

Research Article

Impact of Yeast and/or Exogenous Fibrolytic Enzymes-Treated Olive Trees By-Products on Digestibility and Ruminal Fermentation of Damascus Goat Bucks

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Abstract:

Agro-waste from olive trees (OTB) which is not properly utilized and left it without treatment may lead to major social, environmental and economic problems. Such wastes can be biologically treated to increase their nutritive values and be utilized as ruminant alternative feeds. Investigate if their synergism between live yeast culture and Exogenous fibrolytic Enzymes (EFE) and impact of each of them or their mixture on OTB digestibility, nutritional values, nitrogen utilization and some ruminal fermentation are the main objectives of this study. Damascus goat bucks were randomly assigned into five groups of three animals each using complete random design. Goats were fed, 70% concentrate feed mixture (CFM)+ 30% berseem hay (control group), 70% CFM+ untreated olive trees by-product as a replacer for berseem hay (R1), 70% CFM+30% OTB treated with EFE (R2), 70% CFM+30% OTB treated with live yeast culture (R3) and 70% CFM+30% OTB treated with a mixture of EFE and live yeast culture (R4). Synergism was noted between live yeast culture and exogenous fibrolytic Enzymes (EFE) on the tested parameters. Results indicated that addition either as live yeast culture or exogenous fibrolytic enzymes increased ($P<0.05$) the digestibility of all nutrients which were reflected on the nutritive values (as TDN and DCP) of olive trees byproducts. Addition of live yeast culture or exogenous fibrolytic enzymes reduced ammonia-N and increased both TVFA's. Inclusion of biologically treated olive tree by products (OTB) in Damascus bucks rations improved nutritive value and ruminal activity.

1. Introduction

In Egypt, there is a serious gap between the necessary and available feed ingredients for livestock. An estimated 3.1 million tons of total digestible nutrients are lost annually due to this feedstuff deficit (Fayed et al., 2009). Additionally, roughage feed supplies are the foundation of small ruminant nutrition in Egypt (Azzaz et al., 2012). The low productivity of local livestock and the ongoing price increases for traditional roughages prompted nutritionists to look for alternate feed sources (Azzaz et al., 2017). In this regard, only 15% of the approximately 30 million tons of by-products produced by agricultural and agro industrial operations are utilized for animal feed (Fadel and El-Ghonemy, 2015).

When leaves and twigs from olive trees (OTB) are not used effectively and are not treated, they can lead to major problems from an economic, social, and environmental perspective. Fayed et al. (2009) revealed that each olive tree yields about 22 kilogramme of leaves a year. According to the Egyptian Ministry of Agriculture and Land Reclamation, the fertile area of olive trees reached 257,000 feddan. (Ministry of Agriculture and Land Reclamation, 2024). These enormous quantities of olive tree byproducts (OTB) may be used as ruminant roughage substitutes (Fayed et al., 2009). The origin, storage and climate conditions, moisture content, and degree of lignification all affect OTB's chemical composition (Hend, 2009). 50–60% dry matter, 7–11% crude protein, 5–7% ether extract, 13–23% crude fiber, 53–59% nitrogen free extract, 40–45% neutral detergent

fiber, 28–35% acid detergent fiber, and 18–20% acid detergent lignin are all present in the air-dried OTB (Hend, 2009). Additionally, the leaves are low in tyrosine and cysteine and high in arginine, glutamic, leucine, aspartic and valine amino acids. Furthermore, the main fatty acids in the crude fat of olive leaves are palmitic and linolenic acids (Lee et al., 2005).

Low protein and high fiber concentrations, as well as the presence of anti-nutritional components (such tannins), which may contribute to OTB's poor palatability and digestibility, are the primary barriers to expanding the inclusion of OTB in ruminant diets, as is evident from the chemical composition. Therefore, it is necessary to break the chemical connections between lignin, cellulose, and hemicellulose in order to increase the nutritional value of OTB as a lignocellulolytic substance (Azzaz et al., 2016; Kholif et al., 2018). Numerous techniques, including biological, mechanical and chemical treatments, have been proposed to achieve that (Hend, 2009). Without having an adverse effect on the health of the animals, the microbiological treatments enhanced the nutritional value of the agricultural waste (Aboul-Fotouh et al., 2016).

Exogenous fibrolytic enzymes (EFE) and live yeast culture have both been employed recently to increase the utilization efficiency of poor-quality roughages. Numerous investigations have demonstrated the beneficial effects of EFE supplementation on microbial populations, fibrolytic activity of rumen liquor, and rumen characteristics. (Gaafar et al., 2010; Bhasker et al., 2013). Additionally, studies have shown that adding

live yeast culture to the diets of cattle, sheep, and goats alters rumen fermentation and stimulates ruminal digestion (Mahender et al., 2006; Srinivas Kumar et al., 2011). Additionally, a number of attempts have been undertaken to feed dairy animals a combination of probiotic formulations (Erasmus et al., 2005), presuming that they have a synergistic effect on animal health and productivity.

A synergistic effect was expected as yeast can make the ruminal environment more suitable for optimum feed digestion (Elghandour et al., 2015^a). At the same time, the inclusion of dietary exogenous enzymes in the diet of ruminants could enhance feed utilization (Morsy et al., 2016).

The impact of adding live yeast culture and/or EFE on rumen fermentation, however, has only been described in a small number of comparative studies. Thus, assessing the impact of treating OTB with live yeast culture and/or EFE on nutrient digestibility, nutritional values, and some ruminal fermentation was the aim of the experiment.

2. Materials and Methods

This study was conducted in El-Gemiza, Animal Production Research Station belonging to the Animal Production Research Institute, Agricultural Research

Centre, Egypt. The olive trees by products (leaves and twigs) were collected from olive farms along Matrouh Road, then chopped and dried naturally for 2 weeks and packed till use. Fifteen Damascus goat bucks were divided into five similar groups (three animals each). Damascus goat bucks were fed on one of the following ration:

Animals in the first group was fed control ration consisted of 70% concentrate feed mixture (CFM: 60% corn, 22% soybean meal, 15% wheat bran, 1% limestone, 1% minerals and vitamins mixture and 1% NaCl)+30% berseem hay (control group). The second group (UOTB) was fed on 70%CFM + untreated olive trees by-product as a replacer for berseem hay (R1). The third group was fed R2 ration (70% CFM+30% OTB treated with EFE preparation (Fibrozyme™, 4 g/day) containing a composite of active xylanase and cellulase). The fourth group was fed R3 ration (70% CFM+30% OTB treated with a live yeast culture preparation (Yea – Sacc¹⁰²⁶, 4 g/h/day) containing dried live yeast culture (*Saccharomyces cerevisiae*¹⁰²⁶), while the last group was fed R4 ration (70% CFM+30% OTB treated with 8 g/h/day exogenous enzymes and live yeast culture mixture. Diets were offered to each animal individually at 08:00 and 16:00 h in two equal portions.

Table 1. Impact of EFE and live yeast culture treatment on the chemical composition of olive Tree by-products.

Item	UOTB	OTBE	OTBY	OTBYE	BH
Chemical analysis (g/kg DM)					
DM	880.4	893.2	914	930.7	905
OM	840	844.8	852.3	860.1	883.2
Ash	160	155.2	147.7	139.9	116.8
CP	60.3	110	125	152.7	138.5
CF	230.2	160.5	151.7	132.3	315.2
EE	52	59.2	58.8	59.9	22.7
NFE	497.5	515.1	516.8	515.2	406.8
Cell wall constituents (g/kg DM)					
NDF	530.7	510.2	492.5	448.3	439.2
ADF	390.1	382.5	377.2	370.1	362
ADL	125.2	112.1	102.7	88.3	70.2
Cellulose	264.9	270.4	274.5	281.8	291.8
Hemicellulose	140.6	127.7	115.3	78.2	77.2

UOTB, untreated olive Trees by products; OTBY, Olive Trees by products treated with live yeast culture; OTBE, Olive Trees by products treated with EFE; OTBYE, Olive Trees by products treated with both of Live yeast culture and EFE; BH, Berseem hay

2.1. Digestibility and nitrogen balance trials

Digestibility and nitrogen balance trials were carried out using Fifteen Damascus goat bucks (57.6 ±1.33, in average) (three bucks for each group). Trial lasted for four weeks; the first three weeks were as a preliminary period, followed by one week for feces and urine collection. Animals were fed twice daily at 8 am and 3 pm, water was offered freely. Each animal was offered the experimental rations according to NRC, (2007). Chemical composition of feeds, feces and urine were determined according to AOAC (2005) methods. Sub

samples (20%) of feces and urine were taken once daily then stored at – 18 °C until analyses. Fecal samples were dried at 60 °C for 72 hrs. Feed and fecal samples were ground through 1 mm screen on a Wiley mill grinder and a sample of 50 gm/ (ration/bucks) was taken for analysis. The samples of feed and feces were analyzed for crude protein (CP), crude fiber (CF), ether extract (EE) and ash, while the urine samples were analyzed for nitrogen (N) content according to AOAC (2005). Cell wall constituents (NDF, ADF and ADL) were determined according to VanSoest (1991). Hemicellulose and cellulose were calculated by differences.

Table 2. Chemical composition of the experimental rations (g/kg of DM)

Item	CFM	Control	R1	R2	R3	R4
Chemical composition						
DM	936.1	927.8	923.2	928.5	933.9	937.1
OM	919.7	910.1	890.8	899.1	901.9	903.5
Ash	80.3	89.9	109.2	100.9	98.1	96.5
CP	122.0	128.5	106.7	128.9	126.3	129.4
CF	112.9	187.2	153.6	143.3	132.9	128.7
EE	30.2	28.7	33.1	38.7	38.9	39.3
NFE	654.6	565.7	597.4	623	603.8	606.1
Cell wall constituents						
NDF	304.9	349.5	375.9	358.6	347.2	344.8
ADF	177.1	233.2	238.6	233.1	231.2	222.8
ADL	66.3	68.4	87.3	78.9	76.8	72.4
Cellulose	110.8	164.8	151.3	154.2	154.4	150.4
Hemicellulose	127.8	116.3	137.3	125.5	116.0	122.0

CFM, concentrated feed mixture; control; group fed 70% concentrate feed mixture (CFM) + 30% berseem hay; R1, group fed 70% concentrate feed mixture (CFM) + 30% untreated olive trees by products; R2, group fed 70% concentrate feed mixture (CFM) + 30% olive trees by products treated with EFE; R3, group fed 70% concentrate feed mixture (CFM) + 30% olive trees by products treated with live yeast culture; R4, group fed 70% concentrate feed mixture (CFM) + 30% olive trees by products treated with live yeast culture and EFE; DM, dry matter; OM, organic matter; CP, crude protein; CF, crude fiber; EE, ether extract; NFE, Nitrogen free Extract; NDF, Neutral detergent fiber; ADF, Acid detergent fiber; ADL, Acid detergent lignin

2.2. Rumen fermentation trials

Rumen samples were collected by a stomach tube at 3 hours post-feeding. Ruminal pH was measured immediately after collection using a digital pH meter (Sophisticated microprocessor, pH meter). Rumen fluid was strained through four layer of cheesecloth into plastic containers and kept frozen for later analysis. Half of the samples were acidified using concentrated ortho-phosphoric acid and 0.1N hydrochloric acid to determine the volatile fatty acids (VFA). The second half of samples was alkalized using 0.1N NaOH to determine the concentration of rumen ammonia.

2.3. Statistical analysis

The obtained data were statistically analyzed for one-way ANOVA using SAS software (SAS, 2006). The experimental model was:

$$Y_{ij} = M + Ti + e_{ij}$$

Where: Y_{ij} = experimental observation; M = general mean; Ti = effect of treatment; e_{ij} = experimental error; Duncan's multiple tests were applied for comparison of means (Duncan, 1955).

3. Results and Discussions

3.1. Feed intake and Nutrient digestibilities

The results presented in Table (3) showed that intake DM was significant ($P < 0.05$) among treatments. The observed significant increase in the daily feed intake in all groups fed OTB treated with EFE, live yeast culture or live yeast culture and EFE mixture may be due to the significant decrease in OTB fibrous content and the improvement in fiber digestibility. The ration R3 exhibits the highest feed intake (1242.10g/h/d)

without any significant differences between R2 and R4, while the control group has the lowest (1150.19 g/h/d).

Unlike to these results, Hong and Gallagher (1994) revealed that sheep fed ration with or without Sc (5 g/h/day) showed no significant differences between control and treatment in in-vivo digestibility of DM, acid detergent fiber (ADF), nitrogen (N) or in vitro DM digestibility. Also, Titi *et al.* (2008) observed that supplementation of yeast culture in the diets of lambs and kids had no effect on dry matter intake (DM).

Rations containing treated OTB with live yeast culture and EFE combination (R4) increased ($p < 0.05$) all nutrients digestibility and cell wall constituents (NDF, ADF, lignin) digestibility compared to other groups (Table 3). There was no significant differences were found between R2 and R3 in all nutrients digestibility. No significant differences were found among treatments of NFE digestibility. Also, no significant differences were found between rations treated OTB and UOTB of EE digestibility. The higher apparent digestibility coefficient with R4 rations may be due to the improvement of their digestibility and absorption. These findings are supported by results of many researchers, whom reported that fiber content, specifically the NDF have a great influence on the intake and digestibility of roughages by small ruminants (Go'mez Cabrera *et al.*, 1982; Harper and McNeill, 2015).

Enhancement of fiber digestion and rumen environment are among the benefits of exogenous enzyme (Morsy *et al.*, 2016) and yeast (Hassan *et al.*, 2016) feeding to ruminants. Enhancement of nutrient digestion in this study is consistent with earlier studies in which greater nutrient digestibility resulting from enzyme (Rojo *et al.*, 2015) and yeast (Hassan *et al.*, 2016)

supplement has been recorded. Enhanced ruminal fermentation with ingestion of the exogenous enzymes and yeast is arguably the predominant factor for the observed improvement in digestibility of the nutrients, in particular, dietary fiber content. Enhanced nutrient digestibility with the exogenous enzymes is attributed to its contents of cellulose and xylanase. Exogenous fibrolytic enzyme increases the rate of digestion of fiber in the rumen (Yang et al., 1999), reduces digesta viscosity (Hristov et al., 2000) and alters ruminal fermentation (Khattab et al., 2011). Wang et al. (2001) found greater attachment and colonization of ruminal bacteria on feed particles when supplemented with exogenous enzymes. Eun et al. (2007) found synergy between ruminal endogenous and exogenous enzymes with greater hydrolytic activity in the rumen. In a different experiment, exogenous enzyme supplementation enhanced populations of both ruminal fibrolytic and

non-fibrolytic bacteria (Wang et al., 2001), which led to more microbial biomass and increased polysaccharidase activity. Enhanced nutrient digestibility with the addition of yeast can be explained by the fact that it scavenges oxygen from the surface of newly ingested fresh feeds, hence lowering rumen redox potential (Chaucheyras-Durand et al., 2008). Such actions make the ruminal habitat anaerobic, suitable for ruminal microbial activity (Newbold et al., 1996). Moreover, yeast cells also have soluble compounds like organic and amino acids, peptides and vitamins necessary for efficient ruminal bacteria growth and activity (Chaucheyras-Durand et al., 2008). Earlier research has shown higher total ruminal bacteria and cellulolytic bacteria populations with *S. cerevisiae* supplementation in buffalo calf diet and lactating cow diet, respectively (Harrison et al., 1988).

Table 3. Effect of yeast and/or exogenous fibrolytic enzymes -treated olive trees by-products on feed intake and digestibility coefficient

Items	Experimental groups				
	Control	R1	R2	R3	R4
	Feed intake (g/h/d)				
Total feed intake	1150.19±5.82 ^c	1196.76±2.37 ^b	1212.62±2.2 ^{ab}	1242.10±7.9 ^a	1230.21±20.15 ^a
	Digestibility (%)				
DM	57.56±1.22 ^b	58.15±1.39 ^b	63.18±0.67 ^a	62.28±0.7 ^a	62.22±0.69 ^a
OM	57.77±1.14 ^c	60.44±0.41 ^b	61.38±0.78 ^{ab}	64±0.25 ^a	64.79±0.34 ^a
CP	61.25±0.49 ^b	62.94±0.43 ^b	63.87±0.82 ^{ab}	64.36±1.83 ^{ab}	66.74±0.4 ^a
CF	57.55±0.53 ^c	62.47±0.75 ^b	63.51±0.61 ^b	63.12±0.99 ^b	65.74±0.4 ^a
EE	57.34±0.63 ^b	60.69±0.59 ^a	61.52±1.19 ^a	63.7±1.31 ^a	63.65±0.28 ^a
NFE	60.55±0.75 ^a	61.2±1.48 ^a	62.9±0.4 ^a	63.63±0.63 ^a	60.65±2.1 ^a
	Cell wall constituents (%)				
NDF	57.23±0.185 ^c	61.04±0.487 ^b	62.29±0.023 ^a	62.37±0.095 ^a	62.94±0.411 ^a
ADF	42.4±0.278 ^c	45.34±2.07 ^{bc}	47.5±0.311 ^{ab}	47.82±0.409 ^{ab}	49.72±0.288 ^a
Lignin	31.57±0.193 ^e	35.73±0.163 ^d	37.55±0.262 ^c	38.47±0.193 ^b	39.24±0.178 ^a

a,b,c,d,e: means in the same row followed by different superscripts are significantly ($P<0.05$) different

DM, dry matter; OM, organic matter; CP, crude protein; CF, crude fiber; ; EE, ether extract; NFE, Nitrogen free Extract; NDF, Neutral detergent fiber; ADF, Acid detergent fiber

3.2. Nutritive values

Nutritive values expressed as TDN, DCP, DE and ME were ($P<0.05$) increased by supplementation of live yeast culture and EFE mixture (R4) compared to other treatments (Table 4). The bucks fed treated rations with additives showed superiority in nutritive values over those fed untreated ration (R1) and control. The improved TDN and DCP might be due to the higher nutrients digestibility of OTBYE groups (R4). These results are in accordance with Abou-Seri et al. (2020) who found that the TDN and DCP were significantly increased by added yeast culture plus enzymes group. However, the improvement in nutrients digestibility in relation to treatment of live yeast culture and EFE mixture, was accompanied by the improvement in the nutritive value of the given diet expressed either as Kcal metabolizable energy (ME) or as digestible crude protein (DCP) (Roth et al., 1992).

3.3. Nitrogen utilization

The data of nitrogen intake in table (5) showed that

significant differences were found among treatments of nitrogen intake. The presented results indicated that dietary the R4 ration ($P<0.05$) increased the nitrogen retained (NR), N retained as % of N-intake and as % of N-absorbed compared to other groups. Supplement of live yeast culture or EFE significantly ($P<0.05$) increased the nitrogen absorbed (NA) compared to control group and R1. However, all rations were showed positive retained N. Differences in nitrogen retained values may be due to the differences in amino acids composition of protein sources and its digestibility. The higher percentage of dietary nitrogen retained noticed with ration supplemental live yeast culture and EFE mixture or live yeast culture alone compared with the control, these may be due to the more digestible protein; it had more ($P<0.05$) nitrogen utilization. Dietary nitrogen utilization (% N retained of N-intake) was obviously higher ($P<0.05$) with ration supplemented with live yeast culture and EFE mixture (R4) or live yeast culture (R3) than the all other rations.

Table 4. Effect of yeast and/or exogenous fibrolytic enzymes -treated olive trees by-products on the nutritive values in goats fed the experimental rations.

Items	Experimental Groups				
	Control	R1	R2	R3	R4
TDN, %	56.66±0.034 ^e	59.65±0.028 ^d	60.61±0.005 ^{bc}	60.72±0.057 ^b	61.90±0.011 ^a
TDNI, g	652.02±0.398 ^e	713.6±0.345 ^d	734.97±0.069 ^c	754.2±0.717 ^b	761.5±0.142 ^a
DCP, %	6.71±0.017 ^d	6.99±0.028 ^c	7.23±0.017 ^b	7.29±0.046 ^{ab}	7.40±0.057 ^a
DCPI, g	77.22±0.199 ^d	83.62±0.345 ^c	87.67±0.209 ^b	90.55±0.573 ^a	91.04±0.71 ^a
DE (M cal/kg)	2.49±0.0017 ^e	2.62±0.0014 ^d	2.67±0.0003 ^c	2.67±0.0026 ^b	2.72±0.0003 ^a
ME (Mcal kg ⁻¹)	2.06±0.0011 ^e	2.17±0.0011 ^d	2.2±0.0003 ^c	2.2±0.002 ^b	2.25±0.0005 ^a

^{a,b,c,d,e}: means in the same row followed by different superscripts are significantly ($P<0.05$) different

Table 5. Effect of yeast and/or exogenous fibrolytic enzymes -treated olive trees by-products on nitrogen utilization

Items	Experimental groups				
	Control	R1	R2	R3	R4
Nitrogen intake (NI), g/d	19.12±0.005 ^e	19.44±0.023 ^d	19.56±0.034 ^c	19.88±0.017 ^b	19.99±0.011 ^a
Nitrogen absorbed (NA), g/d	13.01±0.011 ^c	13.07±0.04 ^c	13.23±0.005 ^b	13.40±0.028 ^a	13.48±0.046 ^a
Nitrogen retained (NR), g/d	4.75±0.028 ^d	4.98±0.017 ^c	5.22±0.011 ^b	5.43±0.017 ^a	5.48±0.046 ^a
N- retained e as % of N-intake	24.84±0.144 ^d	25.62±0.057 ^c	26.69±0.011 ^b	27.31±0.063 ^a	27.41±0.216 ^a
N- retained as % of N-absorbed	36.51±0.19 ^d	38.10±0.014 ^c	39.46±0.072 ^b	40.52±0.04 ^a	40.65±0.202 ^a

^{a,b,c,d,e}: means in the same row followed by different superscripts are significantly ($P<0.05$) different

3.4. Ruminal fermentation

Ruminal pH and ruminal metabolites (NH₃-N and TVFA's) values were significantly affected by supplementation of live yeast culture and EFE (Table 6). The pH value of rumen liquor were significantly ($P<0.05$) decreased by treatment of olive trees byproducts with live yeast culture or EFE or their both compared with UOTB (R1) and control group. The pH values are within the normal range obtained by Van Soest (1982) who stated that the optimum pH value for growth of cellulytic microorganisms was 6.7±0.5 pH degree.

These results differed with the findings of Can et al. (2007) and Poonooru et al. 2015 who found that supplementation of both EFE and live yeast culture in TMR increased ($P<0.01$) the rumen pH as compared to the control demonstrating the additive effect. In contrast, LopuszanskaRusek and Bilik (2011) reported that supplementation of both EFE and live yeast culture in rations of dairy cows had no effect ($P>0.05$) on rumen pH, in addition, most of the researchers reported that EFE supplementation had no effect on rumen pH (Pinos-Rodriguez et al., 2008; Singh and Das, 2009; Ganai et al., 2011; Bhasker et al., 2013; Lara Bueno et al., 2013; Torres et al., 2013). These results incorroborated with the earlier reports of Garg et al. (2009), Ibrahim et al. (2012), Raj Kiran and Srinivas Kumar (2013), and Nehra et al. (2014) who found that supplementation of live yeast culture in TMR increased ($P<0.01$) the rumen pH as compared to the control.

Supplemental with live yeast culture and EFE combination had significantly ($P<0.05$) decreased the NH₃-N compared to UOTB and control group. While, the concentrations of TVFA's significantly increased ($P<0.05$) with OTBYE ration (R4) compared to other

rations. This increase in TVFA's may be due to the increase of apparent digestibility of organic matter. The decrease of ruminal NH₃-N concentration with OTBYE ration may be due to improve of the rumen microbe's activity utilizing NH₃-N to produce microbial protein, in the meantime, improve degradation of feed utilization (Froetschel, 1990).

The higher concentrations of TVFA in the rumen fluid could be attributed to stimulatory effect of yeast culture on viable and total bacterial population, which in turn enhanced the fermentation in the rumen and resulted in increased production of TVFA (Gurpreet Singh et al., 2008). These observations are very consistent with the findings of Ibrahim et al. (2012), Raj Kiran and Srinivas Kumar (2013), Nehra et al. (2014), and Ganai et al. (2015).

Yeast and yeast-enzyme mixture reduced the ruminal ammonia-N concentrations, indicating the potential of *S. cerevisiae* to alter microbial N metabolism. It is possible that the number or activity of proteolytic bacteria was lowered in the goat rumen treated with *S. cerevisiae*, as noted by Elghandour et al (2015^b). Lower ammonia-N levels with greater nutrient digestibility at the same moment, is a sign of a balance between soluble N and carbohydrate availability, leading to increased microbial growth and reduced N loss. The current findings agree with those of Al Ibrahim et al. (2010). Protease activity in EZ treatment can be accountable for increased ammonia-N concentration due to enhanced protein degradation (Togtokhbayer et al., 2015). Higher VFA concentrations with the treatment of the exogenous enzymes and yeast may be due to better nutrient digestion, since VFA concentrations are reliant on feed digestibility, rate of absorption, and activity of ruminal microflora (Flatt et al., 1956).

Table 6. Effect of yeast and/or exogenous fibrolytic enzymes -treated olive trees by-products on some ruminal fermentation

Overall mean	Control	R1	R2	R3	R4
pH	6.69±0.006 ^a	6.55±0.003 ^b	6.46±0.001 ^d	6.48±0.001 ^c	6.47±0.001 ^d
NH3-N mg/100 ml	15.15±0.011 ^a	12.83±0.01 ^b	12.69±0.008 ^c	12.44±0.012 ^d	12.29±0.005 ^e
VFAs mg/100 ml	10.48±0.004 ^e	11.5±0.019 ^d	11.59±0.01 ^c	11.74±0.012 ^b	12.24±0.011 ^a

a,b,c,d,e: means in the same row followed by different superscripts are significantly ($P<0.05$) different

4. Conclusions

From the present study it can be concluded that dietary supplement either live yeast culture and/ or EFE to the diet, showed beneficial supplement effects to improve nutritive value olive trees by-products of and ruminal activity of Damascus bucks .

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