# EFFECT OF THE BIOLOGICAL TREATMENT FOR SUGAR BEET PULP ON NUTRIENTS DIGESTIBILITY AND GROWTH PERFORMANCE OF SHEEP LAMBS UNDER DESERT CONDITIONS

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# SUMMARY

eplacement of part of yellow corn by dried sugar beet pulp untreated or biologically treated by Saccharomyces cerevisiae, Trichoderma viride or Cellulomonas cellulasea to represent 40% of the concentrate feed mixture had done in the present study to investigate its effect on rumen fermentations and microbes, blood parameters, nutrients digestibility, nutritive value, rate of passage in the rumen, nitrogen and water balances and lambs performance. Twenty five weaned Barki ewes lambs were randomly divided into five groups to conduct growth trail followed by digestibility trail. Lambs fed on five rations: R (1): Concentrate feed mixture (CFM) + berseem hay (BH) (control), R (2): CFM contained untreated SBP + BH, R (3): CFM contained SBP treated with S. cerevisiae + BH, R (4): CFM contained SBP treated with T. viride + BH. R (5): CFM contained SBP treated with C. cellulasea + BH. The ratio of CFM to BH was 60%: 40% in all rations. The main results indicated that biological treatments for SBP significantly increased ( $P \le 0.01$ ) ruminal pH values, total ruminal VFA's, microbial protein, ammonia nitrogen, non-protein nitrogen, true protein, total nitrogen concentrations and ruminal protozoa numbers. Also, R3, R4 and R5 increased the concentrations of blood serum glucose, total proteins, albumin and creatinine. Also, these treatments achieved the highest ( $P \le 0.01$ ) feed intake digestion coefficients, nutritive values, rate of passage in the rumen, nitrogen and water utilization comparing with untreated group, which reversed on lambs performance as increasing body weight, average daily gain, feed efficiency and economic efficiency comparing to R2. Results of rations contained biological treated SBP were near to those of control.

Keywords: Sugar beet pulp, biological treatments, digestibility and lambs performance.

# INTRODUCTION

The lack of sufficient feeds to meet the nutritional requirements of existing animal population is one of the most critical problems of animal production in Egypt. Furthermore, increasing cost of conventional feeds had stimulated interest in easily available and less costly feed substitutes. The gap between the availability and requirements of animal feed in Egypt is about 9 million tons of dry matter equivalents to almost 4 million tons of total digestible nutrients (TDN) per year (Bendary *et al.*, 2006), therefore efforts allowed some by-products and organic wastes with the aim of decreasing the animals feed shortage.

Several methods were applied to increase the digestibility and the feeding value of agro-industrial byproducts to diminish the gape of farm animal feeds (Ministry of Agriculture 2016). In Egypt, the total planted area of sugar beet was about 504 thousand faddans (Agriculture Economics, 2015). Sugar beet pulp (SBP) is the by-product of sugar extracting industry from sugar beet.

Mohamed and Abou-Zeina (2008) and Aly (2012) stated that using microbiological treatments to the initially degradation of the cell wall constituents of the agro-industrial by-products to lead to more susceptible of ruminal microbial activity and fermentations is a very useful alternative method than physical and chemical treatments. Several of microorganisms have been reported to be use in diet of ruminants to upgrade feed utilization and animal performance. Treating sugar beet pulp with yeast, bacteria or fungus that secrete enzymes like as cellulases, hemicellulases, legninases that destruct the cell wall structure became nowadays an acceptable method to improve the feeding value of roughages, forages, farm and plant crop wastes (Sherien, 2005; Abd El-Maged, 2006 and Abd El-Fattah, 2013).

The main objective of the present study was to evaluate the effect of replacing 40% yellow corn in concentrate feed mixture by dried sugar beet pulp untreated or biologically treated by *Saccharomyces cerevisiae, Trichoderma viride* or *Cellulomonas cellulasea* on rumen fermentations and microbes, blood parameters, nutrients digestibility, nutritive value, rate of passage in the rumen, nitrogen and water balances and lambs performance.

## MATERIALS AND METHODS

A growth and a digestibility trails were carried out at Ras Sudr Experimental Research Station, Desert Research Center, located in Southern Sinai Governorate, Egypt, from February to July (2019), to investigate the effect of feeding diets contained sugar beet pulp (SBP, untreated or biologically treated with yeast, fungi or bacteria) as agriculture by-products on digestion coefficients, nutritive values, nitrogen and water balance, rumen fermentations and microbes, some blood components and growing lambs performance.

#### Biological treatments for sugar beet pulp:

#### Microorganisms:

Microorganisms (*Trichoderma viride, Saccharomyces cerevisiae* and *Cellulomonas cellulasea*) 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.

#### Production of treated sugar beet pulp:

Amount of 100 kg of air-dried sugar beet pulp were moistened for 60 % moisture and inculcated with each microorganism. The used fungi, bacterial and yeast were added by ratio of 150 ml media to 100 kg ration plus 10 % molasses solution from the dry matter as a source of energy. The mixture put in plastic bag and kept closed, the inculcation lasted for 14 days at  $30 \pm 2$  °C, then bags were opened and oven dried at 70 °C for chemical analysis.

#### Growth trial:

Barki ewe lambs (twenty five weaning lambs, about 3-4 months old and 12.50 kg live body weight) were used in this experiment. Lambs were randomly divided into five groups; each group had fed one of the following rations:

R (1): Concentrate feed mixture (CFM) + berseem hay (BH) control.

R (2): CFM contained untreated SBP + BH.

- R (3): CFM contained SBP treated with Saccharomyces cerevisiae + BH.
- R (4): CFM contained SBP treated with *Trichoderma viride* + BH.

R (5): CFM contained SBP treated with Cellulomonas cellulasea + BH.

The concentrate feed mixture of control (R1) consisted of yellow corn (55%), wheat bran (20%), soya bean meal (15%), molasses (5%), limestone (3%), salt (1.5%) and minerals premix (0.5%). while concentrate feed mixture for R2, R3, R4 and R5 consisted of yellow corn (15%), 40% sugar beet pulp, wheat bran (20%), soya bean meal (15%), molasses (5%), limestone (3%), salt (1.5%) and minerals premix (0.5%), SBP represented 40 % of CFM. The ratio of CFM to BH was 60%: 40% in all treatments.

All animals were fed their daily diets free in feedlot according to average body weight, which was changing every two weeks. The concentrate and roughage were offered twice daily at 7 am and 1 pm. The offered and the refusals feed were weighted daily and the animals were weighted every two weeks. Fresh water had excess to the animals twice daily at 8 am and 2 pm. This experiment lasted for 180 days.

#### **Digestibility trails:**

At the end of the growing trail, three lambs from each treatment were randomly chosen and used in digestibility trial to determine nutrients digestibility, nutritive value, nitrogen balance and water utilization. Lambs were placed in metabolic cages for 20 days, the first 15 days were considered as an adaptation and preliminary period, the last 5 days were as a collection period. The daily amount of feed consumed, residuals, feces, urine and drinking water were estimated for each animal during the collection period.

Lambs through the experiments were fed their daily ration according to their live body weight according to Kearl (1982).

Chemical compositions of feedstuffs, untreated SBP and biologically treated with yeast, fungi or bacteria and experimental rations are presented in Tables (1 and 2).

 Table (1): Chemical composition and cell wall constituents of untreated and biologically treated sugar beet pulp.

Item	USBP	SBPS	SBPT	SBPC
Chemical composition % on DM basis:				
DM	91.10	93.00	92.90	92.82
OM	90.60	92.90	92.80	92.91
Ash	9.40	7.10	7.20	7.09
EE	1.18	2.24	2.10	2.08
CP	9.20	20.85	20.25	20.10
CF	24.40	19.98	19.98	20.02
NFE	55.82	49.83	50.47	50.71
NFC	19.80	15.77	16.33	16.53
Cell wall constituents % on DM basis:				
NDF	60.42	54.04	54.12	54.20
ADF	29.05	24.40	24.95	25.06
ADL	2.84	1.95	2.00	2.15
Hemicellulose	31.37	29.64	29.17	29.14
Cellulose	26.21	22.45	22.95	22.91

*CFM: concentrate feed mixture, BH: berseem hay, USBP: untreated SBP, SBPS: SBP treated with S. cerevisiae, SBPT: SBP treated with T. viride, SBPC: SBP treated with C. cellulasea.* 

	Feeds	stuffs			Rations		
Item	CFM	BH	R1	R2	R3	R4	R5
Chemical composition % on	DM basis:						
DM	93.80	91.24	90.69	90.50	91.26	91.22	91.18
OM	92.00	88.01	88.93	91.56	90.48	90.44	90.49
Ash	8.00	11.99	11.07	8.44	9.52	9.56	9.51
EE	3.10	2.55	2.61	2.07	2.49	2.43	2.43
СР	12.49	14.00	11.86	10.12	14.78	14.54	14.48
CF	11.32	26.61	21.01	22.98	21.21	21.21	21.23
NFE	65.09	44.85	53.45	56.41	52.00	52.26	52.35
NFC	45.43	8.50	16.38	19.70	16.09	16.31	16.39
Cell wall constituents % on I	OM basis:						
NDF	30.98	62.96	58.07	59.67	57.12	57.15	57.19
ADF	17.75	44.44	32.84	32.97	31.11	31.33	31.37
ADL	7.82	7.13	12.82	10.99	10.63	10.65	10.71
Cellulose	13.23	18.52	20.02	21.98	20.48	20.68	20.66
Hemicellulose	9.93	37.31	25.23	26.71	26.01	25.83	25.81

Table (2): Chemical composition and cell wall constituents of feedstuffs and the experimental rations.

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP+ *BH*. *R*(3): *CFM* contained SBP treated with S.cerevisiae + *BH*. *R*(4): *CFM* contained SBP treated with T. viride + *BH*. *R*(5): *CFM* contained SBP treated with C.cellulasea + *BH*.

## Laboratory analysis:

Feeds and feces were determined according to the AOAC (1999). Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent leginin (ADL) were determined according to the procedures of Van Soest (1994).

#### Rumen liquor parameters and microbes:

Samples of rumen liquor were collected at the end of each month at 4 hours post feeding from the five lambs of each treatment. pH was immediately measured using a digital pH meter. Total volatile fatty acids were estimated according to Warner (1964). Total nitrogen, non-protein nitrogen and ammonia nitrogen concentrations were determined using the methods of AOAC (1999), true protein nitrogen was calculated (TN-NPN). Ruminal microbial protein was estimated as described by Makkar *et al.* (1982).

Description by Dehority (1993) used to publish the identification of genera and species of ruminal ciliate protozoa, while it's counts were determined using the method described by Ogimoto and Imai (1981). Dilution series were prepared under  $O_2$ -free and presence of  $CO_2$  by the anaerobic method of Bryant (1972) using the anaerobic diluents described by Mann (1968) to determine cellulolytic bacteria number.

## Analysis of blood sampling:

Blood samples were collected at the end of each month at 4 hours post-feeding from the five lambs of each treatment. Total protein was determined by using electronic apparatus, albumin was analyzed according to Doumas and Biggs (1971) and globulin was calculated by subtracting. Patton and Crouch (1977) method was used to analyze urea concentration. Blood GOT and GPT was analyzed according to Wikison *et al.* (1972).

#### Rate of passage:

A single dose of 5 grams chromium oxide  $(Cr_2O_3)$  was given to each animal, 5 grams of  $Cr_2O_3$  was dissolved in 250 ml distilled water and drenched to animal once at morning before feces collection. In the second day of digestibility trail before feeding, 25 grams of fecal samples for the rate of passage were collected at 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58, 62, 66, 70, 74 hours to calculated the rate of passage by fecal marker concentration curves, according to Grovum and Williams (1973). Fecal samples were dried and preserved for Cr analysis by ICAP. Concentration of Cr in digestive tract sections and feces was determined by ICAP after digestion of 0.2 g DM in 15 ml of a 5:1 mixture of Nitric (0.6 v/v) acids according to Devega and Poppi (1997).

#### Statistical analysis:

Statistical analysis of data was done using SAS, (2009). One-way analysis design was used to analyze body weight, daily gain, digestion coefficients, nutritive value, nitrogen and water utilizations, the statistical model was:

$$Y_{ij} = \mu + T_i + e_{ij}.$$

Where:  $Y_{ij}$ = experimental observation,  $\mu$ =general mean,  $T_i$ =effect of treatment and  $e_{ij=}$  the experimental error.

Complete block design was used for analysis rumen fermentations parameters, rumen microbes and blood parameters, the statistical model was:

$$Y_{ijk} = \mu + T_i + M_j + (TM)_{ij} + M_k + (TM)_{ik} + e_{ijk}$$

Where:  $Y_{ijk}$ = experimental observation,  $\mu$ = general mean,  $T_i$ = effect of treatment,  $M_j$ : effect of time, TMij: interaction between treatment and time and  $e_{ijk}$ = the experimental error.

Duncan's multiple test used to carry out the separation among means (Duncan, 1955).

## **RESULTS AND DISCUSSION**

#### Effect of rations on rumen parameters:

The results of rumen parameters are illustrated in Tables (3 and 4). Biological treatments for SBP significantly increased ( $P \le 0.01$ ) ruminal pH values for lambs fed those rations more than lambs fed control or untreated SBP, the highest value was for R5 followed by R4 then R3, while the lowest pH value was recorded for R1. Total ruminal VFA's concentration (ml equivalent/100 ml) showed non-significant difference among rations contained biological treated SBP which significant increased ruminal TVFA's concentration more than rations contained untreated SBP and control groups. The present results showed that

TVFA's take the same trend of pH thus the rumen pH, while, Fouad (1991) reported that concluded that the rumen pH in general decreased with increasing the TVFA's concentration in lambs rumen. Variation in rumen pH might be responsible for the changes in other ruminal metabolites. Fouad (1991) found that the changes in the rumen pH affected microorganisms activates and consequently the mutability concentrations.

The concentrations of microbial protein, ammonia nitrogen, non-protein nitrogen, true protein, and total nitrogen (mg/100 ml) showed highly significant (P $\leq$ 0.01) difference among all rations. Lambs fed biologically treated SBP had the highest (P $\leq$ 0.01) values comparing with those fed control and untreated SBP, R5 had the highest (P $\leq$ 0.01) values of all parameters followed by R4 then R3 with high significant difference, except that the difference between R4 and R3 was not significant for the concentrations of ammonia nitrogen and non-protein nitrogen. While R2 had the lowest (P $\leq$ 0.01) concentrations of all parameters followed by R1.

All rumen parameters values showed gradual increase ( $P \le 0.01$ ) by progressed age of lambs, the lowest values of ruminal pH, total volatile fatty acids, total nitrogen, non-protein nitrogen and ammonia nitrogen were at the first month, while the highest values were at the sixth month. Except that true protein nitrogen concentrations didn't show any change by progressed age of lambs.

Increasing ruminal parameters values by using biological treated SBP may be due to the increase of crude protein content and the decrease of fiber content which reversed on the increase of all nutrients digestibility, or may be due to the improvement of ruminal microbial populations which have very important effect on rumen fermentations (Aziz 2009).

The interaction between the ration and the age of lambs showed that the lowest (P $\leq 0.01$ ) values of ruminal pH and TVFA's were for R1 at the first month, while the highest (P $\leq 0.01$ ) value was for R5 at the six month. While the lowest (P $\leq 0.01$ ) values of all other rumen parameters were for R2 at the first month and the highest (P $\leq 0.01$ ) values were for R5 at the six month.

	_			Ration			_	
Item	Month	R1	R2	R3	R4	R5	±SE	Overall mean
pН	$1^{st}$	5.52	5.78	6.06	6.14	6.24	0.053	$5.94^{f} \pm 0.024$
	$2^{nd}$	6.06	6.26	6.51	6.84	6.86	0.053	$6.50^{e} \pm 0.024$
	$3^{rd}$	6.16	6.31	6.64	6.90	7.05	0.053	$6.61^{d} \pm 0.024$
	$4^{\text{th}}$	6.61	6.89	7.22	7.48	7.69	0.053	$7.18^{\circ} \pm 0.024$
	$5^{\text{th}}$	6.92	7.15	7.54	7.61	7.78	0.053	$7.40^{b} \pm 0.024$
	$6^{\text{th}}$	7.10	7.38	7.63	7.78	7.88	0.053	$7.55^{a}\pm0.024$
overall mean		6.39 <sup>d</sup>	6.62 <sup>e</sup>	6.93 <sup>c</sup>	$7.12^{b}$	$7.25^{a}$	0.021	
TVFA's, ml	$1^{st}$	6.49	6.57	7.64	7.94	7.34	0.239	$7.20^{e} \pm 0.107$
equivalent	$2^{nd}$	7.46	6.86	7.69	7.79	7.96	0.239	$7.55^{d} \pm 0.107$
/100 ml	$3^{rd}$	8.32	8.16	8.50	8.90	8.99	0.239	$8.57^{\circ} \pm 0.107$
	$4^{\text{th}}$	8.53	8.10	8.82	9.05	9.11	0.239	$8.72^{\circ} \pm 0.107$
	$5^{\text{th}}$	8.94	8.22	9.20	9.59	9.79	0.239	$9.15^{b} \pm 0.107$
	$6^{th}$	9.84	8.60	10.03	10.09	10.20	0.239	$9.75^{a}\pm0.107$
overall mean		8.26 <sup>b</sup>	7.75 <sup>°</sup>	8.65 <sup>a</sup>	8.89 <sup>a</sup>	$8.90^{a}$	0.097	

Table (3): Rumen pH and total volatile fatty acids of growing lambs fed the experimental rations.

*Means with different letters with each row and column are significantly different (P* $\leq$ 0.01).

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP+ BH. *R*(3): *CFM* contained SBP treated with S.cerevisiae + *BH*. *R*(4): *CFM* contained SBP treated with T. viride + *BH*. *R*(5): *CFM* contained SBP treated with C.cellulasea + *BH*.

The present results are supported by the results of El-Ashry *et al.* (2003), Kholif *et al.* (2005) who showed that ruminal TVFAs significantly (P<0.05) increased by feeding lactating goats banana wastes treated with *T. viride* or *S. cerevisiae* compared with the non-treated banana wastes. El-Shabrawy *et al.* (2012) reported that pH values and total VFA's concentrations were significantly (P $\leq$ 0.05) higher for growing crossbreed Frisian male calves fed supplemented ration by *S. cerevisiae*. Moreover, El-Badawi *et al.* (2003), Sherien (2005) and Saleh (2007) stated that the protein content of SBP that have disappearance value of 65.37% was changed to a great extent to microbial protein that contains nucleic acids that is undigested or poorly digested in rumen and absorbed in small intestine. With this respect, El-Badawi (2007) concluded that rumen parameters and microbial protein production was improved with rations containing

biologically treated SBP. Aziz (2014 and 2019) found that ruminal pH and total VFA's concentrations of adult sheep were improved with ration contains SBP treated with *T. viride*, *S. cerevisiae* and *C. cellulasea* more than untreated SBP and control.

				Rations				
Item	Month	R1	R2	R3	R4	R5	±SE	Overall mean
Microbial	$1^{st}$	73.85	68.35	75.02	75.93	77.39	0.190	$74.11^{\circ} \pm 0.085$
protein, mg/100	$2^{nd}$	73.33	70.13	73.59	76.08	77.99	0.190	$74.22^{\circ} \pm 0.085$
	$3^{rd}$	78.34	74.23	78.48	79.07	81.08	0.190	$78.24^{a}\pm0.085$
	$4^{\text{th}}$	75.16	72.47	76.35	77.70	80.45	0.190	$76.42^{b} \pm 0.085$
	$5^{\text{th}}$	74.68	73.11	76.86	78.44	80.51	0.190	$76.72^{b} \pm 0.085$
	$6^{th}$	75.05	74.04	76.75	77.64	79.34	0.190	$76.56^{b} \pm 0.085$
overall mean		75.07 <sup>d</sup>	72.05 <sup>e</sup>	76.17 <sup>c</sup>	77.47 <sup>b</sup>	79.46 <sup>a</sup>	0.077	
Ammonia,	$1^{st}$	11.07	9.40	11.26	11.64	11.83	0.108	$11.04^{f} \pm 0.048$
nitrogen mg/ 100	$2^{nd}$	12.00	11.25	12.29	12.43	12.57	0.108	$12.11^{e} \pm 0.048$
ml	$3^{rd}$	13.46	12.76	13.76	13.78	13.90	0.108	$13.53^{d} \pm 0.048$
	$4^{\text{th}}$	13.93	13.59	14.41	14.32	15.07	0.108	$14.26^{\circ} \pm 0.048$
	$5^{\text{th}}$	15.16	14.57	15.25	15.20	15.37	0.108	$15.11^{b} \pm 0.048$
	$6^{th}$	15.58	15.21	15.81	15.89	15.94	0.108	$15.69^{a} \pm 0.048$
overall mean		13.53 <sup>c</sup>	12.79 <sup>d</sup>	13.80 <sup>b</sup>	13.88 <sup>b</sup>	14.11 <sup>a</sup>	0.044	
NPN, mg/100	$1^{st}$	16.61	14.10	16.89	17.47	17.75	0.162	$16.56^{f} \pm 0.072$
ml	$2^{nd}$	18.00	16.88	18.43	18.65	18.85	0.162	$18.16^{e} \pm 0.072$
	$3^{rd}$	20.19	19.13	20.64	20.67	20.86	0.162	$20.30^{d} \pm 0.072$
	$4^{\text{th}}$	20.90	20.38	21.62	21.48	22.61	0.162	$21.40^{\circ} \pm 0.072$
	$5^{\text{th}}$	22.74	21.86	22.88	22.81	23.05	0.162	22.67 <sup>b</sup> ±0.072
	$6^{th}$	23.37	22.82	23.72	23.84	23.92	0.162	$23.53^{a} \pm 0.072$
overall mean		$20.30^{\circ}$	$19.20^{d}$	$20.70^{b}$	$20.82^{b}$	$21.17^{a}$	0.066	
True protein	$1^{st}$	26.17	25.18	27.07	28.40	29.14	0.110	27.19±0.049
nitrogen, mg/	$2^{nd}$	26.25	25.19	27.11	28.38	29.07	0.110	27.20±0.049
100 ml	$3^{rd}$	25.85	25.02	26.77	28.32	29.06	0.110	$27.00 \pm 0.049$
	$4^{\text{th}}$	26.08	25.01	26.67	28.17	28.69	0.110	26.92±0.049
	$5^{\text{th}}$	25.88	25.18	26.81	28.36	29.00	0.110	$27.04 \pm 0.049$
	$6^{th}$	26.40	25.03	26.87	28.42	29.14	0.110	27.17±0.049
overall mean		$26.10^{d}$	25.10 <sup>e</sup>	26.88 <sup>c</sup>	28.34 <sup>b</sup>	29.01 <sup>a</sup>	0.045	
Total nitrogen,	$1^{st}$	42.78	39.28	43.96	45.87	46.89	0.190	$43.75^{f} \pm 0.085$
mg/100 ml	$2^{nd}$	44.25	42.07	45.55	47.03	47.93	0.190	$45.37^{e} \pm 0.085$
	$3^{rd}$	46.04	44.16	47.42	49.00	49.92	0.190	$47.31^{d} \pm 0.085$
	$4^{\text{th}}$	46.99	45.39	48.29	49.66	51.31	0.190	48.33°±0.085
	5 <sup>th</sup>	48.62	47.04	49.70	51.17	52.05	0.190	$49.72^{b} \pm 0.085$
	$6^{th}$	49.78	47.86	50.59	52.26	53.06	0.190	$50.71^{a} \pm 0.085$
overall mean		46.41 <sup>d</sup>	44.30 <sup>e</sup>	47.58 <sup>c</sup>	49.16 <sup>b</sup>	50.19 <sup>a</sup>	0.077	

 Table (4): Microbial protein, ammonia nitrogen, NPN, total nitrogen, true protein nitrogen of growing lambs fed experimental treatments.

Means with different letters with each row and column are significantly different ( $P \leq 0.01$ ).

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP+ BH. *R*(3): *CFM* contained SBP treated with S.cerevisiae + BH. *R*(4): *CFM* contained SBP treated with T. viride + BH. *R*(5): *CFM* contained SBP treated with C.cellulasea + BH.

## Effect of feeding sugar beet pulp on ruminal ciliate protozoa and cellulolytic bacteria:

Ruminal ciliate protozoa species and their account and cellulolytic bacteria account in the rumen liquor are represented in Tables (5a and b). The results indicated that biological treatments significantly increased ( $P \le 0.01$ ) total and differential numbers of ruminal ciliate protozoa ( $x10^4$  cell/ml) more than control and untreated groups, except that control group had higher density of *Epidinium spp*. more than biological and untreated SBP. The difference was significant ( $P \le 0.01$ ) among R3, R4 and R5 for the account of differential and total protozoa count, whereas, R4 had the highest account of *Entodinum, Polyplastron, Ophryoscolox, Dasytrachia spps* and total protozoa count, however, R5 and R3 had the highest account of *Diplodinum* and

*Isotrchia spps.* Control group was higher than R2 for all species, except for *Polyplastron* and *Isotrchia spps.* Also, R2 was higher than R5 and R3 for *Polyplastron spps.* The most appearance among all differential kinds of ciliate protozoa species was for *Entodinum spp.* Rations containing untreated or treated SBP (P $\leq$ 0.01) increased cellulolytic bacteria numbers (x10<sup>6</sup> cell /ml) more than control group; also, treated SBP was (P $\leq$ 0.01) higher than untreated. The highest value was for R5 followed by R4 then R3, the values were 4.031, 3.892, 3.521, 3.521 and 2.908 x10<sup>6</sup> cell /ml; respectively.

The interaction between the ration and the age of lambs showed that the lowest ( $P \le 0.01$ ) account of ruminal total ruminal protozoa was for R2 at the first month, while the highest ( $P \le 0.01$ ) value was for R4 at the six month. While the lowest ( $P \le 0.01$ ) account of cellulolytic bacteria was for R1 at the first month and the highest ( $P \le 0.01$ ) account was for R5 at the six month.

				Ration				
Item	Month	R1	R2	R3	R4	R5	±SE	Overall mean
Entodinum spp.	$1^{st}$	1.998	1.844	2.462	2.580	2.226	0.055	$2.222^{f} \pm 0.246$
	$2^{nd}$	2.278	2.428	2.798	3.044	3.092	0.0550	2.728 <sup>e</sup> ±0.246
	3 <sup>rd</sup>	3.154	2.636	3.852	3.828	3.518	.055	$3.397^{d} \pm 0.246$
	$4^{\text{th}}$	4.012	3.000	4.118	4.150	3.966	0.055	$3.849^{\circ} \pm 0.246$
	$5^{\text{th}}$	4.402	3.600	5.032	5.052	4.696	0.055	4.556 <sup>b</sup> ±0.246
	$6^{th}$	4.286	3.894	5.150	5.354	5.042	0.055	$4.745^{a}\pm0.246$
overall mean		3.355 <sup>d</sup>	$2.900^{e}$	3.902 <sup>b</sup>	4.001 <sup>a</sup>	3.756 <sup>c</sup>	0.022	
Diplodinum spp.	$1^{st}$	0.055	0.053	0.050	0.058	0.067	0.033	$0.057^{f} \pm 0.147$
	$2^{nd}$	0.072	0.068	0.066	0.075	0.083	0.033	$0.073^{e} \pm 0.147$
	$3^{rd}$	0.087	0.083	0.080	0.090	0.098	0.033	$0.088^{d} \pm 0.147$
	4 <sup>th</sup>	0.095	0.093	0.089	0.098	0.107	0.033	$0.096^{\circ} \pm 0.147$
	5 <sup>th</sup>	0.108	0.105	0.102	0.111	0.119	0.033	$0.109^{b} \pm 0.147$
	$6^{th}$	0.123	0.120	0.116	0.125	0.135	0.033	$0.124^{a} \pm 0.147$
overall mean		$0.090^{\circ}$	$0.087^{d}$	$0.084^{e}$	0.093 <sup>b</sup>	$0.101^{a}$	0.134	
Epidinium spp.	1 <sup>st</sup>	0.061	0.050	0.054	0.055	0.188	0.040	$0.081^{\circ} \pm 0.182$
	$2^{nd}$	0.369	0.063	0.068	0.069	0.074	0.040	$0.129^{a} \pm 0.182$
	$3^{rd}$	0.089	0.079	0.084	0.085	0.091	0.040	$0.085^{\circ} \pm 0.182$
	4 <sup>th</sup>	0.098	0.090	0.095	0.096	0.101	0.040	$0.096^{b} \pm 0.182$
	5 <sup>th</sup>	0.110	0.102	0.107	0.108	0.115	0.040	$0.108^{b} \pm 0.182$
	$6^{th}$	0.127	0.122	0.127	0.129	0.135	0.040	$0.128^{a} \pm 0.182$
overall mean		$0.142^{a}$	$0.084^{e}$	$0.089^{\circ}$	$0.090^{\circ}$	0.117 <sup>b</sup>	0.016	
Polyplastron	1 <sup>st</sup>	0.091	0.111	0.075	0.146	0.088	0.032	$0.102^{t} \pm 0.146$
spp.	$2^{nd}$	0.136	0.154	0.120	0.190	0.132	0.032	$0.146^{e} \pm 0.146$
	$3^{rd}$	0.162	0.181	0.146	0.216	0.158	0.032	$0.172^{d} \pm 0.146$
	4 <sup>th</sup>	0.192	0.212	0.177	0.246	0.189	0.032	$0.203^{\circ} \pm 0.146$
	5 <sup>th</sup>	0.220	0.238	0.204	0.274	0.216	0.032	0.230 <sup>b</sup> ±0.146
	$6^{th}$	0.306	0.325	0.290	0.361	0.302	0.032	$0.316^{a} \pm 0.146$
overall mean		$0.185^{\circ}$	0.203 <sup>b</sup>	$0.168^{e}$	0.239 <sup>a</sup>	0.181 <sup>d</sup>	0.133	
Ophryoscolox	1 <sup>st</sup>	0.035	0.044	0.047	0.060	0.046	0.031	$0.046^{d} \pm 0.138$
spp.	$2^{nd}$	0.156	0.054	0.056	0.069	0.054	0.031	$0.078^{\circ} \pm 0.138$
	$3^{rd}$	0.053	0.063	0.063	0.206	0.063	0.031	$0.090^{bc} \pm 0.138$
	$4^{\text{th}}$	0.083	0.092	0.093	0.107	0.092	0.031	$0.093^{bc} \pm 0.138$
	5 <sup>th</sup>	0.109	0.119	0.120	0.134	0.119	0.031	$0.120^{ab} \pm 0.138$
	6 <sup>th</sup>	0.139	0.148	0.152	0.165	0.150	0.031	$0.151^{a} \pm 0.138$
overall mean		0.096	$0.087^{\circ}$	$0.088^{\circ}$	0.123 <sup>a</sup>	$0.087^{c}$	0.012	

Table (5a): Identification and account of ruminal ciliate protozoa species and cellulolytic bacteria of growing lambs fed the experimental rations.

Means with different letters with each row and column are significantly different ( $P \le 0.01$ ).

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP+ BH. *R*(3): *CFM* contained SBP treated with S.cerevisiae + BH. *R*(4): *CFM* contained SBP treated with T. viride + BH. *R*(5): *CFM* contained SBP treated with C.cellulasea + BH.

The obtained values of ruminal protozoa considered as normal level in rumen (Hungate, 1966). The reason for the beneficial effect of protozoa may be their digestive capacity, their effect on the specific growth rate of the bacteria or some general effects on the rumen environment (Kurihara *et al.*, 1968). Several factors seem to influence the concentration and composition of the protazoal fauna in the rumen; these include composition of diet, pH, turnover rate, frequency of feeding and feed level among others. It seems that diets containing between 40 to 60% concentrate supported maximal protozoa numbers with a diverse fauna containing species in most of the genera (Dehority and Orpin, 1988).

These results are in accordance with these obtained by Jouany *et al.* (1998) who found that addition of live yeast culture to ruminant diet increased protozoa count. Ivan *et al.* (2000) found that *Entodinium* was the most detrimental of ciliate protozoa species. Shakweer (2003) observed that biological treatments for rice straw and sugarcane bagasse increased protozoa counts.

				Ration				
Item	Month	R1	R2	R3	R4	R5	±SE	Overall mean
Dasytrachia spp.	$1^{st}$	0.094	0.082	0.111	0.136	0.120	0.118	$0.109^{f} \pm 0.052$
	$2^{nd}$	0.133	0.120	0.149	0.173	0.158	0.118	$0.147^{e} \pm 0.052$
	$3^{rd}$	0.171	0.159	0.188	0.213	0.197	0.118	$0.186^{d} \pm 0.052$
	$4^{\text{th}}$	0.213	0.202	0.230	0.255	0.239	0.118	$0.228^{\circ} \pm 0.052$
	$5^{\text{th}}$	0.253	0.248	0.276	0.301	0.286	0.118	$0.273^{b} \pm 0.052$
	$6^{\text{th}}$	0.358	0.346	0.374	0.399	0.382	0.118	$0.372^{a} \pm 0.052$
overall mean		$0.204^{d}$	0.193 <sup>e</sup>	0.221 <sup>c</sup>	$0.246^{a}$	$0.230^{b}$	0.048	
Isotrchia spp.	$1^{st}$	0.015	0.058	0.166	0.065	0.069	0.027	$0.075^{\circ} \pm 0.092$
	$2^{nd}$	0.047	0.110	0.105	0.117	0.121	0.027	$0.100^{\circ} \pm 0.092$
	3 <sup>rd</sup>	0.079	0.140	0.135	0.148	0.152	0.027	$0.131^{b} \pm 0.092$
	$4^{\text{th}}$	0.098	0.163	0.158	0.170	0.174	0.027	$0.153^{ab} \pm 0.09$
	$5^{\text{th}}$	0.111	0.177	0.172	0.184	0.189	0.027	$0.167^{a} \pm 0.092$
	$6^{\text{th}}$	0.121	0.188	0.183	0.196	0.201	0.027	$0.178^{a} \pm 0.092$
overall mean		$0.079^{d}$	0.139 <sup>c</sup>	0.153 <sup>a</sup>	$0.147^{b}$	$0.151^{a}$	0.084	
Total protozoa	$1^{st}$	2.351	2.244	2.967	3.103	2.806	0.081	$2.694^{f} \pm 0.036$
count	$2^{nd}$	3.193	3.000	3.364	3.739	3.716	0.081	$3.402^{e} \pm 0.036$
$x10^4$ cell /ml	3 <sup>rd</sup>	3.798	3.343	4.551	4.788	4.278	0.081	$4.152^{d} \pm 0.036$
rumen liquor	$4^{\text{th}}$	4.794	3.853	4.961	5.124	4.870	0.081	4.720 <sup>c</sup> ±0.036
1	$5^{\text{th}}$	5.315	4.592	6.015	6.167	5.741	0.081	$5.566^{b} \pm 0.036$
	$6^{th}$	5.462	5.145	6.394	6.730	6.348	0.081	$6.016^{a} \pm 0.036$
overall mean		4.152 <sup>d</sup>	3.696 <sup>e</sup>	4.709 <sup>c</sup>	$4.942^{a}$	4.627 <sup>b</sup>	0.033	
Cellulolytic	$1^{st}$	2.404	2.992	3.020	3.386	3.526	0.056	$3.065^{f} \pm 0.025$
bacteria numbers	$2^{nd}$	2.568	3.138	3.176	3.550	3.682	0.056	3.222 <sup>e</sup> ±0.025
x10 <sup>6</sup> cell /ml	3 <sup>rd</sup>	2.734	3.306	3.352	3.722	3.856	0.056	$3.394^{d} \pm 0.025$
rumen	$4^{\text{th}}$	2.930	3.512	3.536	3.910	4.054	0.056	$3.588^{\circ} \pm 0.025$
	$5^{\text{th}}$	3.280	3.856	3.898	4.264	4.414	0.056	3.942 <sup>b</sup> ±0.025
	$6^{\text{th}}$	3.536	4.108	4.148	4.524	4.654	0.056	$4.194^{a}\pm0.025$
overall mean		2.908 <sup>e</sup>	3.485 <sup>d</sup>	3.521 <sup>c</sup>	3.892 <sup>b</sup>	4.031 <sup>a</sup>	0.023	

 Table (5b): Continual identification and account of ruminal ciliate protozoa species and cellulolytic bacteria of growing lambs fed the experimental rations.

Means with different letters with each row and column are significantly different ( $P \leq 0.01$ ).

*R*(1): *CFM* + BH. *R*(2): *CFM* contained USBP+ BH. *R*(3): *CFM* contained SBP treated with S.cerevisiae + BH. *R*(4): *CFM* contained SBP treated with T. viride + BH. *R*(5): *CFM* contained SBP treated with C.cellulasea + BH.

Aziz (2009) found that treating poor quality roughage with *T. viride* or *S. cerevisiae* increased total and differential numbers of ruminal protozoa. Also, Aziz (2014 and 2019) indicated an increase in ruminal ciliate protozoa and cellulolytic bacteria for sheep fed biologically treated SBP by *S. cerevisiae*, *T. viride* and *C. cellulasea*. While, Mohsen *et al.* (1999) found no effect of feeding rations containing 25 or 50% SBP on protozoal counts of sheep. Moreover Dawson and Tricarico (2002) and Marghany *et al.* (2005) reported that addition of live yeast culture to ruminant diet has improved fiber digestibility and stimulated cellulolytic

bacteria. Also, Kumar *et al.* (2013) and Hristov *et al.* (2013) stated that biological treatments providing vitamins and organic acids to support and stimulate the growth of rumen protozoa, and cellulolytic bacteria.

## Effect of feeding sugar beet pulp on blood parameters:

## **Blood biochemical parameters:**

The data of Table (6) showed that blood serum glucose (mg/dl), total proteins (g/dl), albumin (g/dl), globulin (g/dl) and albumin: globulin ratio concentrations were significantly (P $\leq$ 0.01) affected by experimental rations. Biological treatments increased (P $\leq$ 0.01) the concentrations of these parameters comparing with control and untreated SBP. The most improvement of these parameters was for R4 followed by R3 then R5. Although the difference among the three treatments was slight, it was significant (P $\leq$ 0.01),

				Rations				
Item	Month	R1	R2	R3	R4	R5	±SE	Overall mean
Glucose, mg/dl	$1^{st}$	48.50	48.75	50.79	51.65	49.80	0.102	$49.90^{\rm f} \pm 0.045$
-	$2^{nd}$	51.81	52.20	54.39	55.31	53.50	0.102	$53.44^{e} \pm 0.045$
	3 <sup>rd</sup>	53.82	54.13	56.33	57.21	55.54	0.102	$55.40^{d} \pm 0.045$
	$4^{\text{th}}$	56.76	56.70	58.94	59.96	58.02	0.102	$58.08^{\circ} \pm 0.045$
	$5^{\text{th}}$	60.36	60.77	63.00	63.88	62.25	0.102	$62.05^{b} \pm 0.045$
	$6^{th}$	67.34	67.81	69.94	70.86	69.05	0.102	$69.00^{a} \pm 0.045$
overall mean		56.43 <sup>e</sup>	56.73 <sup>d</sup>	$58.90^{b}$	59.81 <sup>a</sup>	58.02 <sup>c</sup>	0.041	
Total proteins,	$1^{st}$	5.01	4.35	5.63	5.91	5.12	0.183	$5.20^{\rm f} \pm 0.082$
g/dl	$2^{nd}$	5.47	4.79	6.10	6.35	5.51	0.183	$5.64^{e} \pm 0.082$
-	3 <sup>rd</sup>	5.85	5.16	6.46	6.69	5.87	0.183	$6.01^{d} \pm 0.082$
	$4^{\text{th}}$	6.26	5.57	6.85	7.10	6.29	0.183	$6.41^{\circ} \pm 0.082$
	$5^{\text{th}}$	6.69	6.03	7.27	7.58	6.76	0.183	$6.86^{b} \pm 0.082$
	$6^{\text{th}}$	7.30	6.63	7.93	8.14	7.34	0.183	$7.47^{a}\pm0.082$
overall mean		6.10 <sup>d</sup>	5.42 <sup>e</sup>	6.71 <sup>b</sup>	6.96 <sup>a</sup>	6.15 <sup>c</sup>	0.075	
Albumin, g/dl	$1^{st}$	2.80	2.66	3.41	3.96	3.15	0.016	$3.19^{f} \pm 0.075$
	$2^{nd}$	2.98	2.83	3.59	4.10	3.33	0.016	$3.36^{e} \pm 0.075$
	3 <sup>rd</sup>	3.11	2.95	3.70	4.28	3.46	0.016	$3.50^{d} \pm 0.075$
	$4^{\text{th}}$	3.29	3.12	3.89	4.46	3.64	0.016	$3.68^{\circ} \pm 0.075$
	$5^{\text{th}}$	3.60	3.40	4.20	4.75	3.92	0.016	$3.97^{b} \pm 0.075$
	$6^{th}$	3.93	3.79	4.53	5.05	4.29	0.016	$4.32^{a}\pm0.075$
overall mean		3.28 <sup>d</sup>	3.12 <sup>e</sup>	3.89 <sup>b</sup>	4.43 <sup>a</sup>	3.63 <sup>c</sup>	0.068	
Globulin, g/dl	$1^{st}$	2.21	1.69	2.22	1.94	1.96	0.024	$2.00^{f} \pm 0.011$
	$2^{nd}$	2.49	1.96	2.50	2.25	2.18	0.024	$2.28^{e} \pm 0.011$
	3 <sup>rd</sup>	2.74	2.21	2.76	2.40	2.41	0.024	$2.50^{d} \pm 0.011$
	$4^{\text{th}}$	2.96	2.44	2.96	2.64	2.64	0.024	$2.73^{\circ} \pm 0.011$
	$5^{\text{th}}$	3.09	2.63	3.06	2.83	2.84	0.024	$2.89^{b} \pm 0.011$
	$6^{th}$	3.37	2.84	3.40	3.09	3.04	0.024	$3.15^{a} \pm 0.011$
overall mean		2.81 <sup>a</sup>	2.30 <sup>c</sup>	$2.82^{a}$	$2.52^{b}$	$2.51^{b}$	0.010	
A/G ratio	$1^{st}$	1.29	1.58	1.59	2.12	1.64	0.034	$1.64^{a}\pm 0.015$
	$2^{nd}$	1.21	1.45	1.47	1.88	1.54	0.034	$1.51^{b} \pm 0.015$
	$3^{rd}$	1.15	1.34	1.37	1.82	1.44	0.034	$1.42^{\circ} \pm 0.015$
	$4^{\text{th}}$	1.12	1.28	1.34	1.72	1.38	0.034	$1.37^{d} \pm 0.015$
	$5^{\text{th}}$	1.18	1.30	1.40	1.70	1.39	0.034	$1.39^{cd} \pm 0.015$
	6 <sup>th</sup>	1.17	1.33	1.35	1.66	1.41	0.034	$1.39^{cd} \pm 0.015$
overall mean		1.19 <sup>e</sup>	1.38 <sup>d</sup>	1.42 <sup>c</sup>	$1.82^{a}$	$1.47^{a}$	0.014	

Table (6): Blood biochemical parameters of growing lambs fed the experimental rations.

*Means with different letters with each row and column are significantly different* ( $P \leq 0.01$ ).

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP+ BH. *R*(3): *CFM* contained SBP treated with S.cerevisiae + *BH*. *R*(4): *CFM* contained SBP treated with T. viride + *BH*. *R*(5): *CFM* contained SBP treated with C.cellulasea + *BH*.

except the difference between R4 and R5 was not significant for albumin: globulin ratio values. Lambs that received R2 showed the lowest ( $P \le 0.01$ ) concentrations for parameters comparing with control group, except

for glucose and albumin: globulin ratio concentrations, R2 was higher than R1. Control ration (R1) showed ( $P \le 0.01$ ) higher globulin concentration more than R3, R4and R5 as it was not significantly differed from.

The interaction between the ration and the age lambs showed that the lowest (P $\leq$ 0.01) value of glucose was for R1 at the first month, while the lowest (P $\leq$ 0.01) values of total proteins, albumin and globulin were for R2 at the first month. The highest (P $\leq$ 0.01) values for all parameters were for R4 at the six month.

The improvement of blood biochemical parameters by feeding SBP may be due to SBP contains polysaccharides which decayed into glucose that is absorbed by blood and used as a source of blood proteins.

## Kidney and liver functions:

The data of Table (7) indicated that biological treatments for SBP significantly ( $P \le 0.01$ ) increased blood serum creatinine, urea, GOT, GPT concentrations comparing with untreated SBP. The highest concentrations were for R4 followed by R3 then R5, while R2 showed the lowest concentrations. The difference between R3 and R5 was not significant for GOT concentration; also the difference between R4 and R3 was not significant for GOT concentration. It is clear that urea concentration was higher ( $P \le 0.01$ ) for lambs fed control more than other treatments. Also, GPT concentration of R1 lambs was not significantly differed from the concentration of R4 and R3. However, R1 showed less GOT concentration than other treatments.

	Table (	7):	Blood	kidnev	and	liver	function	s paramete	rs of g	rowing	lambs	fed th	ie exi	perimenta	l rations.
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				Rations				
Item	Month	R1	R2	R3	R4	R5	±SE	Overall mean
Creatinine,	$1^{st}$	0.66	0.56	0.84	0.90	0.78	0.066	$0.75^{\rm f} \pm 0.029$
mg/dl	$2^{nd}$	0.68	0.58	0.85	0.93	0.80	0.066	$0.76^{e} \pm 0.029$
	3 <sup>rd</sup>	0.69	0.60	0.86	0.94	0.81	0.066	$0.78^{d} \pm 0.029$
	$4^{\text{th}}$	0.70	0.61	0.88	0.96	0.83	0.066	$0.80^{\circ} \pm 0.029$
	$5^{\text{th}}$	0.72	0.63	0.89	0.96	0.84	0.066	$0.81^{b} \pm 0.029$
	$6^{\text{th}}$	0.74	0.65	0.91	1.04	0.86	0.066	$0.84^{a}\pm0.029$
overall mean		0.69 <sup>d</sup>	0.61 <sup>e</sup>	$0.87^{b}$	0.95 <sup>a</sup>	$0.82^{\circ}$	0.027	
Urea, mg/dl	$1^{st}$	32.76	23.17	24.76	28.30	24.28	0.086	$26.65^{f} \pm 0.038$
-	$2^{nd}$	34.95	25.28	26.95	30.53	26.44	0.086	$28.83^{e} \pm 0.038$
	3 <sup>rd</sup>	37.08	27.41	29.29	32.82	28.69	0.086	$31.06^{d} \pm 0.038$
	$4^{\text{th}}$	39.25	29.81	31.43	34.99	30.94	0.086	$33.28^{\circ} \pm 0.038$
	$5^{\text{th}}$	41.61	32.00	33.49	37.04	33.04	0.086	$35.44^{b} \pm 0.038$
	$6^{th}$	43.43	33.68	35.52	39.04	34.66	0.086	$37.26^{a} \pm 0.038$
overall mean		$38.18^{a}$	$28.56^{e}$	30.24 <sup>c</sup>	33.79 <sup>b</sup>	$29.67^{d}$	0.035	
GOT, U/L	$1^{st}$	13.58	14.54	16.17	17.47	17.41	0.374	$15.83^{f} \pm 0.167$
	$2^{nd}$	15.36	16.29	17.89	19.20	17.24	0.374	17.20 <sup>e</sup> ±0.167
	$3^{rd}$	16.69	17.65	19.26	20.56	18.56	0.374	$18.54^{d} \pm 0.167$
	$4^{\text{th}}$	19.39	19.61	21.88	23.24	21.27	0.374	$21.08^{\circ} \pm 0.167$
	$5^{\text{th}}$	22.48	23.44	24.99	26.28	24.34	0.374	24.30 <sup>b</sup> ±0.167
	$6^{th}$	24.88	25.93	27.42	28.72	26.76	0.374	$26.74^{a}\pm0.167$
overall mean		18.73 <sup>d</sup>	19.58 <sup>c</sup>	21.27 <sup>b</sup>	$22.58^{a}$	20.93 <sup>b</sup>	0.153	
GPT, U/L	$1^{st}$	2.28	1.46	2.15	2.39	1.82	0.147	$2.02^{f} \pm 0.065$
	$2^{nd}$	2.54	1.72	2.39	2.61	2.08	0.147	$2.27^{e} \pm 0.065$
	3 <sup>rd</sup>	2.81	2.01	2.68	2.86	2.37	0.147	$2.55^{d} \pm 0.065$
	$4^{\text{th}}$	3.74	2.98	3.65	3.75	3.37	0.147	$3.50^{\circ} \pm 0.065$
	$5^{\text{th}}$	4.57	3.77	4.46	4.56	4.17	0.147	$4.30^{b} \pm 0.065$
	$6^{\text{th}}$	5.58	5.44	6.06	6.15	5.80	0.147	$5.80^{a} \pm 0.065$
overall mean		3.58 <sup>a</sup>	2.90 <sup>c</sup>	3.56 <sup>a</sup>	3.72 <sup>a</sup>	3.27 <sup>d</sup>	0.060	

Means with different letters with each row and column are significantly different ( $P \leq 0.01$ ).

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP+ BH. *R*(3): *CFM* contained SBP treated with S.cerevisiae + BH. *R*(4): *CFM* contained SBP treated with T. viride + BH. *R*(5): *CFM* contained SBP treated with C.cellulasea + BH.

The interaction between the ration and the age of lambs showed that R2 had the lowest (P $\leq$ 0.01) values of creatinine, urea, GOT, GPT at the first and the six month, while R4 had the highest (P $\leq$ 0.01) values at the first and the six month.

The results of blood parameters for lambs fed biologically treated SBP can be explained by the results of rumen fermentations, as they increased ammonia-nitrogen, total nitrogen and true protein concentrations, as also increased digestibility confections compared with control and untreated treatments. The decrease in serum urea by biological treatments can be attributed to the increase of NH<sub>3</sub>-N utilization by rumen microbes (Chaucheyars- Durand and Fonty, 2001), also, it is a real useful indicator for CP status and N metabolism (Valkeners *et al.*, 2008). The present values of blood serum metabolites are laying within the normal range those obtained by El-Ashry et al. (1997). Rakha (1985) reported that the normal urea-N in sheep and goats was ranged from 8 to 40 mg/dl. The values recorded for GOT and GPT are within normal range reported by Mohamed and Abou-Zeina (2008) with biologically treated Sugar beet pulp.

The present results are supported by the results of Kholif et al. (2005) who reported that goats fed banana wastes treated with *T. viride* or *S. cerevisiae* showed higher serum total protein and albumin more than control, however A/G ratio was not affected by the treatments. Aziz (2009) indicated that serum total protein, albumin, globulin and creatinine concentrations of sheep lambs fed olive trees by-products treated with *T. viride* or *S. cerevisiae* were higher than the values of those fed controls, although they were less for urea, GOT and GPT concentrations. Also, Muhamad (2012) reported that serum urea concentration was decreased (P $\leq$ 0.01) by adding yeast culture to ration of lambs, while GOT was increased and GPT was decreased in comparison with the other treatments. Moreover, Aziz (2014 and 2019) found that treating SBP by *S. cerevisiae, T. viride* or *C. cellulase* increased serum total protein, albumin and globulin, however they decreased urea, GOT and GPT concentrations for sheep.

#### Effect of feeding sugar beet pulp on feed intake, digestion coefficients and nutritive values:

The data of Table (8) indicated that lambs during digestibility trail showed the same trend during growth trail that live body weight and feed intake as DMI, DDMI, OMI, DOMI, DOMR, CPI, DCP and TDN (g/h/d) of R3, R4 and R5 were significantly (P $\leq 0.01$ ) higher than R2 and R1. Digestion coefficients indicated significant (P $\leq 0.01$ ) difference among treatments; biological treatments increased all nutrients digestibility comparing with untreated group. The highest (P $\leq 0.01$ ) digestion coefficients values were recorded for R4 followed by R3 and R4 as the difference between them was almost not significant. While the lowest (P $\leq 0.01$ ) digestion coefficients values were recorded for R2, except that it did not significantly differed from the other rations for EE digestibility, also it had higher NFE and hemicellulose more than control; also it had higher NFC digestibility more than R5, R3 and R4. Control group didn't significantly differ from R5 for the digestibility of EE, CP and CF, while it had the best NFC digestibility.

The data in Table (8) showed that biologically treated SBP (R3, R4 and R5) significantly (P $\leq$ 0.01) increased nutritive values expressed as TDN % and DCP%. It seems that R4 was the most efficient ration followed by R3 then R5. The lowest (P $\leq$ 0.01) nutritive values (DCP) were recorded for R2 which was less than R1, while the lowest (P $\leq$ 0.01) value of TDN was recorded for R1. Also, digestible energy and metabolic energy (Mcal kg DM) were significantly (P $\leq$ 0.01) higher in R4, R3 and R5 more than R1 and R2, with no significant difference between R3 and R5, although R2 was (P $\leq$ 0.01) higher than R1.

The improvement in nutrients digestibility and nutritive values due to biological treatments might be due to the better palatability of treated SBP than untreated SBP and better utilization by lambs or might be related to the more utilization of the dietary energy and positive fermentation in the rumen, or might be related to the effect of biological treatments on cell wall constituents. It is generally well known that as the cell wall constituents were increased the digestibility values were decreased. In other words cell wall constituents digestibility is lower than digestibility of cell soluble constituents.

In this respect, Khampa *et al.* (2009) reported higher nutrient digestibilities as a result of yeast supplementation, which could be related to the microbial activities which solubilizing of carbohydrate esters of phenolic monomers in the cell wall.

In this line, several authors observed an improvement in DM, CP and CF digestion coefficients and nutritive values expressed as TDN and DCP over a wide range of low quality roughages treated by biological treatments (Deraz and Ismail, 2001; Kholif *et al.*, 2005, Mahrous and Abou Ammou, 2005; Yacout *et al.*, 2007, Abo-Eid *et al.*, 2007 and Aziz, 2009). Moreover, Allam *et al.* (2006) reported that biological treatment for SBP with *T. viride* and *S. cerevisiae* increased DM, OM, CF and fiber fraction

(NDF, ADF, cellulose and ADL) digestibilities, while CP and EE digestion coefficients were not affected. Khaliel *et al.* (2018) showed that the highest values of *in-vitro* DM, OM, CP and CF disappearance were recorded for sugar beet pulp treated with *Trichoderma Harzianum*, while the lowest values were recorded for untreated SBP. Aziz (2014 and 2019) found that treating SBP by *S. cerevisiae*, *T. viride* or *C. cellulase* increased DM, OM, CP, EE, CF, NDF, ADF, ADL, cellulose and hemicellulose digestibility, TDN and DCP% for sheep.

Table (8): Feed intake, digestion coefficients and nutritive value of lambs fed the experimental rational state
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			Rations			
Item	R1	R2	R3	R4	R5	±SE
Number of animals	3	3	3	3	3	
Live body weight	34.08 <sup>cb</sup>	32.93 <sup>e</sup>	34.61 <sup>b</sup>	35.36 <sup>a</sup>	33.90 <sup>c</sup>	
Feed intakes, g/h/d:						
DMI	1314.10 <sup>b</sup>	1193.89 <sup>e</sup>	1333.61 <sup>a</sup>	1306.68 <sup>c</sup>	1290.30 <sup>d</sup>	1.919
DDMI	1010.98 <sup>b</sup>	903.82 <sup>c</sup>	$1065.42^{a}$	$1063.49^{a}$	1014.90 <sup>b</sup>	3.975
OMI	1168.62 <sup>c</sup>	$1093.12^{d}$	1206.65 <sup>a</sup>	1181.76 <sup>b</sup>	1167.59 <sup>c</sup>	1.737
DOMI	897.58 <sup>°</sup>	841.46 <sup>d</sup>	978.56 <sup>a</sup>	975.96 <sup>a</sup>	940.64 <sup>b</sup>	4.008
DOMR	583.43°	546.95 <sup>d</sup>	636.06 <sup>a</sup>	634.37 <sup>a</sup>	611.41 <sup>b</sup>	2.604
CPI	155.85 <sup>d</sup>	$120.82^{e}$	$197.10^{a}$	189.99 <sup>b</sup>	186.83 <sup>°</sup>	0.266
DCP	119.30 <sup>d</sup>	90.47 <sup>e</sup>	156.55 <sup>a</sup>	153.51 <sup>b</sup>	143.65 <sup>c</sup>	0.620
TDN	930.93°	$865.54^{d}$	1011.09 <sup>a</sup>	$1007.17^{a}$	$970.56^{b}$	3.786
Digestibility, %:						
DM	76.93 <sup>d</sup>	75.70 <sup>e</sup>	79.89 <sup>b</sup>	81.39 <sup>a</sup>	78.65 <sup>°</sup>	0.268
OM	76.80 <sup>c</sup>	76.97 <sup>°</sup>	81.09 <sup>b</sup>	$82.58^{a}$	80.56 <sup>b</sup>	0.296
EE	79.51 <sup>ab</sup>	$78.25^{ab}$	$80.29^{ab}$	$81.54^{a}$	77.95 <sup>b</sup>	1.004
CP	76.55°	$74.88^{d}$	79.43 <sup>b</sup>	$80.80^{a}$	76.89 <sup>c</sup>	0.314
CF	76.92 <sup>b</sup>	70.65 <sup>°</sup>	77.16 <sup>b</sup>	$79.52^{a}$	76.69 <sup>b</sup>	0.495
NFE	$76.59^{d}$	79.85 <sup>°</sup>	83.10 <sup>b</sup>	$84.20^{a}$	83.17 <sup>b</sup>	0.268
NFC	$91.42^{a}$	80.74 <sup>b</sup>	74.49 <sup>c</sup>	74.05 <sup>°</sup>	78.61 <sup>bc</sup>	1.558
NDF	74.73 <sup>e</sup>	76.01 <sup>d</sup>	83.32 <sup>b</sup>	85.36 <sup>a</sup>	$82.07^{\circ}$	0.282
ADF	70.45 <sup>c</sup>	70.29 <sup>c</sup>	75.12 <sup>b</sup>	77.73 <sup>a</sup>	76.16 <sup>b</sup>	0.389
ADL	80.16 <sup>c</sup>	$78.40^{d}$	84.14 <sup>b</sup>	85.73 <sup>a</sup>	86.25 <sup>a</sup>	0.286
Cellulose	64.22 <sup>c</sup>	66.24 <sup>d</sup>	70.44 <sup>b</sup>	73.60 <sup>a</sup>	70.93 <sup>b</sup>	0.448
Hemicellulose	$80.30^{d}$	$83.08^{b}$	83.12 <sup>b</sup>	$84.86^{a}$	81.25 <sup>c</sup>	0.208
Nutritive value:						
TDN, % of DMI	$70.84^{d}$	72.50 <sup>c</sup>	75.81 <sup>b</sup>	$77.07^{a}$	75.22 <sup>b</sup>	0.255
DCP, % of DMI	$9.08^{\circ}$	$7.58^{d}$	11.74 <sup>a</sup>	11.74 <sup>a</sup>	11.13 <sup>b</sup>	0.042
DE (Mcal kg DM) <sup>*</sup>	3.12 <sup>d</sup>	$3.20^{\circ}$	3.34 <sup>b</sup>	$3.40^{a}$	3.31 <sup>b</sup>	0.011
ME (Mcal kg DM) <sup>**</sup>	$2.56^{d}$	2.62 <sup>c</sup>	2.74 <sup>b</sup>	$2.79^{a}$	2.72 <sup>b</sup>	0.008

*Means with different letters with each row are significantly different (P* $\leq$ 0.01).

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP + *BH*. *R*(3): *CFM* contained SBP treated with S.cerevisiae + *BH*. *R*(4): *CFM* contained SBP treated with T. viride + *BH*. *R*(5): *CFM* contained SBP treated with C.cellulasea + *BH*.

\*DE= Digestible energy = TDN % ×0.04409 (Crampton, et al., 1957).

\*\* $ME = Metabolic \ energy = TDN \ g/head \times 3.6 \ (Church \ and \ Pond \ (1982).$ 

## Effect of feeding sugar beet pulp on rate of passage of feeds:

The data of rate of passage for feed presented in Table (9) and figure (1). Rations contained biologically treated SBP ( $P\leq0.01$ ) increased rate of passage more than untreated SBP and control groups. It is clear that R4 had the highest (P<0.01) value of rate of passage (2.66%) followed by R5 (2.58%), then R3 (2.50%), while R5 had the lowest value (2.32) followed by R1 (2.37). Figure (1) indicated that rate of passage was increased by progressed time, the lowest value was noticed at 6 hours post feeding, being 0.40, 0.36, 0.35, 0.30 and 0.29 % for R4, R5, R3, R1 and R2; respectively. Then the values showed gradual increase to reach the maximum value at 34 hours, being 4.45, 4.34, 4.28, 4.10 and 4.10 % for R4, R5, R3, R1 and R2; respectively. Then the values of (1977) reported that rumen dilution rate can influence feed intake and digestibility which is affected by the length of time available for

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rumen fermentation as well as efficiency of microbial protein synthesis in the rumen. In the current study, increasing rate of passage for R4 may be due to the improving in dry and organic matter digestibility, or may be due to improving the efficiency microbial protein synthesis, as that increasing rate of passage is associated with improving in digestibility and microbial protein synthesis (Owens and Goetsch, 1986 and AFRC, 1992).

Table (9): Effect of feeding sugar beet pulp on rate or rations.	of passage of feeds for lambs fed the experimental
	Ration

	Ration							
Item	R1	R2	R3	R4	R5	±SE		
6 hours	0.30	0.29	0.35	۰,٤٠	0.36	-		
10 hours	0.70	0.68	0.80	۰,۹۰	0.82	-		
14 hours	1.20	1.18	1.29	۱,۳۸	1.31	-		
18 hours	2.00	2.00	2.20	۲,۳٥	2.28	-		
22 hours	2.40	2.39	2.56	۲,۷۸	2.70	-		
26 hours	3.20	3.20	3.36	٣,0٧	3.39	-		
30 hours	3.80	3.78	3.94	٤,١٨	4.06	-		
34 hours	4.10	4.10	4.28	٤,٤0	4.34	-		
38 hours	3.80	3.79	3.94	٤,١٨	4.12	-		
42 hours	3.40	3.40	3.56	٣,٧٣	3.62	-		
46 hours	3.00	2.29	3.10	٣,٢٢	3.17	-		
50 hours	2.80	2.78	2.95	۳,10	3.08	-		
54 hours	2.60	2.60	2.76	۲,٩٤	2.83	-		
58 hours	2.40	2.40	2.35	۲,0۰	2.41	-		
62 hours	1.80	1.79	1.98	۲,۱۲	2.10	-		
66 hours	1.80	1.80	1.98	۲,۱۲	2.06	-		
70 hours	1.70	1.68	1.88	۲,•۳	1.96	-		
74 hours	1.60	1.59	1.76	۱,٩٠	1.85	-		
Rate of passage, % /hour	$2.37^{d}$	2.32 <sup>e</sup>	$2.50^{\circ}$	$2.66^{a}$	2.58 <sup>b</sup>	0.014		

*Means with different letters with each row are significantly different* ( $P \le 0.01$ ).

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP+ *BH*. *R*(3): *CFM* contained SBP treated with S.cerevisiae + *BH*. *R*(4): *CFM* contained SBP treated with T. viride + *BH*. *R*(5): *CFM* contained SBP treated with C.cellulasea + *BH*.





Similar results was obtained by Abdou (2011) who reported that addition of *S. cerevisiae* to the rations of goats fed 60:40% concentrate: roughage increased rate of passage in the rumen compered to control, it was ranged between 3.4 and 4.47%. The present values of rate of passage are less than those obtained by Abdou (2011), this difference may be due to the difference in the ingredients of the ration.

## Effect of feeding sugar beet pulp on nitrogen utilization:

Biologically treated SBP (R3, R4 and R5, respectively) significantly ( $P \le 0.01$ ) increased nitrogen intake (g/h/d) and digested nitrogen (g/h/d and % of NI) values compared with control and untreated SBP (Table 10), whereas R2 was the lowest ( $P \le 0.01$ ) values. Also, the three rations increased ( $P \le 0.01$ ) fecal and urinary nitrogen (g/h/d), although they decreased the values as % of NI comparing with R1 and R2 which was the same trend of total nitrogen excretion (g/h/d and % of NI). As R3, R4 and R5 were the highest nitrogen intake and digested nitrogen, they improved nitrogen utilization (g/h/d, % of N intake and % of digested N) as the difference among them was almost non-significant by about 5.98 and 10.61 (g/h/d) more than R1 and R2, respectively.

			Ration			
Item	R1	R2	R3	R4	R5	±SE
Nitrogen intake, g/h/d	24.93 <sup>d</sup>	19.33 <sup>e</sup>	31.54 <sup>a</sup>	30.40 <sup>b</sup>	29.89 <sup>c</sup>	0.043
Digested nitrogen,						
g/h/d	19.09 <sup>d</sup>	$14.48^{e}$	25.05 <sup>a</sup>	24.57 <sup>b</sup>	22.99 <sup>c</sup>	0.097
% of N intake	76.54 <sup>c</sup>	74.91 <sup>d</sup>	79.42 <sup>b</sup>	$80.82^{a}$	76.92 <sup>c</sup>	0.314
Fecal nitrogen,						
g/h/d	5.84 <sup>c</sup>	4.85 <sup>e</sup>	6.49 <sup>b</sup>	5.83 <sup>c</sup>	$6.90^{a}$	0.085
% of N intake	23.45 <sup>b</sup>	25.11 <sup>a</sup>	20.57 <sup>c</sup>	19.20 <sup>d</sup>	23.11 <sup>b</sup>	0.314
Urinary nitrogen,						
g/h/d	0.393 <sup>ab</sup>	$0.410^{a}$	$0.376^{b}$	0.343 <sup>c</sup>	0.363 <sup>bc</sup>	0.094
% of N intake	$1.58^{b}$	2.12 <sup>a</sup>	1.19 <sup>c</sup>	1.12 <sup>c</sup>	1.21 <sup>c</sup>	0.036
Total N excretion,						
g/h/d	6.23 <sup>c</sup>	$5.26^{d}$	$6.87^{\mathrm{b}}$	$6.17^{\circ}$	$7.26^{a}$	0.081
% of N intake	24.99 <sup>b</sup>	27.24 <sup>a</sup>	21.78 <sup>c</sup>	$20.30^{d}$	24.29 <sup>b</sup>	0.297
Nitrogen balance,						
g/h/d	$18.70^{\circ}$	14.07 <sup>d</sup>	24.67 <sup>a</sup>	24.23 <sup>a</sup>	22.63 <sup>b</sup>	0.094
% of N intake	73.01 <sup>c</sup>	72.78 <sup>d</sup>	78.22 <sup>b</sup>	$79.70^{a}$	75.74 <sup>°</sup>	0.297
% of digested N	97.26 <sup>b</sup>	97.17 <sup>c</sup>	$98.48^{a}$	$98.62^{a}$	98.43 <sup>a</sup>	0.044

Table (10): Nitrogen utilization by lambs fed the experimental rations.

*Means with different letters with each row are significantly different (P* $\leq$ 0.01).

R(1): CFM + BH. R(2): CFM contained USBP+ BH. R(3): CFM contained SBP treated with S.cerevisiae + BH. R(4): CFM contained SBP treated with T. viride + BH. R(5): CFM contained SBP treated with C.cellulasea + BH.

It is clear that biological treatments of SBP increased nitrogen balance more than untreated SBP and control rations. This improvement was attributed to the improvement in rumen fermentation, especially ruminal ammonia, NPN, total nitrogen and true protein nitrogen or may be due to the increase of crude protein content of biologically treated SBP comparing with untreated SBP; this obvious increase in CP content could be explained in view of the reduction in CF, NDF and ADF concentrations. Khaliel *et al.* (2018) found that treatment of SBP with *T. Harzianum* increased the crude protein content of SBP up to 20.30%.

These results are in agreement with those obtained by Allam *et al.* (2006) who reported that biologically treated SBP with *T. viride* and *S. cerevisiae* had the highest value of nitrogen balance and NB/IN. Also, Aziz (2014 and 2019) showed that biologically treated SBP by *S. cerevisiae*, *T. viride* or *C. cellulase* increased nitrogen intake and digested nitrogen which resulted in the improvement of nitrogen balance by sheep.

#### Effect of feeding sugar beet pulp on water balance:

Free drinking water and total water intake consumption (ml/h/d) showed insignificant (P $\leq$ 0.01) differences among all rations (Table 11), although R3, R4 and R5 had higher (P $\leq$ 0.01) metabolic water than

R1 and R2, but had lower combined than R1. Biological treatments decreased (P $\leq$ 0.01) fecal, urinary and total water execration (ml/h/d) more than R1 and R2. The lowest values were for R4, followed by R3, then R5. These results reversed on water balance as R3, R4, R5 and R1 showed (P $\leq$ 0.01) higher water balance more than R2. R4 followed by R3 and R5 had the (P $\leq$ 0.01) highest water balance (% of intake), being 90.80, 89.50 and 89.42 % of intake, respectively than R2.

Similar results were found by Aziz (2014) who found that feeding SBP treated by *S. cerevisiae*, *T. viride* or *C. cellulase* did not affect total water intake, however it had slightly higher water balance than control and untreated SBP.

	Ration								
Item	R1	R2	R3	R4	R5	±SE			
Water consumption:									
Free drinking W, ml/h/d	3916.00	3526.00	3523.00	3716.00	3650.00	136.29			
Metabolic water, ml/h/d	642.34 <sup>c</sup>	597.22 <sup>d</sup>	697.65 <sup>a</sup>	694.95 <sup>a</sup>	669.69 <sup>b</sup>	2.613			
Combined water ,ml/h/d	$134.90^{a}$	125.32 <sup>cd</sup>	127.72 <sup>b</sup>	125.77 <sup>c</sup>	124.81 <sup>d</sup>	0.187			
Total water consumption,									
ml/h/d	4693.24	4248.54	4348.37	4536.72	4444.50	137.35			
Water execration:									
Fecal water, ml/h/d	72.86 <sup>b</sup>	117.36 <sup>a</sup>	84.12 <sup>b</sup>	69.16 <sup>b</sup>	86.96 <sup>b</sup>	5.635			
Fecal water, % of intake	$1.55^{cb}$	$2.76^{a}$	1.93 <sup>b</sup>	1.51 <sup>c</sup>	$1.95^{b}$	0.118			
Urinary water, ml/h/d	439.66 <sup>a</sup>	423.33 <sup>b</sup>	372.66 <sup>d</sup>	348.33 <sup>e</sup>	383.33°	33.44			
Urinary water, % of	9.39	9.96	8.59	7.66	8.62	0.742			
intake									
Total W execration,	512.52 <sup>b</sup>	$540.69^{a}$	$456.78^{d}$	417.49 <sup>e</sup>	470.29 <sup>c</sup>	37.15			
ml/h/d									
Total W EX, % of intake	$10.94^{ab}$	12.73 <sup>a</sup>	$10.53^{ab}$	9.18 <sup>b</sup>	$10.57^{ab}$	0.813			
Water balance:									
ml/h/d	4180.72 <sup>a</sup>	3707.52 <sup>c</sup>	3891.59 <sup>b</sup>	4119.25 <sup>a</sup>	3974.21 <sup>b</sup>	132.85			
% of intake	89.08 <sup>b</sup>	87.27 <sup>c</sup>	$89.50^{ab}$	$90.80^{a}$	$89.42^{ab}$	0.813			

Table (11): V	Water balance	for lambs fed th	e experimental	rations.
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*Means with different letters with each row are significantly different (* $P \le 0.01$ *).* 

R(1): CFM + BH. R(2): CFM contained USBP+ BH. R(3): CFM contained SBP treated with S.cerevisiae + BH. R(4): CFM contained SBP treated with T. viride + BH. R(5): CFM contained SBP treated with C.cellulasea + BH.

### Effect of feeding sugar beet pulp on growing lambs performances:

## Feed intake:

The data of Table (12) showed that lambs received untreated SBP (R2) insignificant lowered feed as it

Table (12): Mean	ı feed intake of	growing	lambs fed the	experimental :	rations.
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	Ration									
Item	R1	R2	R3	R4	R5					
Number of animals	5	5	5	5	5					
Average live body weight kg	24.16	23.30	24.76	25.22	24.36					
Average dry matter intake g/h/d:										
CFM	605.53	550.54	608.25	597.48	590.60					
Нау	403.69	367.03	405.50	398.32	393.73					
Total	1009.22	917.57	1013.75	995.79	984.34					
SBP intake *		220.22	243.30	238.99	236.24					

R(1): CFM + BH. R(2): CFM contained USBP+ BH. R(3): CFM contained SBP treated with S.cerevisiae + BH. R(4): CFM contained SBP treated with T. viride + BH. R(5): CFM contained SBP treated with C.cellulasea + BH. \*SBP intake was calculated from CFM intake g/h/d as SBP represented 40% from CFM. decreased concentrate feed mixture, hay and total dry matter intake during the whole period of feeding comparing with lambs received treated SBP or control. While, lambs received treated SBP (R3, R4 and R5) or control were relatively close together, although R4 and R5 were slightly ( $P \le 0.01$ ) less than control, R3 was slightly ( $P \le 0.01$ ) higher. Lambs fed biologically treated rations consumed SBP more than lambs fed untreated SBP.

This result come on line with those obtained by Kholif *et al.* (2005) and Aziz (2009) who reported that biological treatments slightly increased DMI more than untreated. Also, Muhamad (2012) fund that biological treatments with yeast culture increased feed intake more than control group.

#### Live body weight changes:

The data of Table (13) indicated that the initial body weight (kg) was almost the same for the different lamb groups; however, the final body weight (kg) was significantly ( $P \le 0.01$ ) differed among the treatments, as R4 followed by R3 then R5 had high ( $P \le 0.01$ ) final body weight, being 35.55, 34.81, 34.21, 34.00 and 32.84 kg for R4, R3, R5, R1 and R2; respectively. Also, average body weight throughout the whole period was take the same trend, being 25.22, 24.76, 24.36, 24.16 and 23.29 kg for R4, R3, R5, R1 and R2; respectively. Body weight changes (kg) throughout the whole period showed non-significant difference among biological treatments, however it take the same trend of final and average body weight.

Table (13): Meau	n body weigh	t changes of	f growing	lambs fed	the experime	ental rations
1 abic (15). Mical	n bouy weigh	i changes o	i si o wing	lamos icu	the experime	intar rations

Item	R1	R2	R3	R4	R5	±SE
Initial body weight, kg	12.67	12.32	12.61	12.50	12.43	0.131
Body weight at 1 <sup>st</sup> month, kg	15.66 <sup>b</sup>	14.92 <sup>c</sup>	16.11 <sup>a</sup>	$16.27^{a}$	$15.90^{ab}$	0.132
Body weight at 2 <sup>nd</sup> month, kg	$18.65^{b}$	17.98 <sup>c</sup>	$19.07^{ab}$	19.29 <sup>a</sup>	$18.89^{ab}$	0.136
Body weight at 3 <sup>rd</sup> month, kg	21.91 <sup>b</sup>	21.10 <sup>c</sup>	22.34 <sup>a</sup>	$22.45^{a}$	$22.04^{ab}$	0.130
Body weight at 4 <sup>th</sup> month, kg	25.22 <sup>c</sup>	$24.46^{d}$	$26.07^{ab}$	$26.68^{a}$	$25.46^{bc}$	0.232
Body weight at 5 <sup>th</sup> month, kg	29.51 <sup>b</sup>	$28.46^{\circ}$	30.18 <sup>b</sup>	31.10 <sup>a</sup>	29.68 <sup>b</sup>	0.272
Final body weight, kg	34.00 <sup>b</sup>	32.84 <sup>c</sup>	34.81 <sup>ab</sup>	35.55 <sup>a</sup>	34.21 <sup>b</sup>	0.258
ABW through 6 months, kg	24.16 <sup>c</sup>	$23.29^{d}$	$24.76^{ab}$	$25.22^{a}$	24.36 <sup>bc</sup>	0.164

Means with different letters with each row are significantly different ( $P \le 0.01$ ).

R (1): CFM + BH. R (2): CFM contained USBP+ BH. R (3): CFM contained SBP treated with *S.cerevisiae* + BH. R (4): CFM contained SBP treated with *T. viride* + BH. R (5): CFM contained SBP treated with *C.cellulasea* + BH.

### Average daily and total gains:

The data of Table (14) showed that biological treated SBP rations had the ( $P \le 0.01$ ) highest average daily gain (g) through all periods and total gain (kg) compared with untreated and control groups, as R4 was the first followed by R3 then R5. However, R2 was the least; control group was not significantly differed from R2 and R5. Also, average daily gain through the second and third month was not significantly differed among all treatments. The average daily gain through the whole period was 128.05, 123.33, 121.00, 118.50, 114.00 g for R4, R3, R5, R1 and R2; respectively. Total gain was 23.05, 22.20, 21.78, 21.33 and 20.52 kg for R4, R3, R5, R1 and R2; respectively. The improvement in body weight and daily gain as a result of biological treatments are agreed with the results of rumen fermentations and nutrients digestibility.

Similar results were found by Yacout *et al.* (2007) and Fayed *et al.* (2008) who reported that lambs fed agriculture by-products treated with bacteria achieved the greatest body weight and average daily gain. Also, Aziz (2009) stated that feeding olive trees by-products treated with *T. viride* or *S. cerevisiae* increased body weight, average daily gain and total body gain for lambs by progressed time of feeding. Aziz (2014 and 2019) found that treating SBP by *S. cerevisiae*, *T. viride* or *C. cellulase* increased feed intake and body weight for sheep.

			Ration			
Item	R1	R2	R3	R4	R5	±SE
Daily gain at 1 <sup>st</sup> month, g	99.84 <sup>b</sup>	86.72 <sup>c</sup>	116.70 <sup>a</sup>	125.64 <sup>a</sup>	115.82 <sup>a</sup>	3.64
Daily gain at 2 <sup>nd</sup> month, g	99.59	102.08	98.40	100.66	99.68	1.41
Daily gain at 3 <sup>rd</sup> month, g	108.80	103.93	109.13	105.46	105.06	1.83
Daily gain at 4 <sup>th</sup> month, g	110.06 <sup>b</sup>	111.93 <sup>b</sup>	124.33 <sup>ab</sup>	140.86 <sup>a</sup>	113.73 <sup>b</sup>	6.43
Daily gain at 5 <sup>th</sup> month, g	143.20 <sup>ab</sup>	133.26 <sup>b</sup>	136.86 <sup>ab</sup>	147.26 <sup>a</sup>	140.73 <sup>ab</sup>	4.14
Daily gain at $6^{th}$ month, g	149.53 <sup>ab</sup>	146.13 <sup>b</sup>	154.33 <sup>a</sup>	$148.60^{ab}$	$151.06^{ab}$	1.94
Average through 6 months, g	118.50 <sup>cd</sup>	$114.00^{d}$	123.33 <sup>b</sup>	128.05 <sup>a</sup>	$121.00^{bc}$	1.51
Total gain, kg	21.33 <sup>cd</sup>	$20.52^{d}$	22.20 <sup>b</sup>	23.05 <sup>a</sup>	21.78 <sup>bc</sup>	0.27

fable (14): Average daily gain	n of growing	lambs fed the	experimental rations
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*Means with different letters with each row are significantly different (P* $\leq$ 0.01).

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP+ BH. *R*(3): *CFM* contained SBP treated with S.cerevisiae + BH. *R*(4): *CFM* contained SBP treated with T. viride + BH. *R*(5): *CFM* contained SBP treated with C.cellulasea + BH.

## Profit analysis and feed conversion:

The data of Table (15) indicated that the return from body gain was higher for rations contained biological treated SBP (R5, R4 and R3) than those contained untreated SBP and control groups, being 2305.00, 2219.00, 2178.00, 2133.00 and 2052.00 EL for R4, R3, R5, R1 and R2, respectively. Total feed costs (concentrate and hay) were higher for R3 and R4 more than R1, R5 and R2 as a result of increasing feed intake, being 907.274, 891.20, 890.13, 880.94 and 809.29 EL for R4, R3, R1, R5 and R2, respectively. Final margin for lambs fed treated SBP was higher than lambs fed untreated SBP, as R4 had the final margin followed by R3 then R5, while R2 had the lowest margin, the margin for R1 was almost the same of R2, being 1413.80, 1311.73, 1297.06, 1242.87 and 1242.71 EL for R4, R3, R5, R1 and R2, respectively. The

Table	(15):	Feed	conversion	and p	orofit	analysis	of g	rowing	lambs	fed	the	experimental	rations.
	· ·												

	Ration								
Item	R1	R2	R3	R4	R5				
DM intake g/head/d	11.09	10.47	10.82	10.20	10.66				
TDN intake g/head/d	8.17	7.02	7.90	8.32	8.02				
DCP intake g/head/d	1.01	0.79	1.27	1.20	1.19				
Total body gain (kg)	21.33	20.52	22.19	23.05	21.78				
Return from body gain (EP)*	2133.00	2052.00	2219.00	2305.00	2178.00				
concentrate kg /h/180d	109.00	99.10	109.48	107.55	106.31				
hay kg /h/180d	72.66	66.06	72.99	71.70	70.87				
Total feed intake kg /h/180d	181.66	165.16	182.47	179.24	177.18				
concentrate costs (EL)	599.48	545.03	602.17	591.50	584.70				
hay costs ( EL )	290.66	264.26	291.96	286.79	283.49				
biological treatment cost (EL)	0.00	0.00	13.14	12.91	12.76				
Total feed costs (EL)	890.13	809.29	907.274	891.20	880.94				
Final margin (EL)	1242.87	1242.71	1311.73	1413.80	1297.06				
Feed cost EL/kg gain	41.73	39.44	40.89	38.66	40.45				
Economic efficiency	2.40	2.54	2.45	2.59	2.47				
Feed conversion ratio:									
Kg dry matter feed/1kg gain	11.09	10.47	10.82	10.20	10.66				
Kg TDN/1kg gain	7.86	7.59	8.20	7.87	8.02				
g DCP/1kg gain	1.01	0.79	1.27	1.20	1.19				

*R*(1): *CFM* + *BH*. *R*(2): *CFM* contained USBP+ BH. *R*(3): *CFM* contained SBP treated with S.cerevisiae + *BH*. *R*(4): *CFM* contained SBP treated with T. viride + *BH*. *R*(5): *CFM* contained SBP treated with C.cellulasea + *BH*.

lowest feed cost/kg gain was achieved for R4 (38.66 EL/kg gain), while the highest value was for R1 (41.73 EL/kg gain). Economic efficiency showed that R4 were more efficient than other treatments followed by R2,

Feed conversion improving as a result of biological treatment with *T. viride, S. cerevisiae* and *C. cellulase* may be attributed to the changes of microflora in the rumen or more active role of cellulolytic bacteria (Umesh-Kumar *et al.*, 1997) and/or may be related to shifts in efficiency of fermentation by increasing ruminal propionate and decreasing acetate concentrations (Moloney and Dernnan, 1994).

The present results are supported by those obtained by Allam Sabbah *et al.* (2006) who reported that treated sugar beet pulp with *T.viride* and *S. cerevisiae* to replace 100% of corn grains included in the concentrate feed mixture fed to growing lambs had the best relative economic efficiency. El-Shafie *et al.* (2007) indicated that biological treatment of wheat straw with *T.viride* increased the feed conversion expressed as kg DM/kg gain. Also, Yacout *et al.* (2007) reported that lambs fed corn stalks treated with bacteria increased feed efficiency compared with control ration. Aziz (2009) showed that using *T. viride* or *S. cerevisiae* for treatment agriculture by-products increased final margin and feed efficiency compared with untreated.

# CONCLUSION

Replacement of part of yellow corn in concentrate feed mixture (CFM) by dried sugar beet pulp (40 % of CFM) untreated or biologically treated by *Saccharomyces cerevisiae*, *Trichoderma viride* or *Cellulomonas cellulasea* had remarkable improved influence on rumen fermentations, especially TVFA's, total nitrogen, microbial protein, ruminal protozoa, cellulolytic bacteria, and blood parameters, especially glucose and total proteins. Also, biologically treated sugar beet pulp increased all nutrients digestion coefficients, nitrogen and water balance which reversed on lambs performance as increasing body weight, average daily gain, feed conversion and economic efficiency.

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# تأثير المعاملة البيولوجية لتفل بنجر السكرعلى هضم الغذاء وآداء النمو لحملان الأغنام تحت الظروف الصحراوية

# هند أحمد عزيز

قسم تغذية الحيوان - مركز بحوث الصحراء-القاهرة- مصر.

تم در اسة استبدال جزء من الذرة الصفراء بتغل بنجر السكر الجاف غير معامل أومعامل بالخميرة أو الفطر أو البكتريا بحيث يمثل ٤٠ % من مخلوط المركز فى الدر اسة الحالية لدر اسة تأثير ذلك على تخمرات و ميكر وبات الكرش، قياسات الدم، الهضم الغذائي والقيمة الغذائية، معدل مرور البلعة الغذائية، ميزان النتر وجين والماء، وأداء الحملان. تم تقسيم خمسة و عشرون حمل من الأناث البرقى المفطومة (متوسط عمر ٢-٤ شهور و٢٢٠ كجم وزن حى) عشوائياً إلى خمس مجاميع لإجراء تجربة نمو يليها تجربة هضم. حيث تم تغذية الحملان على خمس عرائق: عليقة (١): مخلوط مركز + دريس برسيم (مقارنة). عليقة (٢): مخلوط مركز يحتوى على تفل بنجر السكر غير معامل + دريس برسيم. عليقة (٦): مخلوط مركز بدريس برسيم (مقارنة). عليقة (٢): مخلوط مركز يحتوى على تفل بنجر السكر غير معامل + دريس برسيم. عليقة (٣): مخلوط مركز بدريس برسيم. إلى معامل بالخميرة + دريس برسيم. عليقة (٤): مخلوط مركز يحتوى على تفل بنجر السكر معامل بالقطر + دريس برسيم. عليقة (٥): مخلوط مركز يحتوى على تفل بنجر السكر غير معامل ب دريس بنجر السكر معامل بالقطر + دريس برسيم. عليقة (٥): مخلوط مركز يحتوى على تفل بنجر السكر معامل بالكريا + دريس برسيم. وكانت نسبة المركز إلى الخشن ٢٠ :٠٤ %. و قد أوضحت النتائج أن المعاملات البيولوجية لتفل بنجر السكر أدت إلى زيادة معنوية فى قيم الرقم والبروتين المكلي والألبيومين والكرياتينين اسيرم الدم. كما أدت العليقة الثالثة والر ابعة والخامسة إلى زيادة معنوية فى قرم الحلى، والبروتين الكلى والألبيومين والكرينية الطيارة، البروتين الميكروبى، نيتر وجين الامونيا، النتر وجين غير البروتينى، النتر وجين الكلى، والبروتين الكلى والألبيومين والكرياتينين اسيرم الدم. كما أدت العليقة الثالثة والر ابعة والخامسة إلى زيادة معنوية فى تركيز كل من الجلوكر مرور البلعة الغذائية، ميزان النتر وجين والماء مقارنة بالعليقة الثالثة والر ابعة والخامسة إلى زيادة معنوية فى تركيز كل من الجلوكوز والبروتين الكلى والألبيومين والكرياتينين اسيرم الدم. كما حققت هذه العلائق أعلى قيم مأكول ومعاملات الهضم والقيمة الغذائية، معدل مرور البلعة الغذائية، ميزان النتر وجين والماء مقارنة بالعليقة الثانية غير المعاملة، ما أيون وليس الجل مي أي وزن الجسم، مرور البلعة الغذائية، ميزان النتر وجين والماء مقارنة بالعليقة الثانية. وقد المعامة إلى مام