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Effect of Feeding Olive Tree Pruning By-Products on Sheep Performance in Sinai

[1]*Afaf M. Fayed,* [2]*M.A. El-Ashry and* [1]*Hend A. Aziz*

[1]Animal Nutrition Department, Desert Research Center, Cairo, Egypt
[2]Animal Production Department, Faculty of Agricultural, Ain Shams University, Egypt

Abstract: This work was carried out to study the effect of feeding olive trees pruning by-products (leaves and twigs) treated biologically and chemically on ewe lambs performance, nutrients digestibility and some rumen and blood parameters. Three growing trials were carried out using female lambs (about 12.8 Kg and 4 months old) as followed: T (1): CFM + berseem hay (control). T (2): CFM +olive leaves and twigs treated with urea and T (3): CFM +olive leaves and twigs treated with *T. viride*+ S. *cerevisiae*. At the end of the growing trials 3 digestibility trails were carried out. The data of growing trials indicated that feed intake did not affected by treatments being 712.50, 711.67, 710.83 g/h/d for T3, T2 and T1, respectively. Initial body weight was almost the same for the different lamb groups (12.84 kg). However, the final body weight was differed among treatments, urea treatment T2 and biological treatment T3 showed higher final body weight than the control group (T1) being 38.70, 37.77 and 37.25 kg, respectively, but, average daily gain had the same trend of live body weight. Economic conversion was highest for urea treatment (T2) followed by treatment with *T. viride* and *S. cerevisiae* (T3) than control group. (T2) and (T3) were less slightly efficient in converting TDN and DCP into gain compared to control group. Concerning the chemical composition of olive by-products, the data showed that urea and biological treatments increased CP content and decreased CF content and its fraction. The data of digestibility trials indicated that T2 followed by T3 tended to increase ($P<0.01$) the digestibility of DM, OM and CP, CF more than control group. (T2) had the highest values of TDN and DCP (% of intake). Water balance showed highly significant difference among treatments. It seems that (T3) improved nitrogen balance (g/h/d) more than urea treatment but the difference was not significant being 55.90, 49.23 and 38.46 as percentage of intake for T3, T2 and T1, respectively. The overall mean of (T2) had the lowest ruminal pH (6.43) while there was no difference between (T3) and (T1). T3 had the highest ruminal TVFA's value (mg/100 ml R.L), followed by T2 then T1 but the difference among the three treatments was not significant. Urea and biological treatments increased ($P<0.01$) ruminal total nitrogen, true protein, NPN and ammonia nitrogen more than control group. T2 and biological treatment with *T.viride* + *S.cerevisiae* T3 increased ($P<0.01$) total serum proteins, albumin, globulin, albumin: globulin ratio, urea, creatinine, GOT and GPT more than (T1). It can be concluded that feeding sheep on olive trees pruning by-products treated biologically or chemically improved rumen fermentation, nutrients digestibility and blood parameters.

Key words: Biological treatments · Urea · Digestibility · Blood and ruminal parameters

INTRODUCTION

In Egypt there is a gap between the available feedstuffs and farm animal requirements. This was estimated as a shortage of 3.1 million tons of TDN per year. Non- traditional by-products must search in order to decrease the relay on traditional resources to fill the gap and to decrease feeding costs [1].

Large areas are cultivated by olive trees, especially in Sinai and the North-Western Coast Zone, therefore, there are great amounts of olive by products without beneficial usage and are considered as wastes. It has been estimated that each olive tree could produce 22 kg leaves and twigs per year and 25 kg olive cake per 100 kg olive fruits [2], who added that using olive trees by-products as animal feed could participate in solving the problems of feed shortage which is particularly realized at drought seasons and hence the selling price of animals products.

The chemical treatments, which have been used to improve the feeding value, include the aqueous ammonia

Corresponding Author: Dr. Afaf A. Fayed, Department of Animal Nutrition, Desert Research Center, Cairo, Egypt

treatment and urea- ammonia treatment, which have shown much promise [3]. Several chemical treatments aimed to disrupt the lignin carbohydrate complex which has been tested in attempts to improve the accessibility of structural carbohydrates to celluloytic microorganisms, chemical pretreatment appeared to improve more particularly the digestibility of the hemicellulose fraction.

Biological treatments could be achieved using various microorganisms adopting the solid substrate fermentation such as white rot fungi which can degrade lignin in the cell wall and attempts have been made to improved *in vitro* digestibility of plant residues by incubation with white rot fungi reports are available in which the nutritive value of straw substrates are evaluated *in vivo*. By microbial treatment the nutritional quality and digestibility of different lignocellulosic by products could be increased and be used in ruminant nutrition. This was observed in increasing protein content, improving dry roughage palatability and dry matter intake. Kirk *et al*. [4] indicated that biological treatments of lignocellulosic materials with white rot fungi may become economical.

The objective of this work was to study the effect of feeding olive trees pruning by products as an unconventional feed source treated with 4% urea or with biological treatment with *T. viride* and *S. cerevisiae* on female sheep performance and study some rumen and blood serum parameters.

MATERIALS AND METHODS

The field experiments were carried out at Ras Sudr Research Station, Desert Research Center (DRC) in South Sinai Governorate. Olive leaves and twigs were pruning and chopped to 2-3 cm then air-dried for 15 days to reach 10-15% moisture then packed till used. *Trichoderma viride* F-516 and *Sacharomyces cerevisiae* were obtained from the Microbial Genetic Department, National Research Center, Dokki, Cairo, Egypt.

Urea Treatment: Air-dried olive leaves and twigs (2-3cm) were moistened for 40 % and sprayed with urea solution at level of 4 % plus 10 % molasses from the dry matter.

The Biological Treatments: Air-dried olive leaves and twigs moistened for 60 % and treated with biological treatments which were a media contained 50 % fungi media and 50 % yeast media at a ratio of 150 ml media to 100 kg ration plus 10 % molasses from the dry matter.

Three Experimental Treatments Were Carried Out:

Treatment (1): 5 lambs received the control ration (CFM + berseem hay).
Treatment (2): 5 lambs received CFM +olive leaves and twigs treated with 4% urea on DM basis.
Treatment (3): 5 lambs received CFM +olive leaves and twigs treated with *T. viride* + *S. cerevisiae* with the ratio of 1:1.

Fifteen weaning Barki ewe lambs (about 3-4 months old and 12.83 kg live body weight) were fed free in feedlot. The animals were randomly divided into three groups of 5 lambs each. All animals were fed on the concentrate feed mixture (CFM) at 70 % of allowance and roughage (olive leaves and twigs or berseem hay) was given *ad lib*. All animals were fed their daily diet according to average body weight, which was changing every two weeks. The concentrate and roughage were offered twice daily at 8 a.m. and 2 p.m. The offered and the refusales were weighted daily and the animals were weighted every two weeks. Fresh water had excess to the animals twice daily at 9 a.m. and 3 p.m. This experiment lasted for 180 days.

At the end of the growth trial three animals from each treatment were used in the digestibility trials for 14 days as preliminary period followed by 8 days as collection period. Animals through the experiments were fed their daily ration according to their live body weight according to Kearl [5]. By the end of the digestibility trials animals were used to obtain 100 ml of rumen fluid every sampling time for 3 consequently days. Value of pH in the rumen liquor was determined as described by the pH meter model the pHep, ammonia nitrogen concentration was determined according to A.O.A.C [6], the total volatile fatty acids (TVFA's) was determined according to Warner [7], total nitrogen and non-protein nitrogen (NPN) were determined according to A.O.A.C [8], while true protein nitrogen was calculated by subtracting the non-protein nitrogen content from total nitrogen content. Also animals from each treatment were used to obtain 12 ml blood from the jagular vein before morning feeding and 4 hours post-feeding for 3 consequence days. The total proteins value was determined using electronic apparatus, albumin value was determined according to Doumas and Biggs [9], globulin was obtained by substracting the albumin values from the total proteins concentration and creatinine was determined according to Henry [10]. Serum samples were analyzed to determine urea according to Patton and

Table 1: Chemical composition and fiber fraction of rations

Items	DM	Ash	EE	CP	CF	NFE	NDF	ADF	ADL	Cellulose	Hemicellulose
Concentrate feed mixture	93.59	7.94	3.10	12.51	11.35	65.10	30.65	17.56	6.85	10.71	13.09
Berseem hay (T1)	91.24	11.99	2.55	14.00	32.64	38.82	62.96	44.44	7.13	37.31	18.52
Untreated Olive by products	93.95	13.50	5.88	6.48	24.66	49.48	74.50	47.45	11.70	35.75	27.05
Olive by products treated with urea (T2)	92.92	14.53	5.95	14.91	16.74	47.87	63.45	39.87	7.70	32.17	23.58
Olive by products treated with *T. viride* + *S. cerevisia* (T3)	94.02	14.71	6.54	10.70	16.30	51.75	65.32	42.46	8.15	34.31	22.86

Crouch [11]. Serum GOT and GPT were determined according to the method described by Schmidt and Schmidt [12].

Statistical Analysis: General linear model procedure was used for statistical analysis through SAS software [13],the used design for the first part of the digestion trails and growth trail was one way analysis, Duncan's multiple tests were applied for comparison of means [14].

RESULTS AND DISCUSSION

Chemical Composition and Fiber Fraction: The data of Table 1 showed the chemical composition and fiber fraction of the olive leaves and twigs used in growth and digestibility trails. Urea treatment had the lowest DM content while biological treatment had the highest value of DM content. Biological treatment with *T. viride* and *S. cerevisiae* had the highest value of EE. The highest value of CP obtained by content urea treatment followed by biological treatment with *T. viride* and *S. cerevisiae*. As for fiber fraction the data showed that urea treatment and biological treatment decreased all fiber fractions, but they have higher content of ADL and hemicellulose compared with berseem hay. These results are in agreement with those obtained by Reis *et al*. [15], they observed a reduction in cellulose and acid detergent fiber content in rice straw treated with 5.4% urea and incubated for 45 days at room temperature. El-Ashry *et al*. [16], Deraz and Ismail [17], Mahrous [18] and Bassuny *et al*. [19] reported that the fungal treatment led to decreased OM and CF contents while, CP and ash contents increased compared with the untreated roughages.

Feed Intake: The data in Table 2 indicate that (T2) followed by (T3) increased total dry matter intake (g/h/d) more than control group, however, the difference was not significant. The present results coincided with those obtained by Khamis [20], who treated olive tree leaves and twigs with 3% calcium hydroxide, he found that the greatest intake of DM recorded by alkaloid treatment compared to control. Also, Kholif *et al*. [21] indicated that dry matter intake (DMI) slightly increased in goats fed banana wastes treated with *panicillium funiculusms* or *Saccharomyces cerevisiae*, while *Trichoderma viride* slightly decreased DMI compared with control.

Table 2: Body weight, daily gain, total feed intake and feed conversion for ewe lambs

	Treatments		
Items	T1	T2	T3
No. of animals	5	5	5
DM intake g/head/d	766.67	780.08	773.06
Initial body weight (kg)	12.84	12.84	12.82
Final body weight (kg)	37.25	38.70	37.77
Total body gain (kg)	24.41	25.86	24.95
Daily gain (g)/head/day	135.61	143.66	138.61
Total feed intake (kg)	138.00	140.41	139.15
*Economic conversion+	4.11	5.22	5.01
Feed conversion ratio:			
Kg dry matter feed/1kg gain	5.65	5.43	5.58
Kg TDN/1kg gain	3.58	3.76	3.83
g DCP/1kg gain	0.52	0.57	0.54

* Economic conversion = return from body gain/ total feed cost

Growth Performance: Initial body weight was almost the same for the different lamb groups being 12.84 kg. However, the final body weight was differed among treatments. T2 and T3 showed higher final body weight than the control group, being 38.70, 37.77 and 37.25 kg, respectively.

The values showed that the highest recorded by T2 and T1 compared with control group being, 143.66, 137.87 and 135.61g /h/day, respectively. Daily growth rate of sheep are comparable to those obtained for growing sheep under desert conditions by Kandil and Ahmed [22].

The improvement in daily gain as a result of adding urea or biological treatments may be due to its effect on microbial efficiency and organic matter digestibility. It is interest to note that the present results of live body weight and average daily gain are in parallel with the results obtained in digestibility trial which showed that most of the nutrients were digested more by urea or by biologically treated rations than the control ration. Gado [23] reported that increasing the concentration of cellulase

Table 3: Effect of experiments on feed intake, digestibility coefficients and nutritive values

Items	Treatments			
	T1	T2	T3	SE
No. of animals	3	3	3	
Live body weight	38.58	38.8	38.88	± 1.023
Dry matter intake g/h/d				
Concentrate	710.83	711.67	712.5	± 5.521
Roughage	221.67	225.67	231.33	±5.238
Total	932.5	937.33	943.83	± 10.725
Digestibility coefficient % :				
DM	80.69 [b]	84.56 [a]	84.10 [a]	± 0.197
OM	78.76 [b]	85.39 [a]	83.36 [a]	± 1.234
EE	90.89 [c]	94.45 [b]	95.08 [a]	± 0.083
CP	73.88 [b]	79.81 [a]	80.63 [a]	± 0.262
CF	67.41 [b]	76.41 [a]	64.99 [c]	±0.422
NFE	87.86 [b]	87.88 [b]	89.11 [a]	± 0.124
NDF	57.17 [b]	65.41 [a]	48.85 [c]	± 0.680
ADF	54.12 [b]	64.62 [a]	46.76 [c]	± 0.733
Cellulose	48.75 [b]	64.94 [a]	39.58 [c]	± 0.851
Hemicellulose	63.05 [b]	66.64 [a]	52.08 [c]	± 0.593
Nutritive values:				
TDN g/kg BW	18.95 [a]	19.75 [a]	19.79 [a]	± 0.285
TDN % of DMI	78.35 [b]	81.72 [a]	81.43 [a]	± 0.160
DCP g/kg BW	2.30 [b]	2.52 [a]	2.37 [b]	± 0.031
DCP% of DMI	9.51 [c]	10.45 [a]	9.73 [b]	± 0.036

enzyme had a positive (P<0.01) reflection on average body gain in bagasse treatment in comparison with control treatment.

Similar results were found by Deraz [24], who found that groups fed biologically treated rice straw were most efficient group, average daily gain was 106.04 gm/day of Ossimi lambs fed biological treated rice straw comparing with those fed control ration 80.06 gm/d for 154 days. Khamis [20] found that the greatest body weight changes expressed as a percent of initial weight for sheep fed treated olive tree by-products (38.7%) compared to control (34.3%). Also, he found that the daily gain was 120 g/h/d compared to control 106.3 g/h/d. Fayed *et al*. [25] reported that biological treatment (cellulolytic bacteria or nitrogen bacteria) significantly (P<0.05) increased the average body weight and average daily gain.

Urea treatment was more efficient in economic conversion than other treatments, being 5.22, 5.01and 4.11 for T2, T3 and T1, respectively. Data of feed efficiency expressed as kg DM, TDN and DCP needed for one kg gain indicated that there was slight difference among the three treatments, Urea treatment was more efficient in converting DM into gain, while control group was more efficient in converting TDN and DCP into gain compared to other treatments.

The improvement in feed efficiency may be attributed to the increase in apparent digestibility of all nutrients as a result of chemical treatment with urea or biological treatment with *T. viride* and *S. cerevisiae* supplement and could be explained by the effect of those treatments on the changes of microflora in the rumen, moreover the improvement in biological treatment may due to the more active role of cellulolytic bacteria as a results of adding yeast culture [26] and/or may be related to shifts in efficiency of fermentation by increasing ruminal propionate and decreasing acetate concentrations [27]. These results are in agreement with that obtained by Khamis [20], who found that feed conversion was better in sheep fed treated olive tree by-products (10.05) compared to control (10.24), also, the cost of dry matter consumed to produce one kg body gain was in favor (3.16) for group fed treated olive by products compared to control (3.36). El-Shafie *et al.* [28] reported that biological treatment of wheat straw with *T.viride* increased the feed conversion of feed utilization expressed as kg DM/kg gain.

Digestibility and Nutritive Values: The data of Table 3 indicated that there was no significant difference in total dry matter intakes (g/h/d) for different groups. Data indicated that T2 followed by T3 tended to increase (P<0.01) the digestibility of DM, OM, CP and CF more than T1, while the difference between T2 and T3 was not significant. (T3) followed by (T2) tended to increase (P<0.01) the digestibility of EE compared to control T1. The digestibility of NFE was the highest (P<0.01) with T3 followed by T1 and T2. The difference between T1 and T2 was not significant. The highest (P<0.01) digestibility of NDF, ADF, ADL, cellulose and hemicellulose recorded by T2 and T1.

Shoukry *et al*. [29] and Yacoyt *et al*. [30] reported that urea treatment of poor quality roughages increased digestibility or degradability of cell wall constituents. Also, Hassan *et al*. [31] reported that the average digestibility coefficients of CF, NDF and cellulose were higher (P<0.05) in ureated banana wastes compared with control but lower than biologically treated groups.

Also, Shoukry *et al*. [32] found that *Trichoderma viride* fungi increased IVDMD of Sugar cane bagasse from 22.1% to 45.5% and the in situ DM disappearance in rumen of sheep was also improved. El-Shafie *et al*.[28] reported that biological treatment of wheat straw with *T.viride* improved the digestibility coefficients of DM, OM, CP, CF, EE, NDF, ADF, ADL, cellulose and hemicellulose compared with control.

Table 4: Water consumption and nitrogen balance for female sheep affected by experimental rations.

Items	Treatments T1	T2	T3	+ SE
Total water intake ml/h/d	5465.70 [a]	4251.37 [a b]	3064.38 [b]	364.1
Total excreted water ml/h/d	1761.29 [a]	604.86 [b]	584.37 [c]	201.8
Water balance ml/h/d	3704.41 [a]	3646.51 [a]	2480.01 [b]	274.4
Nitrogen balance:				
N. intake:-	0.497 [a b]	0.507 [a]	0.470 [b]	0.008
mg/kg BW				
fecal N:-	0.130 [a]	0.103 [b]	0.093 [b]	0.004
mg/kg BW	26.12 [a]	20.19 [b]	19.37 [b]	0.262
% of Intake				
urinary N:	0.176 [a]	0.153 [a]	0.116 [b]	0.008
mg/kg BW	35.42 [a]	30.58 [b]	24.73 [c]	1.204
% of Intake				
Total N excretion	0.306 [a]	0.256 [b]	0.209[c]	0.008
mg/kg BW	61.54 [a]	50.76 [b]	44.09 [c]	1.38
% of Intake				
N Balance:-	0.190 [c]	0.251 [b]	0.279 [a]	0.004
mg/kg BW	38.46 [c]	49.23 [b]	55.90 [a]	1.38
% of Intake				

Concerning the nutritive values, the data showed that T2 and T3 increased (P<0.01) TDN (g/kg BW and % of DMI) compared to T1, the difference between T2 and T3 was not significant, being 81.72, 81.43 and 78.35 % of DMI, respectively. DCP intake was significantly (P<0.01) affected by treatments, urea treatment had the highest values of DCP intake (g/kg BW and % of DMI), the difference between biological treatments and control was not significant, being 10.45, 9.73 and 9.51% of DMI for T2, T3 and T1, respectively.

Water Intake and Nitrogen Utilization: The results of water intake and nitrogen balance for female sheep are presented in Table 4 the data of water intake, water excretion and water balance showed highly significant difference among treatments. Control group T1 tended to increase (P<0.01) total water intake (ml/h/d) more than all treatments, While the data of total excreted water (ml/h/d) indicated that T1 had the highest (P<0.01) water excretion. However, the difference between T2 and T3 was not significant. T3 showed least values of water balance (ml/h/d) while T1 showed the highest value of water balance, the values were 3703.67, 3646.33 and 2441.66 ml/h/d for T1, T2 and T3, respectively.

Similar results were obtained by Hassona [33], who reported that the highest (P<0.01) drinking water was obtained with animals fed CFM plus 5% urea treated rice straw restricted (2058 ml/h/d) and rations contained CFM plus ensiled 5%ureated rice straw *ad lib* (2570 ml/h/d), compared to those fed ration contained CFM + untreated rice straw *ad lib* (1850 ml/h/d). Also, Fayed *et al*. [25] found that the greatest values of drinking water, total water intake, urinary water, total water excretions (ml/h/d) and water balance were achieved with sheep fed silage salt plant mixture fermented with a mixture of cellulolytic bacteria+ nitrogen bacteria followed by that treatment containing nitrogen bacteria alone.

Nitrogen intake (mg/kg BW) was significantly differed among treated groups. The mean value obtained from T2 was the highest group followed by T1. It seems that urea treatment and biological treatment decreased (P<0.01) fecal, urine and total nitrogen excretion as mg/kg BW or as percentage of intake more than control group T1, also it seems that T3 had values less than T2. Nitrogen balance (mg/kg BWor % of intake) was higher (P<0.01) in treated groups more than control group. It seems that T3 improved nitrogen balance (g/h/d) more than T2 but the difference was not significant being 55.90, 49.23 and 38.46 as percentage of intake for T3, T2 and T1, respectively. This increase for biological treatment was a result of less nitrogen excretion. These results indicated that urea and biological treatments improved nitrogen balance.

The highest nitrogen retention by feeding urea treatment could be due to the higher improvement in CP intake and digestibility and the higher utilization of urea nitrogen by sheep. The supplementary feeding improves the intake and performance of the animals. On the other hand, some biological treatments improved the chemical structure and composition of the treated wastes and by-products [16]. Therefore, these treatments improve also the intake, digestibility, feeding value and N-balance [34].

The results of the present study are in agreement with Sharma *et al*. [35],who reported that the values of N-balance (g/h/d) were 1.2, 2.1, 2.7 and 3.7 for animals fed rations contained untreated corn stalks, urea sprayed corn stalks, urea sprayed corn stalks plus ensiling dried and urea sprayed corn stalks plus ensiling wet, respectively. Also, El-Ashry *et al*. [36] used rations containing biologically treated crop-residues and showed positive nitrogen balance. Khorshed [37] reported that biological treatments with *T. viride, S. cervevisiae* or combined of them for cotton stalks or wheat straw feeding for goats showed positive nitrogen balance. In addition, Allam Sabbah *et al*. [38] treated sugar beet pulp with *Trichoderma viride* F-416 and *Sacharomyces cerevisiae* F-12 and replaced it at levels 0, 50, 75 and 100% of corn

Table 5: Ruminal pH and ruminal total volatile fatty acids (VFA's) concentrations of female sheep fed experimental rations

		Treatments			
Item	Time	T1	T2	T3	Overall mean
pH	0	6.96±0.03	6.73±0.03	6.86±0.03	6.85 [a]±0.02
	3	6.26±0.03	6.20±0.03	6.33±0.03	6.26 [c]±0.02
	6	6.46±0.03	6.36±0.03	6.50±0.03	6.44 [b]±0.02
Overall mean		6.57 [a]±0.02	6.43 [b]±0.02	6.57[a]±0.02	
TVFA's	0	6.53±0.16	6.86±0.16	6.76±0.16	6.72 [c]±0.09
mg/100 ml R.L	3	9.25±0.16	9.53±0.16	9.50±0.16	9.42 [a]±0.09
	6	8.28±0.16	8.43±0.16	8.66±0.16	8.46 [b]±0.09
Overall mean		8.02[a]±0.09	8.28[a]±0.09	8.31[a]±0.09	
Total nitrogen	0	103.33±1.57	116.53±1.57	126.93±1.57	115.60[c] ±0.91
mg/100 ml R.L	3	126.00±1.57	146.80±1.57	147.23±1.57	140.01[a]±0.91
	6	114.83±1.57	135.23±1.57	135.90±1.57	128.65 [b]±0.91
Overall mean		114.72[c]±0.91	132.85 [b]±0.91	136.68 [a]±0.91	
True protein nitrogen	0	35.50±1.85	34.66±1.85	44.46±1.85	38.21[c]±1.07
mg/100 ml R.L	3	41.66±1.85	48.70±1.85	50.59±1.85	46.98[a]±1.07
	6	37.16±1.85	43.13±1.85	46.72±1.85	42.34[b]±1.07
Overall mean		38.11[c]±1.07	42.16 [b]±1.07	47.26 [a]±1.07	
NPN mg/100 ml R.L	0	67.83±0.92	81.86±0.92	82.46±0.92	77.38[c]±0.53
	3	84.33±0.92	98.10±0.92	96.64±0.92	93.02[a]±0.53
	6	77.66±0.92	92.10±0.92	89.17±0.92	86.31[b]±0.53
Overall mean		76.61 [b]±0.53	90.69 [a]±0.53	89.42 [a]±0.53	
Ammonia nitrogen	0	32.30±0.43	38.98±0.43	39.27±0.43	36.85[c]±0.25
mg/100 ml R.L	3	40.16±0.43	46.71±0.43	46.02±0.43	44.29[a]±0.25
	6	36.98±0.43	43.85±0.43	42.46±0.43	41.10[b]±0.25
Overall mean		36.48 [b]±0.25	43.18 [a]±0.25	42.58 [a]±0.25	

Means with the different letter in the same row are significantly different at (P<0.01)

grain included in the concentrate feed mixture fed to growing lambs, T1, T2, T3 and T4, respectively. They showed that biological treatment with T3 recorded the highest value in nitrogen balance and NB/IN.

Rumen Liquors Parameters: Data of rumen liquors parameters of the different female sheep groups are illustrated in Table 5. The overall mean of urea treatment had the lowest ruminal pH (6.43) while there was no difference between biological treatment and control group. The overall means of ruminal pH at the different sampling times clearly showed highest values (P>0.01) at zero hr of feeding (6.85) followed by 6 hours (6.44), whereas, the lowest one (P>0.01) was recorded at 3 hr post-feeding (6.26).

The present results may be related to fermentation process of both nonstructural and structural carbohydrates and production of volatile fatty acids which increased with proceeding time, so, that affected the pH to some limit unit they were proportionally and relatively absorbed from the rumen wall resulting in an increase in pH value (i.e. 6hrs post feeding). This assumption is in agreement with the conclusion of Roddy and Roddy [39], who stated that the pH values were inversely related to TVFA's concentration in the rumen. Similar results were obtained by Fouad *et al*. [40], who showed that rumen liquor pH values of control group (6.58) was significantly (P<0.05) higher than urea treatment. As for biological treatments, Allam Sabbah *et al*. [38] treated sugar beet pulp with *Trichoderma viride* F-416 and *Sacharomyces cerevisiae* F-12 and replaced it at levels 0, 50, 75 and 100% of corn grain included in the concentrate feed mixture fed to growing lambs, T1, T2, T3 and T4, respectively. They found no significant difference among treatments in pH values. Also, Abo-Eid *et al*. [41] reported that ruminal pH was not significantly lower for rams fed rations containing biologically treated (*Trichoderma reesei*) roughage (rice straw, corn stalks, olive pulp or date seeds). Also, they reported that the highest pH value was recorded at zero time, while the lowest was at 3 hrs post feeding, the values increased again after 6 hrs.

The data of ruminal total volatile fatty acids values indicated that T3 and T2 had the highest ruminal TVFA's value (mg/100 ml R.L) than T1 but the difference among the three treatments was not significant, being 8.31, 8.28 and 8.02, respectively. The overall means of ruminal total volatile fatty acids at the different sampling times clearly showed an increase (P<0.01) in ruminal TVF's concentration, reached the highest (P>0.01) value at 3hr post-feeding (9.42) and then decreased gradually at 6 hours post feeding (8.46) to reach the lowest one (P>0.01) at zero time pre feeding (6.72). These results suggest that the fermentation of biological treatment (*Trichoderma viride*) and urea were more efficient and faster yielding more TVFA's than that of control. Also it might be due to the increase of digestibility of organic matter [42]. The results of biological treatments might be related to more utilization of dietary energy and positive fermentation in the rumen. These results are in agreement with Yacoyt *et al*. [30],who indicated that the highest (P<0.05) TVFA concentrations were shown by ureated and inoculated with sill-all rations with significant difference (P<0.05). Also, they indicated that ruminal TVFA concentrations reached its maximum level at 3 hrs post feeding for all treatments. Also, Allam Sabbah *et al*. [38] treated sugar beet pulp with *Trichoderma viride* F-416 and *Sacharomyces cerevisiae* F-12 and replaced it at levels 0, 50, 75 and 100% of corn grain included in the concentrate feed mixture fed to growing lambs, T1, T2, T3 and T4, respectively. They showed that biological treatment with T1 and T2 had (P<0.05) higher values of TVFA's at 0, 3 and 6 hours sampling time compared with T3 and T4. T3 had the highest value of ruminal total nitrogen followed by T2 than T1. Ruminal total nitrogen increased (P<0.01) at 3 hours post feeding then decreased gradually at 6 hours post feeding and the lowest value was at zero time pre feeding, being, 140.01, 128.65 and 115.60 mg/100 ml rumen liquor, respectively.

Also, T3 increased (P<0.01) ruminal total nitrogen and ruminal true protein (mg/100 ml R.L) values more than T2 followed by T1. Also, the data clearly showed gradual increase (P>0.01) of ruminal total nitrogen and ruminal true proteins nitrogen concentration with post-feeding time progressed to reach the maximum value at 3hr post-feeding then decrease to the minimum value at zero time of feeding.

The data clearly showed significant (P>0.01) difference in ruminal non-protein nitrogen (NPN) and ruminal ammonia. NPN and ruminal ammonia take the same trend. T2 followed by T3 increased (P<0.01) NPN and ruminal ammonia (mg/100 ml R.L) followed by control group T1. The data also showed gradual increase of ruminal NPN and ruminal ammonia after feeding gradually to reach the maximum value at 3hr post-feeding then decreased to the minimum value at zero time of feeding. The increase in ruminal non-protein nitrogen and ruminal ammonia could be a result of breakdown of proteins and other nitrogenous compounds to NH_3-N of the ensiled materials and/ or the use of urea which was degraded directly to NH_3-N after feeding compared with other treatments.

It might be conclude that the increase in ruminal protein digestion with biological treatments is due to increasing the ruminal ammonia nitrogen compared to the untreated crop by-products.

Our results are supported by results of Yacoyt *et al*. [30], who indicated that the sharp increase in concentration of rumen NH_3-N noticed at 3 hrs post feeding, which could be a result of breakdown of proteins and other nitrogenous compounds. Also, Abo-Eid *et al*.[41] reported that ruminal ammonia was significantly (P<0.05) higher for rams fed rations containing biologically treated (*Trichoderma reesei*) roughage (rice straw, corn stalks, olive pulp and date seeds), NH_3-N reached the maximum values after 3 hrs of feeding for all treatments, while the lowest value was at zero hrs of feeding.

Blood Serum Parameters: The results in Table 6 indicated that total proteins concentration, albumin, globulin and A/G ratio were significantly (P<0.01) affected by treatments. Urea treatment T2 and biological treatment with *T.viride* + *S.cerevisiae* T3 increased (P<0.01) total serum proteins and albumin more than control group the highest value of globulin was for T3 followed by T2 then T1. It is clear that total proteins, albumin and globulin were increased at 4 hr post-feeding compared to pre-feeding values. The data showed that urea treatment T2 had the highest value (P<0.01) of albumin: globulin ratio, however, there was no significant difference between T1 and T3. Also, there was a significant difference between different sampling times. Similar results were obtained by El-Ashry *et al.* [36], who reported that the plasma total protein values showed the highest value with biologically treated corn stalks (7.8 g/100 ml), while diet contained

Table 6: Blood serum parameters for female sheep fed experimental rations

Items	Time	T1	T2	T3	Overall mean
Total proteins g/dl	0	7.15±0.03	8.56±0.03	8.35±0.03	8.02^{b}±0.017
	4	8.25±0.03	9.55±0.03	9.23±0.03	9.01^{a}±0.017
Overall mean		7.70^{c}±0.02	9.05^{a}±0.02	8.79^{b}±0.02	
Albumin g/dl	0	3.56±0.07	4.69±0.07	4.10±0.07	4.12^{b}±0.04
	4	4.39±0.07	5.25±0.07	4.87±0.07	4.84^{a}±0.04
Overall mean		3.97^{c}±0.05	4.97^{a}±0.05	4.48^{b}±0.05	
Globulin g/dl	0	3.60±0.08	3.87±0.08	4.25±0.08	3.90^{b}±0.05
	4	3.86±0.08	4.30±0.08	4.37±0.08	4.17^{a}±0.05
Overall mean		3.72^{c}±0.05	4.08^{b}±0.05	4.31^{a}±0.05	
Albumin:	0	1.02±0.04	1.22±0.04	0.97±0.04	1.07^{b}±0.02
Globulin ratio	4	1.17±0.04	1.22±0.04	1.12±0.04	1.16^{a}±0.02
Overall mean		1.09^{b}±0.03	1.22^{a}±0.03	1.04^{b}±0.03	
Urea mg/dl	0	31.28±1.06	32.60±1.06	25.01±1.06	29.62^{b}±0.61
	4	40.37±1.06	44.67±1.06	37.20±1.06	40.74^{a}±0.61
Overall mean		35.82^{b}±0.75	38.63^{a}±0.75	31.10^{c}±0.75	
Creatinine mg/100ml	0	0.797±0.02	0.743±0.02	0.747±0.02	0.762^{b}±0.01
	4	0.950±0.02	0.940±0.02	0.903±0.02	0.931^{a}±0.01
Overall mean		0.87±0.02	0.84 ±0.02	0.82 ±0.02	
GOT U/L	0	23.00±0.38	25.00±0.38	23.00±0.38	23.66^{b}±0.22
	4	26.00±0.38	27.33±0.38	24.67±0.38	26.00^{a}±0.22
Overall mean		24.50^{b}±0.27	26.17^{a}±0.27	23.83^{b}±0.27	
GPT U/L	0	6.67±0.47	6.67±0.47	4.00±0.47	5.8^{a}±0.27
	4	6.67±0.47	6.67±0.47	4.00±0.47	5.8^{a}±0.27
Overall mean		6.67^{a}±0.33	6.67^{a}±0.33	4.00^{b}±0.33	

Means with the same letter are not significantly different

untreated rice straw has the lowest value (7.3 g/100 ml). Kholif [43] found that banana wastes treated by *T. viride, Pencicillium* and *Saccharomyces cerevisiae* increased (p< 0.01) serum total protein and albumin compared with the control. However A/G ratio was not affected by the treatments.

The data showed that urea concentration of blood serum was significantly increased (P<0.01) in (T2) followed by (T1) at zero time and at 4h post-feeding comparing to (T3). The data showed that urea concentration increased at 4hr post feeding more than at zero time of feeding. The present results of serum urea values for the different experimental treatments are within the normal values for sheep and in agreement with those obtained by El-Ashry *et al.* [16].

The data clearly showed that creatinine concentration of female blood serum was not significantly differed among treatments. The results showed that creatinine concentration increased at 4hr post feeding more than at zero time of feeding. Data of serum GOT activity (U/L) values showed that urea treatment T2 showed higher GOT activity than those fed control T1 or biologically treated diets. However, there was no significant difference between T1 and T3. öMorever, it is interest to note that GOT values at 4h post-feeding were significantly higher than those at zero hour. These results are in full agreement with Kholif [43], who found that feeding banana wastes treated by *T. viride, Pencicillium* and *Saccharomyces cerevisiae* decreased (P<0.05) serum AST and cholesterol concentration compared with the control.

As for GPT activity (U/L) the data indicated that the lowest value was recorded for T3, while the difference between control and urea treatment groups was not significant. Similar results were obtained by Gado *et al.* [44], who reported that there were no differences in GPT and GOT among lambs fed ureated yellow corn or ureated barely grains or untreated yellow corn or untreated barely grains.

CONCLUSION

Feeding sheep on ration containing olive trees pruning by products (leaves and twigs) treated chemically with urea or fermented biologically with *T.viride + S.cerevisiae*, improved animal performance, increased digestibility of all nutrients, increased nutritive value, improved rumen liquor and blood parameters, decreased fed cost.

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