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Nutritional and Productive Performance of Sheep Fed on Date Palm Leaves Silage with or Without Addition of Bacteria

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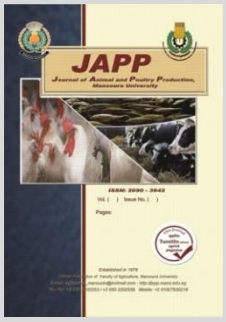

ABSTRACT

Effect of feeding date palm tree leaves as dried or silage incubated with or without bacteria on sheep performance during pregnancy and lactation periods, and lambs performance was investigated in the current study. Forty ewes (4 years old and 49.5±2.5 kg body weight) at the beginning of pregnancy were randomly assigned into four groups (n=10 in each). The first (C) fed control ration consisted of 60% concentrate feed mixture +40% berseem hay. The second (R1) fed ration contained 60% CFM + 40% dried date palm leaves (DDPL). The third (R2) fed ration contained 60% CFM + 40% silage DPL (SDPL). The fourth (R3) fed ration contained 60% CFM + 40% silage DPL incubated with *Cellulomonas cellulasea* (SBDPL). Digestibility trial was done at the end of lactation period. Results revealed that SBDPL increased (P≤0.05) body weight and total gain of ewes by progressing the pregnancy and lactation, with no significant difference with control group, followed by SDPL and DDPL, respectively. C and R3 improved (P≤0.05) digestibility coefficients and nutritive value compared with R2 and R1, in addition to a significant (P≤0.01) increase of rumen fermentations, protozoa and cellulolytic bacteria counts. Also, SBDPL increased (P≤0.05) serum glucose, total proteins, albumin, globulin, urea and creatinine concentrations, which affected milk yield and lambs performance comparing with SDPL and DDPL. Feeding date palm leaves silage with addition of bacteria is better than feeding silage without addition of bacteria or dried date palm leaves and could replace hay in rations of ewes during pregnancy and lactation.

Keywords: Date palm leaves, pregnancy, lactation, sheep performance.

INTRODUCTION

Sheep is a large livestock population in Egypt, feed shortage both in terms of quantity and quality is a major problem hindering the development of livestock industry in Egypt. Also, the shortage in natural grazing lands in Egypt is a main factor of the deficit in dry matter (DM) supply for livestock.

Phoenix dactylifera (Date palm trees) are very popular foods in Egypt and Arabian countries. Egypt is the second country in the world production of date, which produced 1166182 tons (FAO, 2006). Date palm tree produced approximately 20 kg of leaves annually, which mean producing approximately 220000 tons of dry matter annually.

The primary goal of making silage is to maximize the preservation of original nutrients in the forage crop for feeding of livestock at a later date in livestock feeding programs (Stewart, 2011). The purpose of silage additives is to control the preservation process so that by the time of feeding it has retained as many of the nutrients present in the original fresh forage as possible and to ensure that the growth of lactic bacteria predominates during the fermentation process, producing lactic acid in quantities high enough to ensure a good silage (Oliveira, 1995). Bacterial inoculants of silage had received much attention among both researchers and livestock producers (Bolsen *et al*., 1996).

There are several possible modes of action for bacterial feed supplements including increased nutrient digestibility, increased flow of nutrients to the small intestine, improved nutrient retention, stabilization of ruminal pH, improved ruminal fermentations and enhancement of ruminal microbial growth (Yoon and Stern , 1995). Also, Wallace (1994) noticed that microbial feed supplementation has improved milk yield and milk composition. Raeth-Knight *et al.* (2007) stated that addition of the direct-fed microbials improved feed efficiency for dairy cows, and also enhanced animals health. Farahat (2014) stated that biological treatment for lactating goat's diets improved all nutrients digestibility and nutritive values. Moreover, Harrison *et al.* (1988) and Dawson *et al.* (1990) stated that numbers of total ruminal microbes especially cellulolytic bacteria had been increased with biological treatment.

This study was proposed with the objectives to investigate the effect of feeding date palm tree leaves in dried or silage form with or without biological additives on sheep performance during pregnancy and lactation periods and performance of their lambs until weaning.

MATERIALS AND METHODS

The field experiments were carried out at Ras Sudr Experimental Research Station, Desert Research Center, located in Southern Sinai Governorate, Egypt, from January to August 2019. Green date palm leaves were pruning at October 2018 and chopped to 2-3 cm then air-dried for 15 days to reach 10-15% moisture, then stored till to be used.

Silage preparation:

Two forms of silage was carried out without or with bacteria incubation, chopped dried date palm leaves (10-

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15% moisture) were wilted to diminish the moisture content to about 70%. About 5% molasses and 1.5% lime stone were added /100 kg dry matter. *Cellulomonas cellulasea* bacteria added at a level of 150 ml/100 kg dry matter for silage incubated with bacteria. Silages ensiled in silo (2x1.5x1.75 meters) by a mean of plastic sheet to reduce the amount of oxygen and encourage a good fermentation. Another plastic sheet was used to cover the silo. The silages were compressed by workers feet, then hard pressed with 30 cm of soil layer and ensiled for 8 weeks.

Ewes feeding and experimental design:

Forty female Barki ewes (about 4 years old and 49.5±2.5 kg body weight) at the beginning of pregnancy period were randomly assigned into four groups of ten animals each. The experimental period was 32 weeks (20 weeks for pregnancy, and 12 weeks for lactation and weaning). Ewes were fed dry matter at a rate of 4% of their body weight twice daily at 7 a.m. and 2 p.m., while water was offered freely. The first group (C) was fed control ration consisted of 60% concentrate feed mixture (CFM: 55% Yellow corn, 20% wheat bran, 15% soya bean meal, 5% molasses, 3% limestone, 1.5% salt, 0.5% minerals premix) plus 40% berseem hay. The second group (R1) was fed ration contained 60% CFM and 40% dried date palm leaves (DDPL). The third group (R2) was fed ration contained 60% CFM and 40% silage DPL (SDPL), while the last group (R3) was fed ration contained 60% CFM and 40% silage DPL incubated with Cellulomonas cellulasea bacteria (SBDPL).

Digestibility trail:

At the end of lactation period, digestibility trials were carried out to study the effect of feeding the experimental rations on digestibility coefficients, rumen fermentations, ruminal protozoa and bacterial count, and blood constituents. Four ewes from each group were placed in metabolic cages, weighed at the start and the end of the trial. The trial lasted for 20 days from which the first 15 days were considered as an adaptation and preliminary period, followed by 5 days as collection period. Over the collection period, daily amount of feed consumed, residuals, feces, urine and drinking water were estimated for each animal.

Analytical procedures:

Feedstuffs and fecal samples were analyzed according to the AOAC (1995) methods to determine crude protein (CP), ether extract (EE), crude fiber (CF) and ash contents. The neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin contents were determined using the methods described by Van Soest (1994).

Rumen liquor samples were obtained at 0, 3 and 6 hours post feeding. Ruminal pH value was immediately measured with pH meter. Ammonia-nitrogen, total nitrogen and non-protein nitrogen concentrations were determined by the modified semi-micro-kjeldahl digestion method according to AOAC (1995), while true protein nitrogen was calculated by subtracting non-protein nitrogen from total nitrogen. Total volatile fatty acids were determined according to Warner (1964). Ruminal microbial protein was estimated as described by Makkar *et al*. (1982).

The filtered rumen liquor were collected at 0, 3 and 6 hours post feeding and stained with 4 times volume of methyl-green formalin saline solution as described by Ogimoto and Imai (1981) for classification and determination of ruminal ciliate protozoa count as published by Dehority (1993). Dilution series were prepared under O_2 –free CO_2 by the anaerobic method of Bryant (1972) using the anaerobic diluents described by Mann (1968) to determine total number of bacteria and cellulolytic bacteria number.

Blood samples were obtained at 4 h post-feeding from ewes of each treatment; serum was separated and kept frozen till analysis for glucose according to Trinder (1969), total proteins by using electronic apparatus, albumin according to Doumas and Biggs (1971), globulin obtained by subtracting, urea according to Patton and Crouch (1977), cholesterol according to Allain *et al*. (1974), aspartate amino transferase (AST) and alanine amino transferase (ALT) activity according to Wikison *et al*. (1972).

The ewes were milked twice a day (8a.m. and 5 p.m.) during the last three days of each lactation period. Milk samples were collected as constant percentage of morning and evening milking, milk yield was recorded. Samples were analyzed for total solids, fat, total protein lactose and Ash according to AOAC (1995) procedures. Solids-not-fat was calculated by subtracting fat from total solids. Fat corrected milk (4% fat) was calculated according to the equation of Gaines (1928):

$$\mathbf{FCM = 0.4\ M + 15\ F.}$$

Where: M= milk yield (g) and F= fat yield (g).

Statistical analysis:

Statistical analysis system of SAS (2009) was used for statistical analysis, one-way analysis was used for most of the data using the following model:

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

Rumen fermentation parameters and microbes were analyzed by two-way analysis according this model:

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

Where: Y_{ij} = experimental observation, μ = general mean, T_i = effect of treatment (i =1:4), I_j = effect of sampling time (j=1:3), TI_{ij} =effect of interaction between treatment and sampling time, and e_{ij} = experimental error. Duncan's multiple test used for separation among means (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition and cell wall constituents of feedstuffs:

It is of interest to note that after ensiling fermentations with or without bacteria, date palm leaves (SDPL and SBDPL) had high levels of DM, OM, EE and CP contents, while it contained low levels of CF, NDF, ADF, ADL, cellulose and hemicellulose contents (Table 1).

The increase in protein content in DPL silage may be related to silage fermentations which release minerals containing nitrogen salts or due to the release of water soluble sugar from polysaccharides which led to faster growth of lactic acid bacteria which in turn result higher CP content. The present results are in

agreement with Aziz (2009) who showed that olive tree leaves ensiled with biological treatments increased DM, OM, EE and CP and decreased CF, NDF, ADF and ADL. Also, Aziz (2019 and 2020) reported that ensiling DPL with urea or with fibrolytic enzymes enhanced chemical composition especially OM and CP, while CF, NDF, ADF and ADL were decreased.

Table 1. Chemical composition and cell wall constituents (%) of feedstuffs and rations.

Items	Feedstuffs					Rations			
	CFM	BH	DDPL	SDPL	SBDPL	C	R1	R2	R3
DM	94.00	90.97	92.88	93.67	94.00	92.79	93.55	93.87	94.00
OM	92.39	89.00	89.86	91.03	91.78	91.03	91.38	91.85	92.15
Ash	7.61	11.00	10.14	8.97	8.22	8.97	8.62	8.15	7.85
EE	3.10	2.22	1.23	1.68	2.05	2.75	2.35	2.53	2.68
CP	12.18	13.00	6.30	8.86	11.57	12.51	9.93	10.85	11.94
CF	10.96	25.68	40.72	34.22	28.23	16.85	22.86	20.26	17.87
NFE	66.15	48.10	41.61	46.27	49.93	58.92	56.24	58.21	59.66
NFC	47.58	12.37	23.69	31.35	33.62	33.49	37.93	41.10	42.00
NDF	29.53	61.41	58.64	49.14	44.54	42.28	41.17	37.37	35.53
ADF	17.00	42.87	41.71	32.92	27.76	27.35	26.88	23.37	21.30
ADL	7.56	7.12	21.11	17.13	14.34	7.38	12.98	11.39	10.27
Cellulose	9.44	35.75	20.60	15.79	13.42	19.97	13.90	11.98	11.03
Hemicellulose	12.53	18.54	16.93	16.22	16.78	14.93	14.29	14.00	14.23

CFM: concentrate feed mixture, BH: berseem hay, DDPL dried date palm leaves, SDPL: silage date palm leaves, SBDPL: DPL silage treated with *C. cellulasea* bacteria. C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL.R (2): 60% CFM + 40 % SDPL. R (3):60 % CFM + 40 % SBDPL.

Ewes performance during pregnancy period:

The data of Table (2) showed that initial body weight (kg/h/d) at the beginning of pregnancy showed non-significant difference between C and R3 followed by R2, while R1 was the lowest one. Only SBDPL (R3) maintained body weight of ewes by advancing the pregnancy as in control with no significant ($P \leq 0.01$) difference with C group, while SDPL (R2) and DDPL (R1) significantly ($P<0.05$) impaired body weight of ewes. Also, R3 had the highest ($P \leq 0.05$) gained weight during the whole pregnancy periods, while the difference among other treatments was not significant. Only ewes fed R3 did not differed significantly from that in control ($P \leq 0.05$) in feed intake as average DMI (g/h/d) during the two periods of pregnancy and during the whole pregnancy period. The data of gained weight indicating better nutritional management and proved that date palm leaves have potentiality to incorporate into ruminants feeding.

The present results in accordance with Moran and Owen(1995) who stated that cattle fed silage inoculated with *Lactobacillus plantarum* ate 7.5% more DM and gained 11.1% more weight. Also, Kung and Muck (1997) reported that microbial inoculants for silage had positive effect on animal feed intake and total body gain. Meeske and Basson (1998) found that feed intake was higher by 10.7% for lambs fed maize silage inoculated with *Lactic Acid* bacteria compared with control.

Table 2. Body weight and feed intake changes during pregnancy periods of ewes fed the tested rations.

Items	Experimental groups				±
	C	R1	R2	R3	SEM
Body weight (kg):					
Initial	54.00^{a}	47.55^{c}	49.10^{b}	52.40^{ab}	2.025
1st4 weeks of pregnancy	54.78^{a}	48.26^{c}	49.87^{b}	55.06^{a}	1.884
2nd4 weeks of pregnancy	55.98^{a}	49.46^{c}	51.07^{b}	56.26^{a}	2.980
3rd4 weeks of pregnancy	57.10^{a}	50.58^{c}	52.19^{b}	57.38^{a}	2.025
4th4 weeks of pregnancy	58.22^{a}	51.70^{c}	53.31^{b}	58.50^{a}	1.883
5th4 weeks of pregnancy	59.34^{a}	52.82^{c}	54.43^{b}	59.62^{a}	1.884
Total increase (kg)	5.34^{b}	5.27^{b}	5.33^{b}	7.22^{a}	0.896
DMI (g/h/d):					
Early pregnancy (1st12 weeks)	1436.65^{a}	1412.52^{b}	1420.54^{b}	1429.10^{a}	2.940
Late pregnancy (2nd8 weeks)	1716.51^{a}	1679.99^{b}	1689.23^{b}	1704.69^{a}	4.822
Average DMI (g/h/d) (20 weeks)	1576.58^{a}	1546.25^{b}	1554.88^{b}	1566.89^{a}	4.648

^{abc} Means with different superscripts in a row are significantly different ($P<0.05$).
C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL. R (3):60 % CFM + 40 % SBDPL.

Reproductive performance of ewes:

The data of Table (3) indicated that there was no difference among treatments on reproductive performance of ewes. Lambing rate were 100 % with no abortion or stillbirth cases found in all groups. Birth number for each group did not differ, there were no twining cases. C group had the highest birth weight, this reversed on production performance as C scored the highest kg born/10 ewes joined followed by R3 then R2 and R1, which also was the same trend for kg weaned/10 ewes joined.

Ewes performance during lactation:

Rations contained SBDPL and SDPL significantly ($P \leq 0.05$) increased body weight and body weight change of ewes during the three stages and the whole lactation period more than the control ration. However, R1 and R2 showed significantly lower body weight as compared to control (Table 4).

Feed intake as DMI (g/h/d) during the three stages and average DMI during the whole period was significantly ($P<0.05$) lower for R1 anR2 as compared to control, but R3 had no significant difference with the control (Table 4). This indicated nearly similarity in the nutritional values of R3 containing SBDPL as in the control diet including berseem hay.

Table 3. Reproductive and productive performance of ewes fed the testes rations.

Items	Experimental groups			
	C	R1	R2	R3
Reproductive performance:				
Number of ewes joined	10	10	10	10
Ewes aborted	0	0	0	0
Conception rate	100	100	100	100
Kidding rate (%)	100	100	100	100
Live lambs born	10	10	10	10
Twining rate (%)	0	0	0	0
Lamb performance:				
Average birth weight (kg)	3.03	2.83	2.91	3.02
Kg born/10 ewes joined	30. 90	28.30	29.10	30.20
Number ofWeaned lambs	10	10	10	10
Average weaning weight (kg)	12.97	12.48	12.65	12.80
kg weaned/10 ewes joined	129.70	124.80	126.50	128.00

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL. R (3):60 % CFM + 40 % SBDPL.

Table 4. Body weight and feed intake changes during lactation periods of ewes fed the tested rations.

Items	Experimental groups				± SE
	C	R1	R2	R3	
Body weight (kg):					
Initial(just after kidding)	55.18^{b}	49.46^{d}	51.31^{c}	56.66^{a}	1.892
Early lactation (1st 4 weeks)	56.26^{b}	50.29^{d}	52.24^{c}	57.78^{a}	1.892
Mid lactation (2nd 4 weeks)	57.40^{b}	51.21^{d}	53.28^{c}	58.98^{a}	1.890
Late lactation (3rd 4 weeks)	58.49^{b}	52.10^{d}	54.26^{c}	60.14^{a}	1.894
Body weight change (kg)	3.31^{b}	2.64^{d}	2.95^{c}	3.47^{a}	0.000
DMI (g/h/d):					
Early lactation (1st 4 weeks)	1340.14^{a}	1277.12^{b}	1294.18^{b}	1328.89^{a}	6.631
Mid lactation (2nd 4 weeks)	1443.68^{a}	1382.83^{b}	1392.96^{b}	1437.34^{a}	6.820
Late lactation (3rd 4 weeks)	1502.34^{a}	1472.85^{b}	1481.53^{b}	1498.53^{a}	3.061
Average DMI (g/h/d) (12 weeks)	1421.59^{a}	1389.56^{b}	1377.60^{b}	1428.72^{a}	4.840

^{abc} Means with different superscripts in a row are significantly different (P<0.05).

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL, R (3):60 % CFM + 40 % SBDPL.

Similar results were obtained by Khattab *et al*. (2008) who found that ensiling of by-products improved DM intake for lactating goats, while body weight did not differ compared with control. Aziz (2009) showed that feeding olive tree leaves biologically ensiled increased body weight, total body gain and feed intake for sheep females. Also, Aziz and Kholif (2015) found that agriculture by-products treated with *C. cellulasea* increased body weight, total gained and feed intake for goat does during pregnancy and lactation stages more than untreated group.

Digestibility coefficients and nutritive values:

The digestibility trial revealed that R3 significantly (P≤0.05) increased OM, CF, NDF, and hemicellulose digestibility coefficients compared with the control (Table 5). However, R3 had no significant difference with the control group in DM, CP, NFE, NFC, ADF, ADL, and cellulose. Generally, ewes received R1 and R2 showed significantly (P<0.05) lower values of most the digestibility coefficients than that received the control and dried R1. The observed increase in nutrients digestibility coefficients in R3 as compared to T1 and R2 may be attributed to that ensiling process for DPL improved palatability and DM intake. Concerning the nutritive value of the rations, only TDN, DE and ME of R3 did not differ significantly from that for C group. However, all nutritive values of R1 and R2 and DCP in R3 significantly (P<0.05) decreased as compared to C group.

Table 5. Digestibility coefficients and nutritive value of ewes fed the tested rations.

Items	Experimental groups				± SE
	C	R1	R2	R3	
Number of animals	4	4	4	4	
Digestibility %:					
DM	71.30^{a}	63.90^{c}	68.84^{b}	71.07^{a}	0.450
OM	71.85^{b}	66.19^{d}	69.71^{c}	72.04^{a}	0.469
EE	55.85^{a}	48.72^{d}	51.82^{c}	55.20^{b}	0.727
CP	67.83^{a}	63.72^{c}	64.33^{b}	67.76^{a}	0.333
CF	67.76^{b}	61.53^{d}	66.64^{c}	68.19^{a}	0.978
NFE	74.55^{a}	66.46^{c}	72.60^{b}	74.81^{a}	0.407
NFC	97.67^{a}	91.26^{c}	94.18^{b}	97.51^{a}	0.953
NDF	55.13^{b}	42.87^{d}	52.39^{c}	56.00^{a}	0.331
ADF	55.64^{a}	41.11^{c}	45.25^{b}	55.41^{a}	0.414
ADL	58.33^{a}	42.60^{c}	56.15^{b}	58.75^{a}	1.970
Cellulose	56.76^{a}	39.71^{c}	50.15^{b}	56.47^{a}	1.090
Hemicellulose	57.59^{b}	45.91^{d}	47.54^{c}	58.56^{a}	0.000
Nutritive value:					
TDN, % of DM	66.79^{a}	62.19^{c}	65.57^{b}	66.43^{a}	1.045
DCP,% of DM	9.54^{a}	6.60^{c}	6.72^{c}	8.03^{b}	0.512
DE, (Mcal kg DM)*	2.94^{a}	2.74^{b}	2.89^{a}	2.92^{a}	0.046
ME, (Mcal kg DM)**	3.20^{a}	2.51^{c}	2.87^{b}	3.07^{ab}	0.073

^{abc} Means with different superscripts in a row are significantly different (P<0.05).

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL. R (3):60 % CFM + 40 % SBDPL.

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

****ME = Metabolic energy = TDN g/head ×3.6 (Church and Pond, 1982).**

The present results in accordance with Khattab *et al*. (2008), Aziz (2009), Salihu *et al*. (2015) and Abd El Tawab *et al*. (2018) who reported that nutrients digestibility coefficients and nutritive value were higher in groups fed ensiled by-products than control group. Moreover, Aziz (2020) reported that sheep fed ration contained DPL ensiled with enzymes improved digestibility coefficients, TDN and DCP compared with untreated and control.

Nitrogen utilization:

Results of Table (6) indicated significant (P≤0.01) differences among treatments, C group had the highest (P<0.05) values for nitrogen intake (g/h/d), digested nitrogen (g/h/d, and % of N intake), nitrogen excretion (g/h/d) and nitrogen utilization (g/h/d and % of N intake) followed by R3 then R2, while the lowest values were for R1. The difference was not significant between C and R3 or between R2 and R1 for nitrogen utilization (% of digested N).

The present results of nitrogen utilization in good agreement with Khattab *et al*. (2008) who noticed that lactating goats fed by-products silage recorded higher values of nitrogen intake, digested nitrogen and nitrogen balance than that fed not ensiled by-products. Aziz (2019 and 2020) reported that digested nitrogen and nitrogen utilization were enhanced for sheep fed rations contained ensiled DPL with urea or with fibrolytic enzymes compared with sheep fed untreated rations.

Table 6. Nitrogen utilization by ewes fed the tested rations.

Items	Experimental groups				±
	C	R1	R2	R3	SE
Nitrogen intake, g/h/d	26.46a	17.78d	21.02c	24.37b	0.374
Digested nitrogen:					
g/h/d	18.28a	11.81d	13.02c	16.40b	0.287
% of N intake	69.10a	66.45c	61.98d	67.31b	1.121
Fecal nitrogen:					
g/h/d	8.17a	5.96b	8.00a	7.97a	0.315
% of N intake	30.89b	33.55b	38.01a	32.68b	1.121
Urinary nitrogen:					
g/h/d	0.417a	0.432a	0.407ab	0.387b	0.007
% of N intake	1.58c	2.43a	1.94b	1.59c	0.025
Total N excretion:					
g/h/d	8.59a	6.39b	8.40a	8.35a	0.315
% of N intake	32.46b	35.98b	39.96a	34.27b	1.111
Nitrogen utilization:					
g/h/d	17.87a	11.38d	12.61c	16.01b	0.283
% of N intake	67.53a	64.02c	60.04d	65.72b	1.111
% of digested N	97.71a	96.33b	96.86b	97.64a	0.049

[abc] Means with different superscripts in a row are significantly different (P<0.05).

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL. R (3):60 % CFM + 40 % SBDPL.

Rumen parameters:

Data of Table (7) showed that rumen parameters for C group were less than R3 and R2, R3 recorded the highest (P<0.05) values of all rumen parameters concentrations followed by R2, while R1 recorded the lowest (P<0.05) values. C group was not significantly differed from R3 for ruminal pH, TVFA's and TN concentrations, although, the difference was significant (P<0.05) for ruminal molar proportions of individual VFA's, TP, NPN, NH_3N and MP concentrations. Overall means at different sampling times showed that the lowest (P<0.05) values of ruminal parameters were at per-feeding then showed significant increase (P<0.05) and recorded the highest (P<0.05) values after 3 hrs post-feeding then showed significant (P<0.05) decrease at 6 hrs post-feeding. The overall means of ruminal pH at different sampling times were at the opposite side of other rumen parameters, as it showed the lowest value at 3 hrs post-feeding.

It is of interest to show that silage process for DPL with or without bacteria enhanced all rumen parameters concentrations more than dried DPL; this is may be due to the highest digestibility of all nutrients especially CP and CF in addition to the highest nitrogen balance. The increment in microbial protein by adding bacteria to DPL silage is may be due to the improvement in microbial population.

Table 7. Rumen parameters of ewes fed the tested rations.

Items	Time	Experimental groups					Overall mean
		C	R1	R2	R3	±SE	
pH	0	7.17	6.76	6.90	7.19	0.041	7.00^{a}±0.020
	3	6.46	6.00	6.15	6.49	0.041	6.27^{c}±0.020
	6	6.57	6.12	6.33	6.65	0.041	6.42^{b}±0.020
overall mean		6.73^{a}	6.29^{c}	6.46^{b}	6.78^{a}	0.024	
TVFA's ml equivalent /100 ml R.L	0	7.10	6.51	6.95	7.28	0.144	6.96^{c}±0.072
	3	9.68	8.25	9.00	9.82	0.144	9.19^{a}±0.072
	6	8.85	7.78	8.21	8.92	0.144	8.44^{b}±0.072
overall mean		8.54^{a}	7.51^{c}	8.05^{b}	8.67^{a}	0.083	
Individual VFA's (%):							
Acetic acid	0	35.21	29.49	32.19	36.39	0.360	33.32^{c}±0.180
	3	40.11	33.74	38.14	41.17	0.360	38.29^{a}±0.180
	6	38.04	31.00	35.05	39.33	0.360	35.85^{b}±0.180
overall mean		37.79^{b}	31.41^{d}	35.12^{c}	38.96^{a}	0.208	
Propionic acid	0	18.25	15.92	16.44	19.89	0.218	17.62^{c}±0.109
	3	23.10	18.56	20.94	25.64	0.218	22.06^{a}±0.109
	6	21.01	16.97	18.90	23.13	0.218	20.00^{b}±0.109
overall mean		20.79^{b}	17.15^{d}	18.76^{c}	22.89^{a}	0.126	
Butyric acid	0	15.94	12.65	14.27	17.28	0.239	15.03^{c}±0.119
	3	18.44	16.46	17.17	21.37	0.239	18.36^{a}±0.119
	6	17.94	14.78	15.42	19.03	0.239	16.79^{b}±0.119
overall mean		17.44^{b}	14.63^{d}	15.62^{c}	19.23^{a}	0.138	
A/P ratio	0	1.93	1.85	1.95	1.83	0.026	1.89^{a}±0.013
	3	1.74	1.81	1.82	1.60	0.026	1.74^{c}±0.013
	6	1.81	1.82	1.85	1.70	0.026	1.79^{b}±0.013
overall mean		1.82^{b}	1.83^{b}	1.87^{a}	1.71^{c}	0.015	
Total nitrogen mg/100 ml R.L	0	108.99	89.53	94.65	111.60	1.390	101.19^{c}±0.695
	3	127.68	113.29	120.70	129.79	1.390	122.86^{a}±0.695
	6	118.82	105.94	110.52	120.18	1.390	113.86^{b}±0.695
overall mean		118.50^{a}	102.92^{c}	108.62^{b}	120.52^{a}	0.802	
True protein nitrogen mg/ 100 ml R.L	0	36.47	33.66	42.53	47.14	1.196	39.95^{c}±0.598
	3	43.32	39.47	42.83	48.16	1.196	43.44^{a}±0.598
	6	39.97	37.36	43.95	46.85	1.196	42.03^{b}±0.598
overall mean		39.92^{b}	36.83^{d}	43.10^{c}	47.38^{a}	0.690	
NPN mg/100 ml R.L	0	64.45	55.87	58.18	66.46	1.161	61.24^{c}±0.580
	3	81.62	73.81	77.38	84.85	1.161	79.42^{a}±0.580
	6	73.33	68.57	70.54	74.87	1.161	71.83^{b}±0.580
overall mean		73.13^{b}	66.08^{d}	68.70^{c}	75.39^{a}	0.670	
Ammonia nitrogen mg/ 100 ml R.L	0	30.83	26.85	28.16	32.73	0.405	29.64^{c}±0.202
	3	36.72	31.34	33.04	38.63	0.405	34.93^{a}±0.202
	6	31.47	28.70	30.76	34.96	0.405	31.47^{b}±0.202
overall mean		33.00^{b}	28.96^{d}	30.65^{c}	35.44^{a}	0.233	
Microbial protein mg/100mlRL	0	67.98	61.96	63.03	70.36	0.412	65.83^{c}±0.206
	3	111.61	106.23	107.81	117.11	0.412	110.69^{a}±0.206
	6	91.14	84.04	86.26	95.30	0.412	89.190^{b}±0.206
overall mean		90.24^{b}	84.08^{d}	85.70^{c}	94.26^{a}	0.237	

[abc] Means with different superscripts in a row and column are significantly different (P<0.05).

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL. R (3):60 % CFM + 40 % SBDPL.

These results in agreement with those cited by Aziz (2009) who reported that sheep fed biological ensiled olive trees leaves improved ruminal pH, TVFA's, NPN and NH3-N concentrations, as ruminal parameters were at maximum level at 3hrs post- feeding. Aboamer *et al*. (2018) reported that feeding ensiled olive trees leaves with urea for lactating sheep increased TVFA's, total N, true protein, NPN and ammonia N compared with sheep fed untreated diet. Abd El Tawab *et l*. (2018) reported that ammonia concentration recorded higher value for olive cake silage treated with fibrolytic enzymes compared with control. Aziz (2019 and 2020) found an improvement in concentrations of ruminal pH, TVFA's, NPN, NH3-N, TN, TP and MP for sheep fed DPL ensiled with urea or with enzymes.

Ruminal ciliate protozoa and bacteria:

With regard to rumen microbes, results of Tables (8&9) indicated the identification of seven genus with seven species and 14 subspecies of ruminal protozoa. These genera are *Entodinum spp*. [*E. caudatum, E.simplex, E.minimum*and, *E.bursa*], *Epidinium ecaudatum, Polyplastron multivesiculatum, Diplodinum spp*. [*D.psitaceum, D.dentatum* and *D.elongatum*], *Ophryoscolox spp.* [*O. caudatus* and *O. purkynjei*], *Isotrchia spp.* [*I.intestinalis* and *I.prostoma*] and *Dasytrachia rummantium*. R3 significantly (P<0.05) increased all protozoa genera counts ($x10^4$ cell/ml rumen liquor) and total bacteria ($x10^8$ cell /ml rumen) and cellulolytic bacteria ($x10^6$ cell /ml rumen) numbers compared with C group which was the second place followed by R2 then R1. The data postulated non-significant difference among groups for *D. psitaceum*, also, non-significant difference was detected between R3 and C for *Epidinium* and *Polyplastron spps.*,while *Ophryoscolox spps* was significantly (P<0.05) higher in C than R3.These results indicated that ration contained SBDPL was efficient as the control ration. Total protozoa count range was 5.23-8.79 ($x10^4$ cell/ml rumen liquor), while total bacteria range was 3.85 - 5.49 ($x10^8$ cell /ml rumen) and cellulolytic bacteria range was 3.62 -5.18 ($x10^6$ cell /ml rumen). The highest presence among all species was for *Entodinum spps*followed by *Polyolastron spps* then *Epidinium Spp.* Comparison among different sampling times indicated that ruminal protozoa, total bacteria and cellulolytic bacteria counts showed significant (P≤0.01) increase at 3 hrs post-feeding then decreased at 6 hrs post-feeding. The values obtained in this study considered as normal level in rumen (Hungate, 1966).

In the present study, the increase of protozoa numbers in rumen liquor of ewes fed biologically treated silage than control or untreated groups may be related to digestibility increase and more utilization of the dietary energy and positive fermentation in the rumen (Kholif*et al*.,2005). Newbold*et al*. (1996) reported that biological treatment increased the rate of rumen fermentation through increase the total and viable count of rumen microbes. Furthermore, in the present study the pH values were always above 6.0 which ensure of maximal celluloalytic activity and microbial protein synthesis as reported by Hungate (1966).

Table 8. Ruminal ciliate protozoa and ruminal bacteria of ewes fed the tested rations.

Items	Time	Experimental groups					Overall mean
		C	R1	R2	R3	±SE	
Entodinum spp.							
	0	1.455	0.879	1.045	1.633	0.081	1.25^{c}±0.040
E. caudatum	3	2.351	1.939	2.190	2.655	0.081	2.28^{a}±0.040
	6	2.090	1.632	1.881	2.490	0.081	2.02^{b}±0.040
overall mean		1.965^{b}	1.483^{d}	1.705^{c}	2.259^{a}	0.047	
	0	0.700	0.417	0.567	0.840	0.059	0.631^{c}±0.029
E. simplex	3	1.430	1.075	1.218	1.650	0.059	1.343^{a}±0.029
	6	1.129	0.727	0.848	1.242	0.059	0.986^{b}±0.029
overall mean		1.086^{b}	0.740^{d}	0.878^{c}	1.244^{a}	0.034	
	0	0.867	0.362	0.649	0.906	0.065	0.696^{c}±0.032
E. minimum	3	1.830	1.065	1.510	2.182	0.065	1.647^{a}±0.032
	6	1.519	0.662	1.205	1.884	0.065	1.317^{b}±0.032
overall mean		1.405^{b}	0.696^{d}	1.121^{c}	1.657^{a}	0.037	
	0	0.637	0.348	0.485	0.709	0.030	0.544^{c}±0.015
E. bursa	3	0.929	0.510	0.773	1.375	0.030	0.897^{a}±0.015
	6	0.821	0.398	0.617	1.026	0.030	0.715^{b}±0.015
overall mean		0.796^{b}	0.419^{d}	0.625^{c}	1.036^{a}	0.017	
	0	0.279	0.214	0.206	0.284	0.012	0.246^{c}±0.006
Epidinium *ecaudatum*	3	0.464	0.418	0.427	0.486	0.012	0.449^{a}±0.006
	6	0.342	0.304	0.325	0.369	0.012	0.335^{b}±0.006
overall mean		0.362^{a}	0.312^{b}	0.319^{b}	0.380^{a}	0.007	
	0	0.356	0.322	0.338	0.375	0.023	0.348^{b}± 0.011
Polyplastron multivesiculatum	3	0.523	0.502	0.513	0.516	0.023	0.513^{a}± 0.011
	6	0.397	0.324	0.328	0.388	0.023	0.359^{b}± 0.011
overall mean		0.426^{a}	0.382^{b}	0.393^{ab}	0.426^{a}	0.013	
Diplodinum spp.							
	0	0.084	0.077	0.079	0.081	0.004	0.080^{c}±0.002
D. psitaceum	3	0.177	0.168	0.171	0.174	0.004	0.173^{a}±0.002
	6	0.125	0.118	0.119	0.121	0.004	0.121^{b}±0.002
overall mean		0.129	0.121	0.123	0.125	0.002	
	0	0.187	0.148	0.170	0.240	0.006	0.186^{c}±0.003
D. dentatum	3	0.376	0.197	0.277	0.391	0.006	0.310^{a}±0.003
	6	0.260	0.183	0.215	0.286	0.006	0.236^{b}±0.003
overall mean		0.274^{b}	0.176^{d}	0.220^{c}	0.306^{a}	0.003	
	0	0.177	0.126	0.166	0.183	0.008	0.163^{c}± 0.004
D. elongatum	3	0.300	0.219	0.270	0.364	0.008	0.288^{a}± 0.004
	6	0.221	0.181	0.196	0.266	0.008	0.216^{b}± 0.004
overall mean		0.232^{b}	0.175^{d}	0.211^{c}	0.271^{a}	0.004	

^{abc} Means with different superscripts in a row and column are significantly different (P<0.05).

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL.R (2): 60% CFM + 40 % SDPL. R (3): 60 % CFM + 40 % SBDPL.

These results are supported by the findings of Ivan *et al*. (2000) who reported that *Entodinium* was the most detrimental of ciliate protozoa species. Bendaou (2003) found that the pre-degradation in cell walls by ensiling material by-product fermentation simplify microbial access in the rumen contents. Moreover, Aziz, (2014) found that sheep fed sugar beet pulp ensiled with *C. cellulasea* increased ruminal protozoa, total bacteria and cellulolytic bacteria numbers more than untreated and control groups. Aboamer *et al.* (2018) found that lactating sheep fed ensiled olive trees leaves with urea had higher concentration of *Entodinum spp.* and total protozoa count. Also, Aziz (2019 and 2020) showed that sheep fed ensiled DPL with urea or fibrolytic enzymes recorded higher counts of ruminal protozoa compared with that fed untreated.

Table 9. Ruminal ciliate protozoa and ruminal bacteria of ewes fed the tested rations.

Items	Time	Experimental groups					Overall mean
		C	R1	R2	R3	±SE	
Ophryoscolox spp.							
O. caudatus	0	0.121	0.060	0.079	0.104	0.005	0.091^{c}±0.002
	3	0.252	0.122	0.175	0.194	0.005	0.186^{a}±0.002
	6	0.189	0.088	0.100	0.120	0.005	0.124^{b}±0.002
overall mean		0.187^{a}	0.090^{d}	0.118^{c}	0.139^{b}	0.003	
O. purkynjei	0	0.110	0.063	0.073	0.091	0.007	0.084^{c}±0.003
	3	0.208	0.149	0.158	0.189	0.007	0.176^{a}±0.003
	6	0.154	0.092	0.108	0.132	0.007	0.121^{b}±0.003
overall mean		0.157^{a}	0.101^{c}	0.113^{c}	0.137^{b}	0.004	
Isotrchia spp.							
I. prostoma	0	0.199	0.091	0.130	0.216	0.006	0.159^{c}±0.003
	3	0.314	0.244	0.290	0.356	0.006	0.301^{a}±0.003
	6	0.228	0.188	0.227	0.262	0.006	0.226^{b}±0.003
overall mean		0.247^{b}	0.174^{d}	0.216^{c}	0.278^{a}	0.003	
I. intestinalis	0	0.095	0.067	0.079	0.110	0.007	0.088^{c}±0.003
	3	0.235	0.174	0.221	0.257	0.007	0.222^{a}±0.003
	6	0.201	0.147	0.186	0.214	0.007	0.187^{b}±0.003
overall mean		0.177^{b}	0.129^{d}	0.162^{c}	0.194^{a}	0.004	
Dasytrachiarummantium	0	0.141	0.125	0.136	0.162	0.011	0.141^{c}±0.005
	3	0.404	0.321	0.387	0.457	0.011	0.392^{a}±0.005
	6	0.335	0.231	0.286	0.381	0.011	0.308^{b}±0.005
overall mean		0.293^{b}	0.226^{d}	0.269^{c}	0.333^{a}	0.006	
Total protozoa count $x10^4$ cell /ml rumen liquor	0	5.412	3.303	4.208	5.938	0.105	4.715^{c}±0.052
	3	9.798	7.107	8.584	11.251	0.105	9.185^{a}±0.052
	6	8.016	5.279	6.643	9.184	0.105	7.281^{b}±0.052
overall mean		7.742^{b}	5.230^{d}	6.478^{c}	8.791^{a}	0.061	
Total bacterial numbers $x10^8$ cell /ml rumen	0	4.750	3.650	4.202	4.962	0.047	4.391^{c}± 0.023
	3	5.567	4.100	4.687	6.180	0.047	5.133^{a}± 0.023
	6	4.982	3.825	4.497	5.350	0.047	4.663^{b}± 0.023
overall mean		5.100^{b}	3.858^{d}	4.462^{c}	5.497^{a}	0.027	
Cellulolytic bacteria numbers $x10^6$ cell /ml rumen	0	4.487	3.377	3.952	4.542	0.055	4.090^{c}± 0.027
	3	5.237	3.962	4.462	5.925	0.055	4.896^{a}± 0.027
	6	4.732	3.542	4.325	5.075	0.055	4.418^{b}± 0.027
overall mean		4.819^{b}	3.627^{d}	4.246^{c}	5.180^{a}	0.031	

[abc] Means with different superscripts in a row and column are significantly different (P<0.05).

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL. R (3): 60 % CFM + 40 % SBDPL.

Blood serum metabolites:

Blood biochemical parameters:

Data of blood serum (Table 10) showed that glocose (mg/dl), total proteins (g/dl), albumin (g/dl) and globulin (g/dl) concentrations differed significantly (P<0.05) as affected by experimental rations. C group and R3 recorded the maximum values with no significant difference between them, while R2 and R1 were significantly differed as R2 was higher than R1except for globulin as they were not significantly differed. Albumin/ globulin ratio was not affected by the experimental rations. The increment of glocose, total proteins, albumin and globulin in C and R3 may be due to the efficiency of digestion and the improvements of ruminal parameters and microbial protein synthesis in these groups more than R2 and R1.

Kidney and liver function:

The present findings (Table 10) demonstrated that rations contained DPL significantly (P≤0.01) increased urea (mg/dl), creatinine (mg/dl) and aspartate amino transferase (AST) (U/L) concentrations compared with C group. The highest (P<0.05) concentrations were recorded for R3 followed by R2 with non-significant difference for creatinine concentration, while C group recorded the lowest (P≤0.01) concentrations. It is of interest to note that alanine amino transferase (ALT) (U/L) concentration did not significantly differ among the experimental groups. The present values of blood serum metabolites are laying within the normal ranges, these results indicated that feeding rations contained dried DPL or DPL silage incubated or not with bacteria did not cause any lesions in liver and kidney functions of sheep.

Table 10. Blood serum metabolites of ewes fed the tested rations.

Items	Experimental groups				± SE
	C	R1	R2	R3	
biochemical parameters:					
Glucose (mg/dl)	63.24^{a}	60.54^{c}	61.65^{b}	62.70^{a}	0.289
Total proteins (g/dl)	9.90^{a}	8.31^{c}	8.92^{b}	9.83^{a}	0.133
Albumin (g/dl)	5.64^{a}	4.78^{c}	5.05^{b}	5.68^{a}	0.078
Globulin (g/dl)	3.89^{a}	2.68^{b}	2.59^{b}	3.42^{ab}	0.330
A/G ratio	1.40	1.72	1.68	1.43	0.151
Kidney and liver function:					
Urea (mg/dl)	27.47^{b}	28.46^{b}	34.13^{a}	35.68^{a}	0.536
Creatinine (mg/dl)	1.83^{d}	2.12^{c}	2.56^{b}	2.83^{a}	0.077
AST (U/L)	69.81^{c}	70.96^{bc}	71.73^{ab}	72.78^{a}	0.415
ALT (U/L)	16.81	17.11	17.42	17.41	0.287

[abc] Means with different superscripts in a row are significantly different (P<0.05).

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL, R (3): 60 % CFM + 40 % SBDPL.

The present results in agreement with those obtained by Aziz (2009) who indicated that sheep females fed ensiled olive trees leaves significantly (P<0.01)

increased serum total proteins, albumin, globulin, A/G ratio and urea concentrations compared with control and untreated groups, while the difference was not significant for creatinine, GOT and GPT concentrations compared with control. Aboamer *et al.* (2018) reported that feeding ensiled olive trees leaves with urea for lactating sheep showed significant higher levels of blood total proteins and albumin, however, serum urea, AST and ALT were not differed among all groups. Moreover, Aziz (2019 and 2020) stated an improvement in blood serum total protein, Albumin, Globulin, urea, AST and ALT for sheep fed DPL ensiled with urea or with fibrolytic enzymes compared with that fed untreated.

Milk yield and milk composition:

Data of Table (11) indicated that ewes fed rations contained DPL significantly (P<0.05)reduced average and total milk yield and 4% fat corrected milk at early, mid, late and during the whole lactation periods compared with control group which had the highest (P<0.05)values. Ewes fed SBDPL recorded higher values than that fed SDPL and that fed DDPL which was the lowest one. Milk yield and 4% fat corrected milk were higher at the first 4 weeks then decreased by progressed time till reach the lowest yield at the third 4 weeks.

Table 11. Milk yield of ewes fed tested rations.

Items	Experimental groups				±SE
	C	R1	R2	R3	
Milk yield ml/h/d:					
Early lactation (1st 4 weeks)	320.00[a]	244.50[d]	275.00[c]	297.50[b]	5.108
Mid lactation (2nd weeks)	254.50[a]	180.80[d]	208.90[c]	237.60[b]	4.182
Late lactation (3rd 4 weeks)	197.70[a]	121.80[d]	149.10[c]	177.40[b]	3.89
Average daily milk yield during 12 weeks	257.40[a]	187.00[d]	211.00[c]	237.50[b]	0.390
Total milk yield during 12 weeks (L)	23.17[a]	16.83[d]	18.99[c]	21.38[b]	0.577
4% FCM ml/h/d:					
Early lactation (1st 4 weeks)	300.69[a]	224.02[d]	252.66[c]	275.33[b]	5.178
Mid lactation (2nd 4 weeks)	239.26[a]	165.30[d]	191.32[c]	218.76[b]	3.996
Late lactation (3rd 4 weeks)	184.61[a]	110.58[d]	135.69[c]	162.61[b]	3.69
Average daily 4% FCM during 12 weeks	241.51[a]	166.63[d]	193.23[c]	218.90[b]	0.406
Total 4% FCM during 12 weeks (L)	21.74[a]	15.00[d]	17.39[c]	19.70[b]	0.637

[abc] Means with different superscripts in a row are significantly different (P<0.05).

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL, R (3) 60 % CFM + 40 % SBDPL.

With respect to milk composition (Table12), no significant differences were observed among treatments for percentages of total solid, fat, solids not fat, total protein, lactose and Ash along the different lactation periods, which also reflected on average chemical composition of milk. C group was slightly higher than R3, R2 and R1. Results indicated that C group and R3 increased milk yield, 4% fat corrected milk and milk composition than R2 and R1; this result may be possibly attributed to the lowest dry matter intake, TDN and DCP of R2 and R1. Also, the slight increase in fat percentage for C and R3 may be due to high efficiency of ruminal activity and increasing acetic acid production and acetate propionate ratio in the rumen (Hendawy *et al*., 2019).

Similar results were obtained by Bahman *et al*. (1997) who reported that milk production and its compounds in Holstein dairy herbs which received date palm leaves were not differed from those received barley straw. Salahi (2011) and Valizade (2011) concluded that DPL can be fed to animals without any adverse effect on the milk yield and milk constituents (fat, protein and lactose) yield. Kung and Muck (1997) indicated that microbial inoculants for silage increased milk production; the average response in milk production was 3.1 lb per day. Khattab *et al*. (2000) fed lactating goats on by-products combination; they found non-significant increasing in content of milk fat, total solids, total proteins, lactose and ash. Also, Khattab *et al*. (2008) reported that lactating goats fed ensiled by-products had higher milk yield and composition; however, no differences were detected among the different lactation periods. Moreover, Aziz and Kholif (2015) reported that feeding rations contained agriculture by-products ensiled by *C. cellulasea* improved milk yield and composition of goats compared with that fed untreated ration.

Table 12. Milk composition (%) of ewes fed the tested rations.

Items	Experimental groups				± SE
	C	R1	R2	R3	
Milk composition %:					
Early lactation (1st 4 weeks):					
Total solids	12.73	12.22	12.23	12.29	0.048
Fat	3.59	3.44	3.45	3.50	0.021
Solids not fat	9.14	8.78	8.78	8.79	0.042
Total protein	3.84	3.67	3.67	3.75	0.018
Lactose	4.23	3.90	3.93	4.13	0.038
Ash	1.01	0.98	0.98	1.01	0.007
Mid lactation (2nd 4 weeks):					
Total solids	12.79	12.23	12.25	12.30	0.042
Fat	3.60	3.42	3.43	3.47	0.016
Solids not fat	9.19	8.81	8.82	8.83	0.035
Total protein	3.82	3.65	3.65	3.73	0.015
Lactose	4.40	4.19	4.18	4.30	0.031
Ash	0.992	0.966	0.967	0.984	0.002
Late lactation (3rd 4 weeks):					
Total solids	12.80	12.26	12.26	12.32	0.040
Fat	3.55	3.38	3.39	3.44	0.018
Solids not fat	9.25	8.88	8.87	8.88	0.030
Total protein	3.80	3.60	3.61	3.69	0.017
Lactose	4.66	4.33	4.35	4.48	0.028
Ash	0.987	0.956	0.958	0.980	0.003
Average composition during lactation period:					
Total solids	12.78	12.24	12.25	12.31	0.105
Fat	3.59	3.42	3.43	3.47	0.031
Solids not fat	9.19	8.82	8.82	8.84	0.129
Total protein	3.83	3.64	3.65	3.73	0.035
Lactose	4.43	4.14	4.16	4.31	0.055
Ash	1.00	0.970	0.970	0.990	0.006

[abc] Means with different superscripts in a row are significantly different (P<0.05).

C: control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL, R (3): 60 % CFM + 40 % SBDPL.

Lambs performance:

The data of Table (13) clearly indicated that all groups didn't appear any significant differences for body weight (kg) changes from birth up to weaning or average daily and total gain (kg). C group recorded the highest values followed by R3 then R2 and R1. Birth weight ranged from 2.83 to 3 kg, weaning weight ranged from 12.48 to 12.97 kg, while total gain ranged from 9.66 to

9.94 kg. Concerning average daily gain, the data showed significant (P<0.05) difference among groups at the first 4 weeks only, while the difference was not significant during other weeks, average daily gain of different groups take the same trend of body weight except at the second 4 weeks; R2 was higher than other groups, while C was the lowest one. Average daily gain ranged from 107.29 to 110.44 g/d.

Similar results were obtained by Yacout *et al*. (2007) who found that lambs fed corn stalks silage inoculated with bacteria or bacteria plus enzymes had the faster daily weight gain (131g/h/d) compared with other rations. Also, Fayed *et al*. (2008) reported that the greatest body weight and daily gain was achieved with sheep fed silage salt plant mixture fermented with a mixture of cellulolytic bacteria and nitrogen bacteria. Also, Aziz (2009) found that body weight, average daily gain, growth rate and total body gain of lambs increased by feeding olive trees leaves ensiled or biologically treated compered to lambs fed control or untreated leaves.

Economic evaluation of ewes and feed conversion:

Calculated economic evaluation presented in Table (14). As for economic evaluation for pregnant ewes, total feeding cost (EP) was decreased for rations contained DPL by 244.96, 239.86 and 187.76 EP for R1, R2 and R3 comparing with C group. The return from born live (EP) per ewe was the same for C and R3 groups as they were the highest followed by R2 then R1 groups. Net revenue (EP) per ewe over feeding cost indicated that all groups were uneconomic whereas total feeding cost was higher than the return and led to negative revenue for ewes.

As for economic evaluation of lactating ewes, the cheapest feed cost (EP) was for R1 although it was the lowest return from milk (EP) followed by R2 then R3, while C group was the highest cost and milk return (EP) as it had high milk yield through milk production period (12weeks) so it was economically increased milk production and paid back in term of money. Net milk revenue (EP) per ewe over feeding cost was negative for all groups as total feeding cost was higher than the return, rations contained DPL had lower negative revenue than C group.

The data of economic evaluation of growing lambs indicated that C group recorded higher net return of weaned lambs (EP) per ewe more than R1, R2 and R3 by 49, 32 and 17 EP as a result of higher gain of lambs at weaning, although C group was the highest feeding cost. While, DPL rations recorded the highest net revenue of weaned lambs (EP) as a result of lower feeding cost, the increase of revenue was 105.34, 93.62 and 92.57 EP for R2, R3 and R1 more than C group.

Table 13. Body weight change and average daily gain of lambs from birth up to weaning.

Items	Experimental groups				±
	C	R1	R2	R3	SE
Body weight (kg):					
Birth weight	3.03	2.83	2.91	3.02	0.083
1st 4 weeks	5.81	5.19	5.42	5.66	0.050
2nd 4 weeks	9.26	8.81	8.99	9.12	0.030
3rd 4 weeks (weaning weight)	12.97	12.48	12.65	12.80	0.045
Average daily gain (g):					
1st 4 weeks	92.83[a]	78.96[b]	83.66[ab]	88.06[ab]	3.445
2nd 4 weeks	114.96	120.53	119.00	115.26	1.794
3rd 4 weeks	123.53	122.36	121.83	122.83	1.420
Average daily gain (12 weeks)	110.44	107.29	108.17	108.72	1.065
Total gain (kg)	9.94	9.66	9.74	9.79	0.040

[abc] **Means with different superscripts in a row are significantly different (P<0.05).**

C: Control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL, R (3) 60 % CFM + 40 % SBDPL.

Table 14. Economic evaluation for ewes fed the tested rations.

Items	Experimental groups			
	C	R1	R2	R3
Economic evaluation for pregnant ewes:				
Whole DMI /ewe /20 weeks(Kg):				
CFM	141.89	139.16	139.94	141.02
Hay	94.59	0.00	0.00	0.00
DPL	0.00	92.78	93.29	94.01
Feeding cost /ewe/20 weeks(EP):				
CFM	780.41	765.39	769.67	775.61
Hay	378.38	0.00	0.00	0.00
DPL	0.00	148.44	149.27	150.42
Bacteria	0.00	0.00	0.00	45.00
Total feeding cost (EP)	1158.79	913.83	918.93	971.03
Birth weight (kg)	3.03	2.83	2.91	3.02
Born live return/ewe (EP)*	303.00	283.00	291.00	302.00
Net revenue/ewe over feeding cost (EP)	-855.79	-630.83	-627.93	-669.03
Economic evaluation of lactating ewes:				
Whole DMI /ewe /12 weeks(Kg):				
CFM	77.15	74.39	75.04	76.77
Hay	51.43	0.00	0.00	0.00
DPL	0.00	49.59	50.02	51.18
Feeding cost /ewe/12 weeks(EP) :				
CFM	424.33	409.15	412.70	422.21
Hay	205.74	0.00	0.00	0.00
DPL	0.00	79.35	80.04	81.88
Bacteria	0.00	0.00	0.00	15.35
Total feeding cost (EP)	630.07	488.50	492.74	519.45
Milk return of 12 weeks (EP)**	347.49	252.45	284.85	320.63
Net milk revenue /ewe over feeding cost (EP)	-282.58	-236.05	-207.89	-198.82
Economic evaluation of growing lambs:				
Net return of weaned lambs/ ewe***(EP)	1297.00	1248.00	1265.00	1280.00
Net revenue of weaned lambs/feeding cost /ewe (EP)	666.93	759.50	772.26	760.55
Overall economic evaluation /ewe:				
Feeding cost (pregnancy + lactation) (EP)	1788.85	1402.33	1411.67	1490.48
Net return of milk and weaned lambs /ewe (EP)	1644.49	1500.45	1549.85	1600.63
Net revenue /ewe (EP)	-144.36	98.12	138.18	110.15
Feed conversion				
Kg DMI/litter milk	5.52	7.43	6.53	6.02
Kg DMI/Kg gain	9.86	10.02	9.80	10.05

C: Control: 60% CFM +40% BH. R (1): 60% CFM + 40% DDPL. R (2): 60% CFM + 40 % SDPL, R (3) 60 % CFM + 40 % SBDPL. The cost of one kg of CFM, BH, DPL and 1 litter bacteria were 5.5, 4, 1.6 and 200 Egyptian pounds, respectively.

*** The live born lambs considered as the production of pregnancy and given 100 EP / Kg weight as market value.**

**** Market price for sheep's milk was estimated as EP 15 / Las market value.**

***** The assumed 1 Kg live weight price for weaned lambs is 100 EP / Kg weight as market value.**

Overall economic evaluation of ewes during the whole 32 weeks (pregnant and lactation) indicated that net return of milk and weaned lambs per ewe (EP) was higher for C group, although it had uneconomically negative net revenue (-144.36 EP) as a result of higher feeding cost. R2 was more efficient in net revenue (138.18 EP) followed by R3 (110.15 EP) then R1 (98.12 EP). The obtained findings revealed that the best feed conversion expressed as kg DMI/litter milk was recorded for DPL rations; R1 recorded the highest value followed by R2 then R3 then the worst by C group. Also, the best feed conversion expressed as kg DMI/kg gain was recorded for R3 and R1 followed by C group then R2. This data indicated that rations contained DPL instead of hay were efficient in feed conversion like control which contained hay.

The present results in accordance with Yacout *et al*. (2007) and Fayed *et al*. (2008) who reported that feed efficiency for lambs fed by-products silage inoculated with bacteria was better than those fed the control ration. Khattab *et al*. (2008) showed that lactating goats fed ensiling by-products had better feed conversion as DMI g /4%FCM yield and recorded higher economic efficiency than that fed untreated, whereas control group had the worst feed conversion. Also, Aziz (2009) stated that feed costs of control group was higher than rations contained olive tree leaves ensiled with urea or biologically treated, while the return from body gain, economic conversion and feed efficiency increased in treated groups more than control group.

CONCLUSION

Feeding date palm leaves silage with or without addition of bacteria is better than feeding dried date palm leaves, especially silage with addition of bacteria and could replace hay in rations of ewes during pregnancy and lactation periods. As the results of feed intake and body weight by feeding silage were close to the results of control group. Digestibility coefficients, nutritive values, nitrogen balance, rumen fermentations and blood serum metabolites showed an improvement by feeding silage with addition of bacteria.

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الأداء الغذائى والإنتاجى للأغنام المغذاه على سيلاج أوراق نخيل البلح مع أو بدون اضافة البكتريا

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فى الدراسة الحالية تم دراسة تأثير تغذية أوراق سعف النخيل الجافة أو سيلاج غير محضن أو محضن مع بكتريا على أداء الأغنام خلال فترات الحمل و الحليب و أداء الحملان حتى الفطام. تم توزيع أربعون نعجة من الأناث البرقى (متوسط عمرحوالى 4 سنوات و متوسط وزن جسم 49,5 ± 2,5 كجم) عشوائياً فى أربعة مجاميع. المجموعة الأولى: مقارنة غذيت على عليقة مقارنة تتكون من 60 % مخلوط مركز+ 40 % دريس برسيم. المجموعة الثانية: غذيت على عليقة تتكون من60 % مخلوط مركز+ 40 % أوراق سعف النخيل الجافة.المجموعة الثالثة: غذيت على عليقة تتكون من 60 % مخلوط مركز+ 40 % سيلاج أوراق سعف النخيل.المجموعة الرابعة: غذيت على عليقة تتكون من 60 % مخلوط مركز+ 40 % سيلاج أوراق سعف النخيل المحضن مع بكتريا *Cellulomonas cellulasea*. فى نهاية فترة الحليب تم استخدام أربعة نعاج من كل مجموعة فى تجربة هضم لدراسة تأثير تغذية المجاميع التجريبية على معاملات الهضم و تخمرات الكرش و تركيب الدم. و قد أوضحت النتائج أن المجموعة الرابعة أدت إلى زيادة وزن الجسم و الزيادة الكلية للنعاج بتقدم الوقت خلال فترة الحمل و الحليب و لم يكن هناك فرق معنوى بينها و بين مجموعة المقارنة يليها المجموعة الثالثة ثم المجموعة الثانية. و قد أوضحت تجربة الهضم أن مجموعة المقارنة و المجموعة الرابعة أظهرت تحسن معنوى فى معاملات الهضم الغذائى والقيمة الغذائية مقارنة بالمجموعة الثالثة والمجموعة الثانية. بالإضافة للزيادة المعنوية لتخمرات الكرش و أعداد البروتوزوا و البكتريا المحللة للسليولوز. كما أدت المجموعة الرابعة إلى زيادة تركيز كل من جلوكوز سيرم الدم و البروتين الكلى و الألبيومين و الجلوبيولين و اليوريا و الكرياتينين . التغذية على سيلاج أوراق نخيل البلح مع إضافة البكتريا أفضل من التغذية على سيلاج أوراق نخيل البلح بدون إضافة البكتريا أو أوراق نخيل البلح الجافة و يمكن أن تحل محل البرسيم فى علائق النعاج خلال مراحل الحمل و الرضاعة.