BIOLOGICAL TREATMENTS OF BANANA WASTES FOR FEEDING LACTATING GOATS

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SUMMARY

Sixteen lactating Ballad goats weighing 23-27 kg live weight in the first week of lactation were used in the present study. The animals were randomly grouped (four animals each) in 4x4 Latin square design. The trial was extended for 120 days in four experimental periods each of 30 days. All animals were fed on 70% concentrate feed mixture (CFM) and 30% dried banana waste naturally fermented (Control), and fermented using *Trichoderma viride* (T_1), *Penicillium funiculusms* (T_2) and *Saccharomyces cerevisiae* (T_3). The moisture content of banana wastes in all treatments was adjusted to approximately 60% , bagged in airtight polyethylene sheets and incubated at room temperature for 21 days. Ruminal pH and ammonia nitrogen were not affected by treatments. However, TVFA's, total nitrogen, non-protein nitrogen and true protein nitrogen were significantly ($P<0.05$) increased with biological treatments compared with control. Dry matter intake increased slightly ($P>0.05$) with T_2 and T_3 compared with control. Milk yield, 4% FCM, total solids and total protein contents increased significantly ($P<0.05$) with biological treatments compared with control. However, fat, lactose and ash contents and milk pH and acidity percent were not affected by biological treatments. Feed efficiency was improved insignificantly ($P>0.05$) with all biological treatments. Yeast treatment (T_3) increased ($P<0.01$) serum total protein and albumin, while, T_2 (*P. funiculusms*) decreased ($P<0.05$) serum GOT and cholesterol compared with other treatments. Other blood serum parameters as globulin, A/G ratio, urea, creatinine, GPT, alkaline phosphatase, glucose and total lipids were not affected by treatments. Feeding animals on ration containing banana wastes fermented with *Trichoderma viride*, *Penicillium funiculusms* or *Saccharomyces cerevisiae* improved the performance of lactating goats without any adverse effect of animals' health.

Keywords: *Biological treatments, banana wastes, lactating goats, rumen, milk, blood.*

INTRODUCTION

In Egypt, it is known that there is a wide gab between the available feeds and animals requirements especially in summer. Wheat and rice straws are the main roughages used in animal feeding in summer. Regarding to their continuously elevating prices, attempts to use other new sources of roughages such as banana wastes were tried by several workers in Egypt (El-Kady, 1997, Khattab *et al.*, 2000 and El-Ashry *et al.*, 2003). The

main shortcoming of banana wastes as sole animal feed lies in their low digestible energy and protein contents and its containing of ant nutritional compounds (Tannin). Biological treatments such as white rot fungi, as *Trichoderma viride* (Khorshid, 2000 and El-Ashry *et al.*, 2003) and *Penicillium funiculusms* (El-Ashry *et al.*, 1997 and El-Ashry *et al.*, 2003) or fiberolytic enzymes (David *et al.*, 1999, Lewis *et al.*, 1999, Rode *et al.*, 1999, Yang *et al.*, 1999, Knowlton *et al.*, 2002 and Eun and Beauchemin, 2005) were used to improve the nutritive value and digestibility of poor quality roughages. Increasing the digestibility of the diet by using exogenous feed enzymes will be lead to the beneficial effects on animal performance, so such treatments are likely to be greatest for ruminants in negative energy balance, such as animals in early lactation (Rode *et al.*, 1999). Also, yeast treatment was used to improve rumen digestibility of nutrients especially crude fiber, elevation rumen fermentation and more activation of rumen microorganisms (Dawson, 1992).

The objective of this study was to study the effect of feeding biological treated banana wastes to lactating goats on rumen fermentation, milk yield and composition and some blood parameters.

MATERIALS AND METHODS

This study was carried out at The Experimental Station of Milk Replacer, Research Center, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Kalubia and Dairy Science Department, National Research Center, Dokki, Giza, Egypt.

Materials of study:

Green banana wastes were obtained from banana farms at Om Dinar, Embaba, Giza Province, cutted into small parts (15 cm) and then dried sunny for 21-30 days and then cutted to 2-3 cm parts. Molasses and strains of *Saccharomyces cerevisiae* (AFZ-98) were obtained from Sugar Factory at El-Hawamdia City, Giza Province. While, The test types of fungal strains of *Trichoderma viride* F-516 and *Penicillium funiculusms* (629) were obtained from the Microbial Chemistry Laboratory, National Research Center, Dokki, Cairo, Egypt.

Preparation of fungal inoculum:

Three days old slants cultures of *Trichoderma viride* F-516 or *Penicillium funiculosium* (629) were individually crushed into flasks containing 20 ml of sterilized water. The fungal spores suspensions were used at 10% (v/w) to inoculate 500 ml capacity flasks containing 20 g of the ground waste moistened at a solid : liquid ratio of 1:2 with basal medium composed of (g/l) sugar cane-molasses, 40; urea, 2.0; dipotassium phosphate, 2.0 and magnesium sulphate 0.3. The inoculated flasks were incubated at 30 ± 1^{0}C for 72 h. under static solid state fermentation system.

Preparation of fungal treatments:

The above prepared inocula were employed to inoculate 200 g of waste under study moistened by the above basal medium at a solid : liquid ratio of 1:2 and packed in polyethylene bags (40 x 60 cm). The inoculated bags were incubated under static conditions for 7 days at 30 ± 2^{0}C. At the end of incubation period such bags were opened and oven dried at 70 ^{0}C for chemical analysis.

Scaling up the fungal treatments:

The above fermented bags were employed to inoculate polyethylene bags (150 x 225 cm) containing 10 kg of ground waste moistened with the basal medium at a solid : liquid ratio of 1:2. The bags were incubated in a 3x3 meters room maintained at 27-30 ^{0}C for 21days.

After the incubation period, the fermented wastes were air-dried to 6-8% moisture then packed and stored until fed to lactating goats.

Yeast inoculum preparation and treatment:

A loop of 48 h old slants culture of *S. cerevisiae* AFZ-98 was used to inoculate each conical flask containing 100 ml sterilized basal medium. The flasks were incubated statically for 48 h. The growing yeast culture was used to inoculate 200 g of waste under study moistened by the basal medium at a solid : liquid ratio of 1:2, packed in polyethylene bags then incubated for 5 days at 30°C. The treatment was scaled up similar to fungal treatments for 7 days.

Control samples were incubated with water only. The control banana wastes were adjusted with media to approximately 67% moisture and were bagged without air tight polyethylene sheets. The bags were closed and incubated at room temperature for 21 days. The samples were taken out and dried in the oven at 80°C for 12 h, then chopped samples were ground to 1-2 mm through screen and stored in a glass bottle for chemical analysis.

Animals and feeding:

Sixteen lactating Balady goats weighing 23-27 kg live weight in the first week of lactation were used in the present study. The animals were randomly assigned among four experimental treatments (four animal each) using 4x4 Latin square design. The period of this trial extended for 120 days divided to four experimental periods each of 30 days. All animals were fed on 70% concentrate feed mixture (CFM) and 30% dried banana waste fermented with water only (Control), *T. viride* (T_1), *P. funiculusms* (T_2) or *S. cerevisiae* (T_3). The CFM consists of 25% undecorticated cotton seed cake, 35% yellow corn, 20% wheat bran, 15% rice bran, 3% limestone, 1.2% salt and 0.8% minerals. Animals were fed twice daily at 8.00 a.m. and 3.00 p.m. Water was available at all time. The daily rations were offered individually according to each animal requirement according to ARC (1983). Chemical composition of dietary ingredients are shown in Table (1).

Analysis of feed samples:

Samples of CFM, dried banana wastes were analyzed for dry matter, ash, organic matter, crude protein, crude fiber, ether extract and nitrogen free extract (A.O.A.C., 1995) and fiber fractions (Goering and Van Soest, 1970).

Sampling and analysis of rumen liquor:

Rumen contents were collected by stomach tube from two animals of each group at the final day of milk sampling. The samples were taken at 3 h after morning feeding. Strained rumen liquor was stored in glass bottles (25 ml) with few drops of toluene and paraffin oil just to cover the surface and stored at a deep freeze (-18 °C) till they were analyzed for total nitrogen (TN), non protein nitrogen (NPN) and ammonia nitrogen (A.O.A.C.,1995), and total volatile fatty acids (TVFA's) (Warner, 1964).

Sampling and analysis of milk:

Milk yield was recorded weekly during the experimental period, which extended for 30 days for each period. Individual records were kept for each experimental animal. During the last three days of experimental period, samples of milk were collected from each animal at evening and morning milkings. Composite samples (relative to the quantity of milk produced) were taken from the two milkings to determine acidity and pH at once, and then samples of milk were taken to determine total solids, fat content, titratable acidity, total protein content and ash content (Ling,

1963). Lactose content was measured according to Barnett and Abd El-Tawab (1957)

Sampling and analysis of blood serum:

Three animals of each group were sampled at the last day of milk sampling. A sample of 10 ml of blood per animal from the jugular vein at about 3 h after morning feeding of roughage diet. The blood samples were directly collected into a clean dried tube and centrifuged at 4000 r.p.m. for 20 min., then the blood serum was separated into a clean dried glass vial and stored at –18 °C for determine serum total protein (Armestrong and Carr,1964), albumin (Doumas *et al.*, 1971), GOT and GPT (Reitman and Frankel,1957), urea (Patton and Crouch,1977), creatinine (Husdan,1968), alkaline phosphatase activity (El-Aaser *et al.*, 1978), glucose (Siest *et al.*, 1981), total lipids (Postma and Stroes, 1968) and cholesterol (Raltiff and Hall,1973). Globulin and albumin/globulin ratio were calculated.

Statistical analysis:

The data were analyzed according to Statistical Analysis System (SAS, 1989). Duncan multiple test (Duncan, 1955) was used to test the significant between means. Data of milk yield, milk composition, feed efficiency, rumen liquor and blood parameters were analyzed according to 4x4 Latin square design, where the model was; $Y_{ijkl} = \mu + T_i + P_j + A_k + E_{ijkl}$ where, Y expressed the every observation of the k^{th} animal in the j^{th} period given i^{th} treatment, T expressed the treatments effect, P expressed the periods effect A expressed the animals effect and E expressed the experimental error.

RESULTS AND DISCUSSION

Rumen liquor parameters:

The results indicated that pH values were not affected by treatments (Table, 2). Similar results obtained by El-Ashry *et al.*, (1997) who found that biological treatments (fungi or enzymes) are not affected rumen pH.

Values of rumen TVFA's and NPN increased significantly ($P<0.05$) with T_1 followed by yeast treatment (T_3) compared with control, while T_2 was insignificantly affected (Table, 2). These results suggest that the anaerobic fermentation of biological treatment (*T. viride* and *S. cerevisiae*) were more efficient and faster yielding more TVFA's than that in control. Also, it may be due to the increase of digestibility of organic matter (El-Ashry *et al.*, 2003). Yeast increased the rate of rumen fermentation due to its increased the total and viable count of bacteria (Newbold *et al.*, 1996) and cellulolytic bacteria (Harrison *et al.*, 1988, Yoon and Stern, 1996 and Kumar *et al.*, 1997). These results are agreed with the findings of Chiquette (1995), El-Ashry *et al.*,(1997), Kumar *et al.*, (1997), and Khorshed (2000). Regarding the results of yeast treatment, similar results obtained by Harrison *et al.*, (1988) and Yoon and Stern (1996). Those investigators reported that yeast culture (*S. cerevisiae*) supplement to animal rations did not affect TVFA's concentrations.

Concentration of rumen TN increased significantly ($P<0.05$) with yeast treatment (T_3), however, fungal treatments (T_1 and T_2) were insignificantly increased rumen TN (Table, 2). Sharma *et al.*, (1998) reported that TN and microbial protein increased significantly with yeast culture supplementation to rations. El-Ashry *et al.*, (1997) obtained similar results. Rumen true protein nitrogen increased significantly ($P<0.05$) with T_2 and T_3 compared with T_1 (Table, 2).

Concentration of rumen ammonia nitrogen did not affect by biological treatments (Table, 2). These results are in

Table (1): Chemical composition of dietary ingredients (CFM and dried banana wastes treated with different treatments) (on DM basis).

Items	CFM	Dried banana wastes			
		Control (C)	TV (T_1)	PF (T_2)	SC (T_3)
Chemical composition:					
DM	90.93	93.62	96.39	97.18	96.97
OM	92.01	87.0	85.64	86.39	84.52
Ash	7.99	13.0	14.36	13.61	15.48
CP	15.58	5.45	7.15	7.39	7.40
EE	4.21	6.11	6.06	6.66	5.37
CF	12.48	29.3	26.82	27.86	28.46
NFE	67.73	46.14	45.61	44.48	43.29
Fiber fractions:					
NDF	30.65	73.72	67.80	66.90	58.16
ADL	7.56	11.55	8.08	9.81	9.80
Hemicellulose	13.09	29.87	22.47	21.78	14.34
Cellulose	10.0	32.30	27.25	30.31	34.02

Control: Dried banana waste fermented with water only. TV: Dried banana waste fermented with *Trichoderma viride*. PF: Dried banana waste fermented with *Penicillium funiculusms*. SC: Dried banana waste fermented with *Saccharomyces cerevisiae*.

Table (2): Effect of biological treatments on some rumen parameters of lactating goats at 3 hours post morning feeding.

	C	±SE	T1	±SE	T2	±SE	T3	±SE
pH	6.27	0.12	6.18	0.11	6.30	0.11	6.26	0.12
TVFA's (m.eq/dl)	7.95^{be}	0.36	8.95^{a}	0.44	7.78^{e}	0.41	8.76^{ab}	0.40
TN (mg/dl)	92.22^{b}	1.95	94.96^{b}	3.50	102.7^{ab}	5.26	110.7^{a}	7.60
NPN (mg/dl)	55.34^{b}	3.06	66.33^{a}	2.49	58.58^{ab}	4.46	66.60^{a}	3.74
True-PN (mg/dl)	37.08^{ab}	2.57	29.05^{b}	1.70	43.42^{a}	3.86	44.13^{a}	5.35
NH_3-N (mg/dl)	26.10	1.61	27.09	1.57	26.30	1.48	27.86	1.60

C: control, T1: Dried banana waste fermented with *Trichoderma viride*, T2: Dried banana waste fermented with *Penicillium funiculusms*. T3: Dried banana waste fermented with *Saccharomyces cerevisiae*.

Each value is a mean of 8 samples, SE: standard error.

Means in the treatments at the same row with different superscripts are significant ($P<0.05$, a b and c).

a good agreement with the finding of Gado (1997) (with fungal enzymatic treated rations), while, El-Ashry *et al.*, (1997) and Khorshed (2000) found a significant increases in rumen ammonia nitrogen concentration with fungal treated residues. Regarding the yeast treatment, these results are agreed with those of Yoon and Stern (1996). However, Khorshed (2000) found significant increases of ammonia nitrogen concentration with yeast culture treatment.

Dry matter intake, milk yield, milk composition and feed efficiency:

Dry matter intake (DMI) slightly increased with T_2 and T_3, while T_1 slightly decreased DMI compared with control (Table, 3). These results of DMI with fungal treatments are agreed with those obtained by Beauchemin *et al.*, (1999), Rode *et al.*, (1999), and Yang *et al.*, (1999). They reported that fungal or enzymatic treatments were not alter DMI. While, Lewis *et al.*, (1999) suggested an increase of DMI with fungal or enzymatic treatments.

In addition, inspection of the results of yeast treatment (T_3), Seymour *et al.*, (1991), Chiquette (1995) and Kung *et al.*, (1997) suggested similar results of DMI. However, Wohlt *et al.*, (1998) observed an increase in DMI with yeast culture supplementation to animal rations. Data of Table (3) clearly indicate that biological treatments are not affected animal live weight.

Milk yield increased ($P<0.05$) with T_2 and T_3, also 4% FCM yield increased ($P<0.05$) with T_3 compared with control. These results are in a good agreement with those obtained by David *et al.*, (1999), Lewis *et al.*, (1999), Rode *et al.*, (1999), and Yang *et al.*, (1999), who observed that milk production increased with fungal enzymes treated roughages. While, Beauchemin *et al.*, (1999) suggested no effect on milk production with fungal enzymes treatments.

The results of yeast (T_3) are in a good agreement with those noted by Piva *et al.*, (1993), Abo El-Nor and Kholif (1998), Wohlt *et al.*, (1998), Robinson and Garrett (1999) and Kholif *et al.*, (2000).

The increase in milk yield with all biological treatments may be due to one or more of the following reasons; 1) higher DMI and CP content of treated rations (Table, 1) and higher CP digestibility (El-Ashry *et al.*, 2003). 2) higher TVFA's content in rumen of animals given treated rations (Table, 2) especially propionate with yeast treatment (Harrison *et al.*, 1988, and Sharma *et al.*, 1998). 3) slightly increase of milk lactose, which had a positive, correlated with milk yield. 4) higher fiber and fiber fraction digestibilities. 5) yeast culture is more effective on manipulation of rumen environment, which lead to more feed efficiency and more milk production.

TS content increased ($P<0.05$) with T_1 and T_3 compared with control. Similar results of yeast treatment were obtained by Kumar *et al.*, (1992) who reported a significant increase in milk TS percent with yeast culture supplementation. However, Piva *et al.*, (1993), Abo El-Nor and Kholif (1998) and Kholif *et al.* (2000) noticed that yeast culture supplemented rations not affected TS percent. Also, the results of fungal treatments are in a good agreement with David *et al.*, (1999) who observed that fungal enzyme treated forage increased milk TS percent.

Milk fat, SNF and lactose contents recorded insignificantly increase ($P>0.05$) with all biological treatments compared with control. The results of fat content may be due to the manipulation occurred in rumen fermentation by biological treatments especially with

Table (3): Effect of biological treatments on milk yield and composition of lactating goats.

	C	±SE	T_1	±SE	T_2	±SE	T_3	±SE
DMI (g/h/d)	912.0		908.1		942.9		943.3	
Animal weight (kg)	26.94		26.54		26.79		26.96	
Milk yield (g/d)	655.4^{b}	44.6	720.4^{ab}	76.4	778.6^{a}	62.5	809^{a}	76.7*
4% FCM yield (g/d)	623.8^{b}	58.1	733.4^{ab}	103.0	740.4^{ab}	48.9	788^{a}	71.9*
Fat %	3.53	0.31	3.94	0.23	3.87	0.32	3.87	0.20^{ns}
TS %	11.8^{b}	0.4	12.8^{a}	0.4	12.4^{ab}	0.5	12.9^{a}	0.39*
SNF %	8.2	0.17	8.89	0.23	8.57	0.24	9.00	0.36^{ns}
TP %	3.13^{b}	0.10	3.53^{a}	0.11	3.42^{a}	0.11	3.46^{a}	0.10*
Lactose %	4.03	0.13	4.32	0.16	4.16	0.14	4.30	0.10^{ns}
Ash %	0.72	0.02	0.68	0.02	0.71	0.02	0.73	0.02^{ns}
pH value	6.63	0.04	6.68	0.04	6.67	0.06	6.70	0.04^{ns}
Acidity %	0.17	0.01	0.16	0.01	0.16	0.01	0.16	0.01^{ns}
Feed efficiency	0.68	0.09	0.79	0.19	0.79	0.09	0.83	0.15^{ns}

C: control, T1: Dried banana waste fermented with *Trichoderma viride*, T2: Dried banana waste fermented with *Penicillium funiculusms.* T3: Dried banana waste fermented with *Saccharomyces cerevisiae.*

Each value is a mean of 16 samples, SE: standard error.

Means in the treatments with different superscripts are significant (P<0.05, a and b), * : significant at 5% level, ns: not significant.

Table (4): Effect of biological treatments on some blood serum parameters of lactating goats.

Items	C	±SE	T1	±SE	T2	±SE	T3	±SE
Total protein (g/dl)	6.10^{B}	0.13	6.31^{B}	0.16	6.13^{B}	0.11	6.82^{A}	0.23**
Albumin (g/dl)	3.01^{B}	0.14	3.25^{B}	0.10	3.10^{B}	0.09	3.54^{A}	0.13**
Globulin (g/dl)	3.09	0.14	3.06	0.17	3.03	0.12	3.28	0.20^{ns}
A/G ratio	1.02	0.09	1.10	0.09	1.05	0.07	1.13	0.10^{ns}
Urea (mg/dl)	46.3	4.1	47.1	4.0	47.7	3.1	46.4	5.2^{ns}
Creatinine (mg/dl)	0.53	0.09	0.59	0.08	0.51	0.07	0.65	0.08^{ns}
GOT (units/ml)	36.0^{a}	1.1	35.3^{a}	0.9	31.1^{b}	1.9	35.2^{a}	1.0*
GPT (units/ml)	16.9	0.9	15.4	1.0	15.4	0.8	16.6	0.7^{ns}
Alk-p-ase (units/ml)	38.8	1.9	38.8	2.1	39.0	2.1	40.0	1.5^{ns}
Glucose (mg/dl)	65.3	1.7	66.9	1.0	66.3	2.3	69.3	1.5^{ns}
Total lipids (mg/dl)	269	1.7	274	2.1	274	3.7	268	1.8^{ns}
Cholesterol (mg/dl)	124.5^{ab}	7.9	127.5^{ab}	6.7	117.4^{b}	4.4	141.9^{a}	10.2*

C: control, T1: Dried banana waste fermented with *Trichoderma viride*, T2: Dried banana waste fermented with *Penicillium funiculusms.* T3: Dried banana waste fermented with *Saccharomyces cerevisiae.*

Each value is a mean of 16 samples, Alk-p-ase: alkaline phosphatase activity, SE: standard error.

Means in the treatments with different superscripts are significant (P<0.01, A and B) or (P<0.05, a and b), ** : significant at 1% level * : significant at 5% level, ns: not significant.

yeast treatment (T_3) as a result of increase of rumen acetate and acetate : propionate ratio (Kumar *et al.*, 1997). Rumen acetate is the main source for milk short chain fatty acids synthesis leading to increase of milk fat content.

These results are in accordance with the finding of Beauchemin *et al.*, (1999), David *et al.*, (1999), Lewis *et al.*, (1999) and Yang *et al.*, (1999), who reported that milk fat percent was not affected by fungal enzymes treatments. While, Rode et., (1999) suggested a decrease of milk fat with fungal enzymes treatments.

Inspection of yeast treatment, our results are in the line of the results obtained by Seymour *et al.*, (1991), Chiquette (1995), Kung *et al.*, (1997), Abo El-Nor and Kholif (1998), Wohlt *et al.*, (1998), Kholif *et al.* (2000) and Robinson and Garrett (1999) who reported that milk fat percent are not affected by yeast supplementation. However, Piva *et al.*, (1993) suggested an increase of milk fat percent with yeast culture supplement to dairy cow rations.

Concerning lactose content, similar results obtained by Beauchemin *et al.*, (1999) and David *et al.*, (1999), who noted that lactose content did not affect by fungal enzyme treatment. However, Yang *et al.*, (1999) observed an increase of lactose percent with fungal enzyme treatment. Also Rode *et al.*, (1999) found that lactose percent decreased with fibrolytic enzyme supplemented dairy cows rations.

These results of yeast treatment agreed with the finding of Piva *et al.*, (1993), Robinson and Garrett (1998) and Kholif *et al.* (2000) who reported that milk lactose percent are not affected by yeast culture supplemented diet. However, Kumar et al (1992) suggested an increase in milk lactose content with yeast culture supplemented dairy cow diets.

The slight increase of milk lactose content may be due to an increase of rumen propionate (Harrison *et al.*, 1988, and Sharma *et al.*, 1998) and higher crude fiber and fiber fraction digestibility.

Milk total protein percent increased significantly ($P<0.05$) with all biological treatments compared with control. These results are in a good agreement with those obtained by Beauchemin *et al.*, (1999) who reported that milk protein content increased with fungal enzyme treatment. However, David *et al.*, (1999) suggested that milk protein content are not affected by fungal enzyme treatment. Also, Lewis *et al.*, (1999) and Rode *et al.*, (1999) observed that milk protein content tended to be lower for cows fed diet supplemented with fungal enzyme.

Regarding the results of yeast treatment, the results of milk total protein are in accordance with those reported on lactating animals fed diets supplemented with yeast culture by Kumar *et al.*, (1992), Robinson and Garrett (1999) and Kholif *et al.* (2000). While, Seymour *et al.*, (1991), Chiquette (1995), Abo El-Nor and Kholif (1998) and Wohlt *et al.*, (1998) suggested that milk protein did not affect by yeast culture supplemented diet.

Milk ash percent, milk pH and acidity percent are not affected by biological treatments compared with control.

Feed efficiency (FCM/DMI) increased ($P>0.05$) with all biological treatments compared with control.

Effect of biological treatments of dried banana wastes on blood serum parameters:

Serum total protein and albumin were increased significantly ($P<0.01$) with yeast treatment compared with other treatments, however, serum globulin and A/G ratio were not affected by treatments (Table, 4). Serum total protein reflects the nutritional status of the animal and it

has a positive correlation with dietary protein (Kumar *et al.*, 1980). These results are parallel with values of CP content in the experimental rations and the results of organic matter and crude protein digestibility. It is of interest to indicate that rumen liquor total protein show the same trend of serum total protein.

The results of total protein and albumin are in a good agreement with the finding of El-Ashry *et al.*, (1997) and Khorshed (2000) who reported that biological treatments increased serum total protein (in sheep). Also, the results of yeast treatment are in accordance with those obtained by Abo El-Nor and Kholif (1998) and Kholif *et al.* (2000). However, Piva *et al.*, (1993) found that blood plasma total protein were not affected adversely by added dietary yeast culture. In conclusion, serum total protein reflects the nutritional status of the animal and it has a positive correlation with dietary protein (Kumar *et al.*, 1980). These results were parallel with values of CP content in the experimental ration and the results of organic matter and crude protein digestibility. It is of interest to indicate that rumen liquor total protein take the same trend of serum total protein.

The results of globulin are in the line of those obtained by El-Ashry *et al.*, (1997) and Khorshed (2000) (with fungal culture treatments) and Piva *et al.*, (1993), Abo El-Nor and Kholif (1998) and Kholif *et al.* (2000) (with yeast treatments supplementation).

Values of serum urea were not affected by treatments (Table, 4). The results of fungal treatments are in agreement with those obtained by El-Ashry et al,. (1997) and Khorshed (2000) who reported a significant increase in serum urea nitrogen concentration with fungal treatments.

However, Abo El-Nor and Kholif (1998) and Kholif *et al.* (2000) reported significant increase in serum urea nitrogen concentration with yeast culture supplement.

According to Lewis *et al.*, (1957) the overall patterns of rumen ammonia nitrogen concentration are roughly parallel and the measurement of serum urea nitrogen concentration was proposed as supplementary test for the efficiency in the present utilization in ruminants. The apparently normal values obtained in the present study for serum urea nitrogen and rumen fluid ammonia nitrogen suggested efficient utilization of nitrogen in rations by rumen microorganisms.

Values of serum creatinine were not affected by treatment (Table, 4). Generally, serum creatinine level is a useful indicator of glomerular filtration in the kidney. From the previous data, it was found that the values of serum creatinine for goats were within the normal levels. Regarding to the results of serum urea nitrogen and serum creatinine concentrations, it is clear that tested animals were not in a catabolism situation and kidney function was not affected by biological treatments. Consequently, the animals were in a good nutritional condition.

T_2 significantly decreased ($P<0.05$) the activity serum GOT compared with other treatments. while, serum GPT and Alk-p-ase activities were not affected by treatments (Table, 4). The results of yeast treatments are in a good agreement with those obtained by Abo El-Nor and Kholif (1998). While, Kholif *et al.* (2000) found that serum GOT concentration recorded insignificantly increase ($P>0.05$) with dietary yeast culture supplement. On the other hand, our results of fungal treatments are in agreement with those obtained by El-Ashry *et al.*, (1997) and Khorshed (2000) who observed that serum GOT concentration increased

significantly with fungal or yeast treatments.

The present values of GOT and GPT showed normal activity of the animal hepatic tissues and consequently, different biological treatments applied in the present investigation could be used without any adverse effect on the liver functions.

Serum glucose and total lipids showed slightly increases (P>0.05) with all biological treatments compared with control (Table, 4). The slightly increase of serum glucose with biological treatments may be due to higher OM, CF and fiber fractions digestibilities and higher TVFA's content in rumen of animals given treated rations especially propionate with yeast treatment (Harrison *et al.*, 1988) and Sharma *et al.*, (1998).

It is of interest to note that blood serum glucose of different experimental treatments followed same trend of their milk lactose content and milk yield, which may confirm the results of Clark *et al.*, (1977) who claimed a positive relationship between blood serum glucose and milk yield.

These results are closed with the finding of Piva *et al.*, (1993) who reported that plasma glucose were not affected adversely by added dietary yeast culture. However, Abo El-Nor and Kholif (1998), Sharma *et al.*, (1998) and Kholif *et al.* (2000) stated that serum glucose content increased significantly with yeast culture supplementation to buffaloes or cows rations.

Serum cholesterol recorded a significantly increase (P<0.05) with yeast treatment (T_3) compared with T_2 (Table, 4). These results are in a good agreement with those obtained by Piva *et al.*, (1993) who found that plasma cholesterol was not affected by added dietary yeast culture to cows ration. While, Kholif *et al.* (2000) reported a significant increase (P<0.05) of serum cholesterol with yeast culture (Yea Sacc group) compared with control. Generally, values of blood serum parameters were in the normal range.

CONCLUSION

Feeding animals on ration containing banana wastes fermented with *Trichoderma viride, Penicillium funiculusms* or *Saccharomyces cerevisiae* improved the performance of lactating goats without any adverse effect of animals' health.

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معاملة مخلفات الموز بيولوجيا لتغذية الماعز الحلاب

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تم استخدام ستة عشر أنثي ماعز بلدى حلاب حيث قسمت الحيوانات عشوائيا إلى أربع مجموعات لتلقى أربع معاملات بنظام المربع اللاتينى ٤×٤ حيث قسمت التجربة الى أربعة مراحل كل مرحلة استمرت لمدة ٣٠ يوم، وكانت العلائق فى المعاملات المختلفة تتكون من الآتى: المجموعة المقارنة : تتكون من ٧٠ % علف مركز + ٣٠% مخلفات الموز المعاملة بالماء فقط. ، المعاملة الأولى : تتكون من ٧٠ % علف مركز + ٣٠% مخلفات الموز المعاملة بفطر *Trichoderma viride*. ، المعاملة الثانية : تتكون من ٧٠ % علف مركز + ٣٠% مخلفات الموز المعاملة بفطر *Penicillium funiculusms* ، المعاملة الثالثة: تتكون من٧٠ % علف مركز + ٣٠% مخلفات الموز المعاملة بخميرة *Saccharomyces cerevisiae* . و قد تم أخذ عينات اللبن من كل حيوانات التجربة فى آخر ثلاثة أيام من كل مرحله من مراحل التجربة، كما أخذت عينات سائل الكرش من حيوانين من كل مجموعه قبل التغذية و بعد ٣ و ٦ ساعات من التغذية، و أخذ عينات الدم من ثلاثة حيوانات من كل مجموعة بعد أربع ساعات من التغذية فى آخر يوم من كل مرحلة، وقد أوضحت النتائج ما يلى:-

المعاملة الأولى رفعت محتوى الكرش من الأحماض الدهنيه الطيارة معنويا (على مستوى ٥ %) تبعتها المعاملة الثالثة مقارنة بالمجموعة المقارنة.كما ارتفع تركيز النيتروجين الكلى فى الكرش معنويا (على مستوى ٥%) بالمعاملة الثالثة. و أرتفع أيضا تركيز النيتروجين غير البروتينى معنويا (على مستوى ٥%) مع المعاملة الأولى و الثالثة.

حدثت زيادة فى محصول اللبن معنويا (على مستوى ٥ %) مع المعاملة الثانية والثالثة كما ارتفع محصول اللبن المعدل نسبة الدهن (بنسبة ٤ %) معنويا (على مستوى ٥ %) مع المعاملة الثالثة مقارنة بالمعاملة الأولى و المجموعة المقارنة. كما لوحظ وجود زيادة معنوية (على مستوى ٥ %) فى نسبة المواد الصلبة فى اللبن مع المعاملة الأولى و الثالثة مقارنة بالمجموعة المقارنة، كما رفعت المعاملات البيولوجية المختلفة نسبة بروتين اللبن معنويا (على مستوى ٥%) مقارنة بالمجموعة المقارنة، كما ارتفعت الكفاءة الغذائية (محسوبة بقسمة محصول اللبن المعدل نسبة الدهن على المادة الجافة الماكوله) مع كل المعاملات البيولوجية مقارنة بالمجموعة المقارنة.

ارتفع كل من البروتين الكلى و الألبيومين فى سيرم الدم معنويا (على مستوى ١ %) بالمعاملة بالخميرة (الثالثة) مقارنة بالمعاملات الأخرى، كما خفضت المعاملة الثانية نشاط إنزيم GOT معنويا (٥ على مستوى %) مقارنة بالمعاملات الأخرى، كذلك ارتفع تركيز الكوليسترول الكلى فى سيرم الدم معنويا (على مستوى ٥ %) مع المعاملة بالخميرة مقارنة بالمعاملة الثالثة

و الخلاصة أن المعاملة بالخميرة كانت أكثر فاعلية من الفطريات فى تنشيط ميكروفلورا الكرش بما يؤدى إلى زيادة إنتاج الحيوان من اللبن و تحسين صفات اللبن المنتج و بدون أى أضرار صحية على حيوان اللبن.