4.35	3.84	5.22	4.80	5.31	0.279	4.71^{b}±0.125
	4	4.64	4.47	6.20	4.85	6.01	0.279	5.23^{a}±0.125
Overall mean		4.50^{bc}	4.16^{c}	5.71^{a}	4.82^{b}	5.66^{a}	0.197	
Globulin (g/dl)	0	3.56	3.84	3.22	4.06	3.32	0.167	3.60±0.075
	4	4.07	3.62	3.59	4.15	3.39	0.167	3.76±0.075
Overall mean		3.81^{a}	3.73^{ab}	3.40^{b}	4.11^{a}	3.36^{b}	0.118	
AL/GL ratio	0	1.22	1.02	1.68	1.19	1.60	0.117	1.34±0.052
	4	1.14	1.24	1.73	1.17	1.77	0.117	1.41±0.052
Overall mean		1.18^{b}	1.13^{b}	1.70^{a}	1.18^{b}	1.68^{a}	0.083	
Urea (mg/dl)	0	29.50	31.71	22.59	24.24	25.26	1.947	26.66^{b}±0.870
	4	38.73	37.22	27.84	28.80	27.57	1.947	32.03^{a}±0.870
Overall mean		34.11^{a}	34.47^{a}	25.22^{b}	26.52^{b}	26.42^{b}	1.377	
AST (U/L)	0	22.70	22.84	20.65	22.70	22.85	0.836	22.35^{b}±0.374
	4	25.56	25.57	23.21	23.83	23.89	0.836	24.41^{a}±0.374
Overall mean		24.13^{a}	24.21^{a}	21.93^{b}	23.26^{ab}	23.37^{ab}	0.591	
ALT (U/L)	0	4.33	4.33	3.83	4.43	4.33	0.422	4.25^{b}±0.188
	4	5.94	6.30	4.60	5.58	5.28	0.422	5.54^{a}±0.188
Overall mean		5.13^{ab}	5.31^{a}	4.21^{b}	5.00^{ab}	4.80^{ab}	0.298	

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

Biological treatments decreased (P≤0.05) serum urea concentration (mg/dl) more than untreated SBP and control groups, but the difference among biological treatments was not significant (P≤0.05), also the difference between T2 and control groups was not significant (P≤0.05) which had the highest values. Biological treatments of SBP only in T3 significantly (P≤0.05) decreased activity of serum AST and ALT as compared to other treatments which had insignificant effect. As affected by sampling time, all blood parameters were higher (P≤0.05) 4 h post-feeding than pre-feeding values.

These results showed that biological treatments of SBP did not cause any lesions in liver and kidney functions.

It seems that blood parameters were in the normal physiological range with no adverse effect on health of goats during pregnancy. Similar results were obtained by Helal and Abel-Rahman (2010), Shabrawy et al. (2012), Kassab and Mohammed (2013) and Hassan (2014), who found that the mean values of blood metabolites were higher in treated animals with yeast. Also, Aziz (2014) reported that biological treatment of SBP with fungi, bacteria, yeast or yeast combined with fungi or bacteria increased (P≤0.05) serum total proteins, albumin and globulin, while, serum urea values, while AST and ALT activities decreased (P<0.05). On the other hand, El-Bana et al. (2014) indicated that the differences in all blood parameters except total proteins among groups fed SBP untreated or treated with fibrolytic enzymes were not significant.

Goat performance during pregnancy and lambing:

Data in Table (11) indicated insignificant effect of treatments on goats performance. Conception rate and lambing rate were 100% with no abortion or stillbirth cases found in all groups. Number of kids for each group was 8 kids that indicated one twining case for each group with twining rate of 14.29 %. No mortality cases were found after birth in goats kids.

Table (11): Effect of experimental treatments on goats performance during pregnancy and lambing:

Items	Treatments				
	T1	T2	T3	T4	T5
Conception rate (%)	100	100	100	100	100
Lambing rate (%)	100	100	100	100	100
Number of kids	8	8	8	8	8
Twining rate (%)	14.29	14.29	14.29	14.29	14.29
Mortality	0	0	0	0	0

Lactation trial:

Body weight and feed intake:-

Data in Table (12) showed that during early lactation stage, control group and T4 had the highest (P≤0.05) body weight (kg) with no significant (P≤0.05) difference, while the lowest (P≤0.05) weights were for untreated SBP. During mid and late lactation stages, biological treatments increased (P≤0.05) body weight more than control and untreated SBP, being the highest (P≤0.05) in T3, while, T2 had the lowest (P≤0.05) weights. It is clear that, biological treatments increased (P≤0.05) body weight during all lactation stages more than control and USBP. Overall mean indicated that body weight increased (P≤0.05) by progressed time of lactation stages. Body weight change during lactation stages was higher in biological treatments more than control and untreated SBP, the highest (P≤0.05) was for T3, while, the lowest (P≤0.05) was for T2.

These results are supported by Aziz (2014), who reported that biological treatment of SBP with fungi, bacteria, yeast or yeast combined with fungi or bacteria increased (P≤0.05) body weight.

Data also indicated significant (P≤0.05) difference in feed intakes (g/h/d, g/kg BW and g/ kg $BW^{0.75}$). Biological treatments increased (P≤0.05) feed intake more than untreated SBP and control groups. At early lactation stage, T3

significantly (P≤0.05) increased feed intake (g/h/d) followed by T4 then T5, while the lowest value was for untreated SBP, followed by control. At mid lactation stage, T3 had the highest (P≤0.05) intake (g/h/d), there was no significant (P≤0.05) among T4, T5 and control, while T2 showed the lowest intake. At late lactation stage, T3 came in the first class followed byT5, there was no significant (P≤0.05) difference between T4 and control group, while T2 had the lowest (P≤0.05) feed intake.

Table (12): Effect of biological treatments on body weight and feed intake of goat does during lactation period:

Item	Treatment					±SEM	Overall mean
	T1	T2	T3	T4	T5		
Body weight (kg):							
Early lactation	31.40^{a}	30.72^{d}	31.21^{c}	31.38^{a}	31.29^{b}	0.066	31.20^{c}±0.029
Mid lactation	32.15^{d}	31.67^{e}	33.21^{a}	32.24^{c}	32.43^{b}	0.066	32.34^{b}±0.029
Late lactation	33.43^{d}	32.62^{e}	34.51^{a}	33.62^{c}	33.75^{b}	0.066	33.59^{a}±0.029
Overall mean	32.33^{c}	31.67^{d}	32.98^{a}	32.41^{bc}	32.49^{b}	0.038	
Body weight change	2.03^{cd}	1.90^{d}	3.30^{a}	2.24^{bc}	2.46^{b}	0.086	
Feed intake:							
g/h/d:							
Early lactation	1294.45^{b}	1236.11^{c}	1319.05^{ab}	1353.88^{a}	1293.97^{b}	4.080	1299.49^{c}±1.828
Mid lactation	1386.22^{b}	1375.78^{c}	1456.74^{a}	1392.79^{b}	1403.45^{ab}	4.080	1403.00^{b}±1.828
Late lactation	1474.74^{b}	1467.07^{c}	1502.31^{a}	1477.97^{b}	1491.64^{a}	4.080	1482.74^{a}±1.828
Overall mean	1385.14^{d}	1359.65^{e}	1426.03^{a}	1408.21^{b}	1396.35^{c}	2.360	
g/kg BW:							
Early lactation	41.24^{c}	40.23^{d}	42.27^{b}	43.14^{a}	41.36^{c}	0.137	41.65^{c}±0.061
Mid lactation	43.12	43.44	43.86	43.20	43.27	0.137	43.38^{b}±0.061
Late lactation	44.12^{ab}	44.97^{a}	43.53^{c}	43.95^{b}	44.19^{ab}	0.137	44.15^{a}±0.061
Overall mean	42.82^{b}	42.88^{b}	43.22^{a}	43.43^{a}	42.94^{b}	0.079	
g/ kg $BW^{0.75}$:							
Early lactation	97.61^{c}	94.72^{d}	99.90^{b}	102.11^{a}	97.81^{c}	0.307	98.43^{c}±0.137
Mid lactation	102.67^{c}	103.05^{b}	105.29^{a}	102.94^{c}	103.27^{b}	0.307	103.44^{b}±0.137
Late lactation	106.08^{b}	107.47^{a}	105.51^{c}	105.84^{c}	106.52^{b}	0.307	106.29^{a}±0.137
Overall mean	102.12^{bc}	101.75^{c}	103.57^{a}	103.63^{a}	102.54^{b}	0.177	

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

Overall mean of treatments showed significant (P≤0.05) differences among treatments, T3 showed the highest feed intake (g/h/d), followed by T4, T5, T1, then T2. Overall mean of feed intake significantly (P≤0.05) increased by progressed stage of lactation, late lactation stage was more than mid lactation stage, while early lactation was the lowest value.

Similar results were obtained by El-Shabrawy et al. (2012), who found an increase (P≤0.05) in feed intake (kg/h) as DM, DCP and TDN with *Sacharomyces cerevisiae* treatment more than control ration which contained berseem hay and concentrate feed mixture. On the other hand, El-Bana et al. (2014) indicated that there was no significant difference in DM intake among groups fed SBP untreated or treated with fibrolytic enzymes.

Milk yield and composition:

Data in Table (13) indicated that milk yield, 4% fat corrected milk and milk composition (total solid, fat, solids not fat, total protein, lactose and Ash) were

significantly (P≤0.05) higher for goats fed biologically treated SBP more than those fed control and untreated SBP. In this way, T3 had the highest (P≤0.05) milk yield and 4% fat corrected milk, followed by T5 and T4 with no significant difference, On the other hand, there was no significant difference between goats fed USBP and those fed control. It is clear that, milk yield, 4% fat corrected milk and milk composition significantly (P≤0.05) increased by progressed stage of lactation. Except fat, total protein and ash, it decreased by progressed stage of lactation. The decrease of milk fat content by progressed stage of lactation may be possibly attributed to the increase of milk yield by progressed stage of lactation, indicating a negative relationship between milk yield and milk fat percentage.

Table (13): Effect of biological treatments on milk yield and composition of goat does during different lactation periods.

Item	Stage	Treatment					±SEM	Overall mean
		T1	T2	T3	T4	T5		
Milk yield (ml/h/d)	Early	817.85	814.28	901.42	858.57	862.85	6.237	851.00^{c}±2.78
	Mid	867.14	862.14	957.85	900.71	903.57	6.237	898.28^{b}±2.78
	Late	951.42	948.57	1190.71	1122.14	1129.28	6.237	1068.42^{a}±2.78
Overall mean		878.80^{c}	875.00^{c}	1016.66^{a}	960.47^{b}	965.23^{b}	3.601	
4% FCM (ml/h/d)	Early	747.40	742.92	850.27	794.31	800.75	6.298	787.13^{c}±2.81
	Mid	790.22	784.17	901.48	829.70	835.32	6.298	828.18^{b}±2.81
	Late	862.33	857.10	1113.95	1027.41	1034.94	6.298	979.15^{a}±2.81
Overall mean		799.98^{c}	794.73^{c}	955.23^{a}	883.81^{b}	890.33^{b}	3.636	
Milk composition (%):								
Total solids	Early	12.20	12.17	12.82	12.30	12.32	0.010	12.36^{c}±0.004
	Mid	12.21	12.18	12.83	12.31	12.33	0.010	12.37^{b}±0.004
	Late	12.22	12.22	12.86	12.32	12.34	0.010	12.39^{a}±0.004
Overall mean		12.21^{d}	12.19^{e}	12.84^{a}	12.31^{c}	12.33^{b}	0.005	
Fat	Early	3.42	3.41	3.62	3.50	3.52	0.012	3.49^{a}±0.005
	Mid	3.40	3.39	3.60	3.47	3.49	0.012	3.47^{b}±0.005
	Late	3.37	3.35	3.57	3.43	3.44	0.012	3.43^{c}±0.005
Overall mean		3.40^{c}	3.39^{c}	3.59^{a}	3.47^{b}	3.48^{b}	0.007	
Solids not fat	Early	8.77	8.75	9.20	8.80	8.80	0.015	8.86^{c}±0.007
	Mid	8.80	8.78	9.23	8.84	8.84	0.015	8.90^{b}±0.007
	Late	8.85	8.86	9.29	8.89	8.90	0.015	8.96^{a}±0.007
Overall mean		8.81^{c}	8.80^{c}	9.24^{a}	8.84^{b}	8.84^{b}	0.009	
Total protein	Early	3.63	3.62	3.86	3.74	3.77	0.008	3.73^{a}±0.003
	Mid	3.61	3.60	3.83	3.72	3.75	0.008	3.70^{b}±0.003
	Late	3.57	3.55	3.81	3.69	3.71	0.008	3.67^{c}±0.003
Overall mean		3.60^{d}	3.59^{d}	3.84^{a}	3.72^{c}	3.75^{b}	0.004	
Lactose	Early	3.84	3.80	4.25	4.13	4.14	0.024	4.03^{c}±0.010
	Mid	4.10	4.09	4.41	4.30	4.38	0.024	4.26^{b}±0.010
	Late	4.27	4.26	4.68	4.48	4.51	0.024	4.44^{a}±0.010
Overall mean		4.07^{c}	4.05^{c}	4.45^{a}	4.31^{b}	4.34^{b}	0.013	
Ash	Early	0.962	0.962	1.017	1.00	1.014	0.003	0.992^{a}±0.001
	Mid	0.957	0.955	0.991	0.983	0.984	0.003	0.974^{b}±0.001
	Late	0.948	0.944	0.987	0.980	0.981	0.003	0.968^{c}±0.001
Overall mean		0.956^{c}	0.954^{c}	0.998^{a}	0.990^{b}	0.993^{ab}	0.002	

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

In accordance with the present improvement in milk yield, Titi and Lubbadeh (2004) found that increased milk production may be attributed to improved nutrient digestion after enzyme supplementation by ewes and goats. Also, Zheng et al. (2000) reported that total solids in milk of biologically treated dairy cows tended to be higher reflecting the higher fat and protein yields.

Increased milk lactose content may be due to the improvements in feed digestibility, specifically, the increase in ruminally fermented OM, which resulted in a numerical downward shift in the ratio of acetate to propionate, would have increased delivery of glucogenic precursors to the mammary gland (Yang et al. 1999). Similar results were obtained by Kholif et al. (2005) and Kholif and Aziz (2014), who reported that biological treatments improved milk yield and composition. Moreover, Kassab and Mohammed (2013) indicated that dried yeast supplementation with 4 and 8 g/h/d increased daily milk yield, and percentages of total solids and protein of milk.

Kids performance:

Data presented in Table (14) showed that biological treatments increased (P≤0.05) birth weight, being the highest in T3, followed by T5 and T4 with no significant (P≤0.05) differences among them. Also, there were no significant (P≤0.05) differences among T5, T4, T2 and T1. The differences in body weight were significant (P≤0.05) during the first, second and third (weaning) month, being the highest (P≤0.05) in T3, while the difference between T2 and T1 was not significant.

Table (14): Body weight and growth rate of lambs of goat does fed different experimental diets.

Item	Treatment					±SEM
	T1	T2	T3	T4	T5	
Body weight (kg) :						
Birth weight	2.33^{b}	2.33^{b}	2.45^{a}	2.38^{ab}	2.40^{ab}	0.024
1st month	5.19^{d}	5.20^{d}	5.91^{a}	5.50^{c}	5.63^{b}	0.046
2nd month	8.81^{c}	8.84^{c}	9.31^{a}	9.03^{b}	9.08^{b}	0.029
Weaning weight	12.47^{c}	12.50^{c}	13.05^{a}	12.70^{b}	12.77^{b}	0.034
Growth rate (g/h/d):						
1st month	95.29^{c}	95.91^{c}	115.62^{a}	103.95^{b}	107.91^{b}	1.515
2nd month	120.75^{a}	121.16^{a}	113.08^{b}	117.70^{ab}	115.00^{ab}	2.032
3rd month	121.79^{d}	122.00^{c}	124.62^{a}	122.50^{b}	122.91^{b}	1.285
Overall mean	112.60^{c}	113.02^{c}	117.77^{a}	114.72^{b}	115.27^{b}	0.524

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

Data of growth rate showed the same trend of body weight during first, second month and weaning weight. These results of body weight and growth rate indicated that biological treatments were more efficient than control and untreated SBP. In agreement with the present results, El-Shabrawy et al. (2012) reported that addition of *Sacharomyces cerevisiae* to ration containing berseem hay and concentrate feed mixture increased body increased average daily gain by 33.34 % in growing calves. Also, Kassab and Mohammed (2013) indicated that dried yeast supplementation with 4 and 8 g/h/d increased weaning weight and daily gain of lambs. Moreover, El-Bana

et al. (2014) found that body weight, total gain and daily gain increased in groups fed SBP untreated or treated with fibrolytic enzymes.

CONCLUSION

Biological treatments of SBP improved chemical composition, fiber fraction, nutrient digestibility coefficients, nitrogen balance, rumen fermentation, milk yield and milk composition. Therefore, the current study could be concluded that, inclusion of untreated or biologically treated SBP to replace 30% of common concentrate feed mixture of during pregnancy and lactation stages had remarkable improved influence on goat performance.

REFERENCES

Abedo, A.A.; M.A. El-Ashry; A.Y. El-Badawi; F.I.S. Helal and M. Fadel (2005). Effect of feeding biologically treated sugar beet pulp on growth performance of sheep. Egyptian J. Nutrition and Feeds., 8: 579-590.

Agriculture Economics, (2000). Institute of Agric. Economics Ministry of Agric., Egypt.

Allam, M. Sabbah; T.M. Al-Bedawi; Hanaa H. El-Amary and Shereen H. Mohamed (2006). Improving sugar beer pulp through biological treatment and its use in sheep ration. Egyptian J. Nutrition and Feeds. 9(2): 235-247.

A.O.A.C. (1990). Official methods of analysis of the Association of Official Agricultural Chemists. Washington. D.C., USA.

Aziz, Hend. A. (2004). Studies on effect of some non hormonal growth promoters on growth rate and some rumen parameters in small ruminants under desert condition. M. Sc. Thesis, Fac. of Agric., Ain Shams Univ.

Aziz, Hend. A. (2009). Effect of feeding olive tree pruning by-products in Sinai on sheep performance. Ph. D. thesis, Fac. of Agric., Ain Shams Univ.

Aziz, Hend. A. (2014). Effect of biologically treated sugar beet pulp on chemical composition, nutrients disappearance, digestibility, rumen fermentations, rumen microbes and blood composition in adult sheep. J. Agric. Sci. Mansoura Univ., 5(12): 647-671.

Beever D.E. and R.C. Siddons (1986). Digestion and metabolism in the grazing ruminant. In Control of Digestion and Metabolism in Ruminants, pp. 479-497 In: L. P. Milligan, W. L. Grovum, A. Dobson, (editors). New Jersey: Prentice-Hall.

Boguhn, J.; H.Kluth; M. Bulang; T. Engelhard and M. Rodehutscard (2009). Effect of pressed sugar beet pulp silage inclusion in maize based rations on performance of high- yield dairy cows and parameters of rumen fermentation. Anim. Feed Sci. Technol. 4:1, 30-39.

Boucque, C.H.V.; B.G. Cottyn; J.V. Aerts and F.X. Buysse (1976). Dried sugar beet pulp as a high energy feed for beef cattle. Anim. Feed Sci. and Technol, 1:643.

Chikunya, S., C.J. Newbold, L.Rode, X.B. Chen and R.J. Wallace (1996). Influence of dietary rumen degradable protein on bacterial growth in the rumen of sheep receiving different energy sources. A.nim. Feed Sci. and Technol., 63: 1-4, 333.

Coleman G.S. (1980). Advances in Parasitology 18, 121-173.

Dawson, K.A.; K.E. Neuman; J.A. Boling (1990). Effects of microbial supplements containing yeast and lactobacilli on roughage-fed ruminal microbial activities. J Anim Sci 68, 3392-3398.

Dehority, B. A. (1993). Laboratory Manual for classification and Morphology of rumen ciliate protozoa. CRC. Press Inc., Florida.

Doumas, W and H. Biggs (1971). Albumin standards and measurement of serum with bromocresol green. din. Chern. Acta. 31: 87.

Duncan, D.B. (1955). Multiple range and multiple F-test. Biometrics. 11:1-42.

El-Ashry M.A.; M.F. Ahmed; S.A. El-Saadany; M.E.S. Youssef ; I.A. Gommaa and T.A.A. Deraz (1997). Effect of mechanical vs. mechano-chemical or mechano-biochemical treatments of crop residues on their use in ruminant rations: Digestibility, nitrogen balance and some blood and rumen liquor parameters of sheep. Egyptian J. Nutrition and Feeds, 1: (Special Issue): 173-186.

El-Ashry, M.A.; Zeba A. Motagally and Y.A. Maareck (2000). Effect of dried sugar beet pulp in dairy buffalo ration on colostrums, milk yield and composition. Egyptian J. Nutrition and Feeds. 3 (1): 15-22.

El- Bana, H.M.; G.M.Abdul Aziz; A.E.M. Mahmoud and H. A.F.Rahmy (2014). Growth performance of Barki lambs fed on rations containing dried sugar beet pulpwith or without fibrolytic enzymes. Egyptian J. Nutrition and Feeds. 17 (2): 237-246.

El-Sayed H.M.; M.A. El-Ashry; H.M.Metwall; M. Fadel; M.M. Khorshed (2002). Effect of chemical and biological treatments of some crop residues on their nutritive value: 3- Digestion coefficient, rumen and blood serum parameters of sheep. Egyptian J. Nutr. and Feeds, 5 (1): 55-69.

El-Shabrawy, H.M.; M. Hoda El-Hosseiny and I.M. Abou-Elenin (2012). Role of malic acid, malate salts and yeast culture as feed additives on performance of growing crossbread Frisian male calves. Egyptian J. Nutr. and Feeds, 15(3):471-483.

Fayed, M. Afaf; bdel Gany, F. Bouthaina and Emam, S. Shalabia (2008). Nutrional studies on sheep fed some SALT plants treated with bacteria in Sinai. Egyptian J. Nutrition and Feeds. 11(1):93-106.

Fouad, R.T. (1991). Effect of some mechanical treatments and feed additives on the nutritional value of corn stalks. M.Sc. Thesis, Fac. Of Aric., Al-Azhar Univ.

Franzolin, R. and B.A. Dehority (1996). Effect of Prolonged High-concentrate feeding on Ruminal protozoa concentration. J. Anim. Sci. 74: 2803-2809.

Gaafar, H.M.A.; A.M.A. El-Din; Basiuoni andb K.F.A. El-Riedy (2009). Effect of concentrate to roughage ratio and baker's yeast supplementation during hot season on performance of lactating buffaloes. Slovak J.Anim. Sci., 42(4): 188-195.

Gaines, W L. (1928). The energy basis of measuring energy milk in dairy cows. Univ Illinois Agric.

Hassan, A.A.; M.H.M. Yacout; M.K.K. Mohsen; M.I. Bassiouni and M. Abd El-All (2005). Banana wastes (Musa acuminate L.) silage treated biologically or with urea for dairy cows feeding. Egyptian J.Nutr. and Feeds, 8(1) Special Issue:49-61.

Hassan, E.H. (2014). Effect of fenugreek and dried baker's yeast as Natural additives on growth performance, nutrient digestibility and rumen fermentation parameters of growing buffalo calves. Egyptian J. Nutrition and Feeds. 17(1):1-8.

Helal, F.I.S. and K. A. Abel-Rahman (2010). Producteve performance of lactating ewes fed diets supplementing with dry yeast and / or bentonite as feed additives. World Journal of Agriculture Science, 6(5):489-498.

Hungate, R.E. (1966). The Rumrn and its Microbes. Academic Press Inc., New York and London.

Ivan, M.; L. Neill; R. Forster; R. Alimon; T.L.M. Rode and T. Entz (2000). Effects of Isotricha, Dasytricha, Entodinium, and total Fauna on Ruminal fermentation and duodenal flow in wethers fed different diets. J. Dairy Sci. 83: 776-787.

Kassab, A.Y. and A.A. Mohammed (2013). Effect of dietary live dried yeast on some physiological responses and productive performances in Sohagi ewes. Egyptian J. Nutrition and feeds. 16(2):213-223.

Khampa, S.; P. chaowwarat; R. Singhalert; R. Pilajun and M. Wanapat (2009). Supplementation of yeast fermented Cassava chip as a replacement concentrate on rumen fermentation efficiency amd digestibility of nutrients in heifer. J.Anim. and Vet. Advances. 8(6):1091-1095.

Kholif, A.M.; M.A. El-Ashry; H.A. El-Alamy; H.M. El-Sayed; M. Fadel; and S.M. Kholif (2005). Biological treatments of banana wastes for feeding lactating goats. Egyptian J. Nutrition and feeds. (2): 149-162. Kholif, A.M. and H.A. Aziz (2014). Influence of feeding cellulytic enzymes on performance, digestibility and ruminal fermentation in goats. Animal Nutrition and Feed Technology,14: 121-136.

Makkar H.P.S.; O.P. Sharma; R.K. Dawra; S.S. Negi (1982). Simple Determination of Microbial Protein in Rumen Liquor. J. Dairy Sci., 65:2170-2173.

Molina, A.E., A.I.G. Martin and J.F. Aguilera (2000). Comparative study of nutrient digestibility, Kinetics of degradation and passage and rumen fermentation pattern in goats and sheep offered good quality diets.J. of livestock Prod. Sci., 64:2-3, 215.

Norris, K.H. (1976). Predicting forage quality by infrared reflectance spectroscopy. J.Anim. Sci., 43:889.

Ogimoto, K. and S. Imai (1981). Atals of Rumen Microbial-Ogy. Japan Scientific Societies Press, ToKyo.

Patton, C. J. and S.R. Crouch (1977). Anal. Chem.49: 464-469.

Reitman, S. and S. Frankel (1957). Colorimetric method for the determination of serum glutamic-oxaloacetic and glutamic-pyruvate transaminase. Ann. J. Clin. Pathol., 28: 56.

Saleh, M.S.; Eweedah; M. F. Ali and M.K. Mohsen (2001). Comparison between dried sugar beet pulp and yellow corn of energy with berseem in rations of growing lambs. Egyptian J. Nutrition and Feeds. 4 (Special Issue):231-239.

SAS (2000). Statistical Analysis systems Institute Inc., Release 8.1, Cary, NCs USA.

Statistics of Ministry of Agriculture, Egyptian (2011). Economic Affairs, Sector of Agricultural statistics. 2011.

Talha, M.H.; R.I. Moawad; G.H. Zaza and E.E. Ragheb (2002). Effect of partial substitution of corn grains by dried sugar beet pulp in growing lambs rations on their productive performance. J. Agric Sci. Mansoura Univ., 27(8): 5193-5199.

Terry, R.A.; J.M.A. Tilley and G.E. Outen (1969). Effect of pH on cellulose digestion under *in vitro* Conditions. J. SciF. Agric., 20:317.

Titi, H. and W.F. Lubbadeh (2004). Effect of feeding cellulase enzyme on productive responses of pregnant and lactating ewes and goats. Small Ruminant Research, 52: 137-143.

Van Soest, P. J.; J.B. Robertson and B.A. Lewis (1991). Methods for dietry fiber, neutral detergent fiber and non-starch polysaccharides on animal nutrition. J. Dairy, Sci. 74,3583.

Warner, A.C.J. (1964). Production of volatile fatty acids in the rumen methods of measurments. Nutr. Abst.&rev.34:339.

Yang, W.Z.; K.A. Beauchemin and L.M. Rode (1999). Effects of an enzyme feed additive on extent of digestion and milk production of lactating dairy cows. Journal of Dairy Science, 82: 391-403.

Zheng, W.; D.J. Schingoethe; G.A. Stegeman; A.R. Hippen and R.J. Treachert (2000). Determination of when during the lactation cycle to start feeding a cellulase and xylanase enzyme mixture to dairy cows. Journal of Dairy Science, 83: 2319.

تأثير تفل بنجر السكر المعامل بيولوجياً على أداء الماعز الحلابة

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الهدف من هذه الدراسة تقييم تأثير تفل بنجر السكر غير معامل أو معامل بيولوجيا ليحل محل ٣٠ % من مخلوط المركزات الشائع فى علائق الماعز. تم إجراء تجربة هضم معملى لدراسة تأثير عليقة المقارنة و تفل بنجر السكر غير معامل أو معامل على معدل أختفاء المواد الغذائية معملياً. 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 بالخميرة + دريس برسيم. معاملة (٤): مخلوط مركزات+ تفل بنجر السكر معامل بالبكتريا + دريس برسيم. . معاملة (٥): مخلوط مركزات+ تفل بنجر السكر معامل بالفطر + دريس برسيم. تم تقسيم عدد ٣٥ من أناث الماعز البرقى (حوالى ٤ سنوات عمر و وزن حوالى ٣٠ كجم) و غذيت على نفس المعاملات السابقة و استمرت التجربة لمدة ٢٧٠ يوم لدراسة تأثير المعاملات على أداء أناث الماعز خلال فترة الحمل و الولادة و على أداء الجداء حتى الفطام. و تم إجراء تجربة هضم خلال الشهر الثالث من الحمل. و قد أظهرت النتائج أن المعاملات البيولوجية أدت إلى زيادة معنوية فى وزن الجسم و فى الغذاء المأكول. كما أدت المعاملات البيولوجية إلى تحسن معنوي فى كلا من التركيب الكميائى و معامل هضم المواد الغذائية و ميزان النيتروجين و الماء و تخمرات الكرش و محصول و مكونات اللبن و وزن الميلاد و الفطام. و يتضح مما سبق أن استخدام تفل بنجر السكر غير معامل أو معامل بيولوجيا له تأثير ملحوظ على أداء الماعز خلال فترة الحمل و الولادة.