

IMPACT OF UREA-TREATED OLIVE TREES BY-PRODUCTS ON BARKI EWE'S NUTRIENTS DIGESTIBILITY AND MILK PRODUCTIVITY

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SUMMARY

Olive trees by-products (OTB) has high fiber and low protein content that could limit its use for feeding animals. This work aimed to investigate the effect of replacement of berseem hay in the diet of lactating Barki ewes by OTB treated with increasing levels of urea on Animal's nutrient digestibility, milk yield and milk composition. Thirty-five of lactating Barki ewes after one week of parturition were randomly assigned to five groups (seven each). The first; control group (CBH) was fed concentrate feed mixture (CFM) plus berseem hay. The second group (UOTB) was fed CFM + untreated OTB as a replacement of berseem hay. While, OTB2, OTB4 and OTB6 groups were fed CFM + OTB treated with 2%, 4% and 6% urea (on DM), respectively. Urea treatment significantly improved the crude protein (CP) while decrease fiber fractions content of the treated OTB. Total volatile fatty acids (TVFA's), total protein, NPN and ammonia N levels in the rumen were increased ($p < 0.05$) in all groups fed OTB treated with urea. Daily milk yield, fat corrected milk (FCM) and composition were slightly increased in groups fed treated OTB compared to both untreated OTB and control group. Ewes fed OTB treated with 4% urea had the highest values ($p < 0.05$) for milk production and its composition. Feeding olive trees by-products treated with 4% urea as a replacement of berseem hay significantly improved nutrients digestibility and milk production performance of Barki ewes.

Keywords: *Barki ewes, Urea, Olive trees by-products, Nutrients digestibility and Milk production.*

INTRODUCTION

Mediterranean countries produce more than 76% of the global production of olive oil (International olive council, 2006). In 2011, Egypt exported 11% of the world's table olive (International olive council, 2006) that left huge amounts of olive trees by products. One olive tree could produce annually about 25 kg of leaves and branches (olive trees by-products OTB) (Delgado-Pertíñez et. al., 1998). These residues could be useful for feeding small ruminant during the lack of availability of forages (Molina-Alcaide and Yáñez-Ruiz, 2008). Actually, OTB may play an important role in the integrated use of the available resources and reducing the environmental impact (Molina-Alcaide and Nefzaoui, 1996; Azzaz et. al., 2018).

The nutritive value of olive trees by-products varies depending on the methods and duration of the preservation. Fresh OTB has greater nutritional values and drying may preserve it, but excess drying could decrease their intake and nutritive value (Delgado-Pertíñez et. al., 1998). Also, ensiling could be used as a necessary process for keeping OTB for use over the whole year, as these residues seasonally produced.

The chemical composition and nutritional values of the OTB had been studied in several works (Molina-Alcaide and Nefzaoui, 1996; Yáñez Ruiz et al., 2004). Its chemical composition varies according to many factors such as its origin, proportion of branches, preservation and storage conditions, climatic conditions, and degree of contamination with soil (Azzaz et. al., 2018). Olive trees by-products (OTB) is considered as a rich fibrous source (33-56 % NDF/ kg DM) with high content of lignin (16-21% ADL/kg DM) limiting the degradability of cell wall and crude protein (CP) contents (Molina-Alcaide and Nefzaoui, 1996). Its CP content is low (70-129 g/kg DM) with low digestibility (Delgado-Pertíñez et. al., 1998; Molina-Alcaide and

Yáñez-Ruiz, 2008) due to its high contents of acid detergent insoluble nitrogen (ADIN). However, the high dry matter (DM) content and the lack of fermentable sugars should be considered (Molina-Alcaide and Yáñez-Ruiz, 2008). Both organic matter (OM) and CP digestibility of OTB is low and variable. In this concern, treatment with urea could improve the OM digestibility by 19% (Molina Alcaide et al., 2003).

In the previous work (Romaniello et al., 2018), treatment of OTB with urea resulted in significant increase in nutrient digestibility, nutritive values and the growth performance of ewe lambs. The optimal level for treatment with urea and the effect on milk production still not discussed.

Therefore, this work aimed to: 1) consider the effect of chemical treatment with increasing levels of urea on fiber and protein content of OTB. 2) Study effects of feeding treated OTB as an alternative for berseem hay on feed intake, nutrients digestibility, some rumen and blood parameters, and milk production by lactating Barki ewes.

MATERIALS AND METHODS

Olive trees by products (OTB) were collected from olive farms along Cairo - Alexandria Saharan Road, then chopped and dried naturally for two weeks and packed till use. Feeding and lactation experiments were conducted at a private farm (Alsttar farm for animal production), Khatatba city, Monofia governorate, Egypt. The entire experimental period was extended from January 20, 2018 to April 20, 2018. This experimental research has been conducted according to the experimental and ethical rules of the National Research Centre of Egypt.

Treatments of olive tree's by-products with urea: The collected OTB was chopped to 2-3 cm before air - drying for 15 day to reach 10-15% moisture until used. The air-dried OTB was then moistened for 40 % before sprayed with different levels of urea solution (1, 2, 3, 4, 5, and 6% on DM basis). After that, 10% of molasses solution on DM base was added as energy source in ensiled mixture. Finally, the mixtures were kept in tightly closed plastic bag for 21 days until opened and oven dried at 70°C for further chemical analysis by standard methods (AOAC, 1997). These were AOAC index no. 942.05 for DM and total ash, AOAC 977.02 for CP and AOAC 963.15 (petroleum ether extraction) for EE. Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined (Van Soest et. al., 1991).

Animals and feeding: Thirty-five of lactating Barki ewes after one week of parturition were randomly assigned to five groups (seven in each) using complete random design. Ewes have been allowed to feed on dry matter up to 5% of their body weight. The first group (CBH) was fed on concentrate feed mixture (CFM: 60% corn, 22% soybean meal , 15% wheat bran,1% limestone,1% minerals and vitamins mixture and1% NaCl) at 70% of allowance and berseem hay was offered ad lib. The second group (UOTB) was fed on untreated olive trees by-product as a replacer for berseem hay. However, groups (OTB2, OTB4, and OTB6) were fed treated OTB with 2, 4 and 6% urea (on DM), respectively. Diet offered twice per day in two equal portions at 7 a.m. and 4 p.m. The offered and the refusals were weighted daily and the animals were weighted every month.

Digestibility trials: At the last week of each month of the experimental period, fecal grab samples were collected from four animals (each group) in cloth bag connected to the animal back, for five successive days from each animal. A representative samples (10% from the collected feces) were dried in an oven at 70 C for 24 hrs. The dried feces from each animal were mixed and ground to pass a 1 mm sieve in a feed mill (FZ102, Shanghai Hong Ji instrument Co., Ltd., Shanghai, China) for their approximate analysis by standard methods (AOAC, 1997). Acid insoluble ash was used as an internal marker for determination of nutrients digestion coefficients. The digestibility coefficient of nutrient was calculated according to the following formula (Ferret et. al., 1999):

$$\text{Digestion co-efficient} = 100 - \left[100 \times \frac{\% \text{ indicator in feed}}{\% \text{ indicator in feces}} \times \frac{\% \text{ nutrient in feces}}{\% \text{ nutrient in feed}} \right]$$

Rumen parameters: At the end of the digestibility trials, 100 ml of rumen fluid was obtained using stomach tube at 4 hours after morning feeding for three successive days. The ruminal fluid was strained through three layers of cheese cloth, pH was immediately measured, then 1 ml toluene and 1ml paraffin oil

were added and stored in deep freeze at (-20°C) until analysis. Ammonia nitrogen, total nitrogen and non-protein nitrogen (NPN) concentration were determined according to A.O.A.C standard procedure (AOAC, 1997). The true protein nitrogen was calculated by subtracting the non-protein nitrogen content from total nitrogen content. Total volatile fatty acids (TVFAs) was determined (Dijkstra, 1994). For ruminal protozoal counting and classification, the ruminal fluid was strained through one layer of cheese cloth, then 2 drops of formalin were immediately add to the strained ruminal fluid (Naga et. al., 1969).

Blood parameters: samples were collected in glass tubes from jugular vein of each animal at 4 h after morning feeding for the last 3 days of each month of the experimental period. Serum was separated by centrifugation at 4000 x g /20 min. after coagulate at room temperature and kept frozen at -20°C for later analysis. Serum total protein, albumin, urea, aspartate aminotransferase (AST) and alanin aminotransferase (ALT) was determined using commercial kits (Stanbio Laboratory, Boerne, TX, USA) following manufacturer instructions. Globulin was calculated by subtracting the albumin from total protein.

Milk yield and composition: Ewes were milked twice a day for three successive days at the end of each month of the experimental period, at 8.00 a.m. and 4.00 p.m. Then, milk yield from the morning and evening milking were mixed together, recorded and a representative sample were kept at -20°C for later analysis for total solids, fat, protein and lactose by Bentley150 infrared milk analyzer (Bentley Instruments, Chaska, MN, USA). Solids-not-fat (SNF) was calculated by subtracting fat from total solids percentage. Fat corrected milk (4% fat) was calculated by using the following equation (Azzaz et. al., 2015):

$$FCM = 0.4M + 15F, \quad \text{Where: } M = \text{milk yield (g)} \text{ and } F = \text{fat yield (g)}.$$

Statistical analysis: The obtained data were statistically analyzed for one-way ANOVA using SAS software (SAS, 1998). The experimental model was:

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

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

RESULTS AND DISCUSSION

Effects of urea treatment on the chemical composition of olive trees by products: The treatment of OTB with urea resulted in a linear increase in CP content by 6.87% ($R^2 = 0.976$) as the level of urea treatment increased (Table 1). The positive improvement in the chemical composition of OTB after treatment with urea could be attributed to conversion of urea to ammonia in the bulk of the treated OTB. The resulted ammonia reacts with OTB particles and led for more OTB's fiber degradation especially lignin and increases its non-protein nitrogen (NPN) content. However, the rate of increase CP content of OTB with increasing level of urea was not constant. This may be due to the less nitrogen retention capacity for dry roughages when ammonized (Pires et. al., 2010). The Obtained results are in agreement with Resi et al. (1995), who reported significant improvement in CP content of hay treatment with ammonia. For fibrous content, urea has a potential effect in decreasing the fiber fractions content of OTB. Treatment of OTB with urea resulted in a gradual decrease in its content of NDF, ADF and ADL by 12.5, 14.1 and 7.9, respectively. This may be due to increasing in hemicellulose solubilization through breaking the ester linkage between lignin and hemicellulose, and partial break in hydrogen bounds of cellulose structure by ammonia (Garcíaet. al., 1999). Treatment with urea up to 4% appeared to be highly effective in lowering ADL content of OTB. However, using concentration above 4% seemed to be less effective. For fat content, the effect of urea treatment on EE content was limited compared with the other organic component in OTB.

Effects of urea treatment on the chemical composition of ewe's rations: Ewes of UOTB had ration with the lowest CP content, while CBH ewes had the lowest content for EE and NFE (Table, 2). Ewes of UOTB fed ration with the highest ADF content, while, ewes fed OTB4 and OTB6 rations had the lowest ADF content (221.4 and 217.6 g/kg DM,) respectively.

Impact of urea treatment on ewe's body weight, feed intake and nutrients digestibility: Data in Table (3) shows the differences between ewe's groups in the daily feed intake, nutrients digestibility and body weight changes. Ewes of OTB4 and OTB6 had higher ($p < 0.05$) feed intake, final body weight and body weight gain than those of CBH group. The lowest ($p < 0.05$) feed intake, final body weight and body weight gain were

observed for UOTB ewes, while the highest ($p < 0.05$) feed intake, final body weight and body weight gain were recorded for OTB6 ewes. Its worth to mention that, there were no significant change in the body weight gain between ewes fed berseem hay and those fed untreated OTB. For nutrients digestibility, data of Table (3) shows that, there was no significant differences between ewes fed UOTB and CBH rations in DM, CP, CF and NFE digestibility coefficients. However, ewes of CBH group showed slightly higher ($p < 0.05$) OM, EE, NDF and ADF digestibility coefficients than those of UOTB. The ewes fed OTB treated with urea at level of 4% and 6% showed significant increase in all of nutrients digestibility coefficients than those fed both UOTB and CBH rations.

Table (1): Impact of urea treatment on the chemical composition of olive trees by-products

Item	UOTB	OTB1	OTB2	OTB3	OTB4	OTB5	OTB6	BH
Chemical analysis (g/Kg DM)								
DM	897.2	906.8	912.2	915.0	930.0	932.1	938.9	912.4
OM	830.0	833.0	840.0	844.0	851.8	855.0	858.0	880.1
Ash	170.0	167.0	160.0	156.0	148.2	145.0	142.0	119.9
CP	67.5	120.0	129.7	131.0	142.2	149.5	154.0	140.0
CF	245.0	189.6	182.0	179.5	166.4	164.3	159.5	326.4
EE	54.0	57.0	58.4	59.0	59.3	59.5	59.5	25.5
NFE	463.5	466.4	469.9	474.5	483.9	481.7	485.0	388.2
Cell wall constituents (g/kg DM)								
NDF	525.4	505.8	482.9	464.1	449.4	446.5	443.0	447.0
ADF	388.0	380.7	372.4	348.1	328.1	323.5	315.6	360.0
ADL	121.0	113.0	104.5	98.9	78.5	78.0	77.8	71.3
Cellulose	267.0	267.7	267.9	249.2	249.6	245.5	237.8	288.7
Hemicellulose	137.4	125.1	110.5	116.0	121.3	123.0	127.4	87.0

UOTB, untreated olive trees by products; OTB1, olive trees by products treated with urea (1%/ kg DM); OTB2, olive trees by products treated with urea (2%/ kg DM); OTB3, olive trees by products treated with urea (3%/ kg DM); OTB4, olive trees by products treated with urea (4%/ kg DM); OTB5, olive trees by products treated with urea (5%/ kg DM); OTB6, olive trees by products treated with urea (6%/ kg DM), BH, berseem hay

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

Item	CFM	CBH	UOTB	OTB2	OTB4	OTB6
Chemical composition (%):						
DM	935.9	928.9	924.3	928.8	934.1	936.8
OM	920.6	908.5	893.4	896.4	900.0	901.8
Ash	79.4	91.6	106.6	103.6	100.0	98.2
CP	125.1	129.6	107.8	126.5	130.2	133.8
CF	113.5	177.4	153.0	134.1	129.4	127.3
EE	31.0	29.4	37.9	39.2	39.5	39.6
NFE	651.0	572.2	594.8	596.7	600.9	601.2
Cell wall constituents (%)						
NDF	306.5	348.7	372.2	359.4	349.4	347.5
ADF	175.6	230.9	239.3	234.6	221.4	217.6
ADL	68.5	69.3	84.3	79.3	71.5	71.3
Cellulose	107.1	161.6	155.1	155.3	149.9	146.3
Hemicellulose	130.9	117.7	132.9	124.8	128.0	129.9

CFM, concentrated feed mixture; CBH, group fed 70% concentrate feed mixture (CFM) + berseem hay ad lib; UOTB, group fed 70% concentrate feed mixture (CFM) + untreated olive trees by products ad lib; OTB2, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (2%/kg DM) ad lib; OTB4, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (4%/kg DM) ad lib; OTB6, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (6%/kg DM) ad lib.

The observed significant increase in the daily feed intake in all groups fed urea treated OTB may be due to the significant decrease in OTB fibrous content and the improvement in fiber digestibility. 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). The live body weight improvement for ewes fed urea treated OTB at dose above 4% is may be due to positive effect of urea treatment on ration’s nutritive values, digestibility and ewe’s daily feed intake. These Results are in agreement with that reported by Molina-Alcaide and Y´añez-Ruiz (2008), who found significant increase in OM digestibility due to urea treatment. In addition, Fegeros et al. (Fegeros et. al., 1995) found significant increase in the daily feed intake and apparent digestibility of CP, EE, NDF for fresh OTB treated with ammonia. In contrast (Delgado et al., 2000), observed a low apparent CP digestibility for olive leaf. This might be due to the differences in the method of preservation and the wood contents.

Table (3): Impact of urea treatment on ewe’s body weight, feed intake and nutrients digestibility

Item	Experimental groups					SE
	CBH	UOTB	OTB2	OTB4	OTB6	
No. of animals	4	4	4	4	4	
Initial body weight, Kg	31.68	30.40	31.31	31.99	32.30	0.473
Final body weight, Kg	33.71 ^b	32.30 ^c	33.52 ^b	35.00 ^a	35.32 ^a	0.241
Body weight change, Kg	2.03 ^b	1.90 ^b	2.21 ^b	3.01 ^a	3.02 ^a	0.107
Feed intake, g/h/d	1393.91 ^b	1359.65 ^c	1412.5 ^a	1387.1 ^b	1426.03 ^a	6.43
Digestibility, %						
DM	64.17 ^c	63.04 ^c	67.84 ^b	71.41 ^a	70.81 ^a	0.424
OM	65.05 ^c	63.97 ^d	68.13 ^b	72.03 ^a	71.79 ^a	0.2
EE	72.50 ^b	71.34 ^c	73.04 ^b	74.80 ^a	74.77 ^a	0.315
CP	64.32 ^c	64.07 ^c	65.95 ^b	69.73 ^a	69.69 ^a	0.386
CF	53.28 ^c	52.38 ^c	56.76 ^b	61.34 ^a	61.24 ^a	0.493
NFE	68.13 ^c	67.45 ^c	69.045 ^b	70.89 ^a	70.56 ^a	0.278
Fiber fractions, %						
NDF	59.03 ^c	56.86 ^d	62.64 ^b	64.92 ^a	64.13 ^a	0.31
ADF	47.27 ^c	45.78 ^d	51.81 ^b	55.42 ^a	54.66 ^a	0.431

*Means with different letter in the same row are significantly different at (p<0.05).

CBH, group fed 70% concentrate feed mixture (CFM) + berseem hay ad lib; UOTB, group fed 70% concentrate feed mixture (CFM) + untreated olive trees by products ad lib; OTB2, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (2%/kg DM) ad lib; OTB4, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (4%/kg DM) ad lib; OTB6, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (6%/kg DM) ad lib.

Rumen parameters: Ewes fed on UOTB or urea treated OTB had lower (p<0.05) ruminal pH value compared to the CBH group (Table 4). Total volatile fatty acids (TVFA’s) increased significantly in the rumen of groups fed urea treated OTB compared to those fed either UOTB or CBH. In contrast, group fed UOTB has the lowest ruminal concentration of TVFA’s. The reduction of the ruminal pH after feeding is may be attributed to the rate of VFA’s production in the rumen. During the fast fermentation process of nonstructural carbohydrates the rate of VFA production increase leading to a significant decrease in the rumen pH. The noticeable increase (p<0.05) in the total VFA’s concentration with decreasing ruminal pH in animals fed urea treated OTB is may be due to higher EE and NFE content of olive leaves than those of berseem hay. This is in agreement with that found by Reddy and Reddy (Reddy and Reddy, 1985); who stated that ruminal pH was inversely related to the concentration of TVFA’s produced in the rumen (p<0.05). In addition, all groups fed urea treated OTB had significantly high ruminal total N concentration compared with other groups. However, UOTB group had a slightly lower (p<0.05) ruminal total N value compared to CBH group. Moreover, the lowest value (p<0.05) for ruminal true protein (mg/100 ml) was recorded for the UOTB group followed by CBH then OTB2. However, OTB4 and OTB6 group had the

Table (4): Impact of experimental rations on ewe's ruminal parameters

Item	CBH	UOTB	OTB2	OTB4	OTB6	±SE
PH	6.77 ^a	6.35 ^b	6.25 ^{bc}	6.05 ^d	6.10 ^{cd}	0.05
TVFA's, mg/100 ml	8.89 ^c	8.68 ^d	9.99 ^b	10.30 ^a	10.14 ^{ab}	0.07
Total N, mg/100 ml	111.12 ^b	107.02 ^c	122.14 ^a	124.45 ^a	123.82 ^a	0.87
True protein N, mg/100 ml	41.07 ^c	37.90 ^d	44.53 ^b	51.15 ^a	50.60 ^a	0.82
NPN, mg/100 ml	70.05 ^{bc}	69.12 ^c	77.61 ^a	73.30 ^b	73.21 ^b	1.11
Ammonia N, mg/100 ml	33.52 ^d	32.42 ^e	35.61 ^c	40.41 ^b	41.97 ^a	0.26

*Means with different letter in the same row are significantly different at ($p < 0.05$).

CBH, group fed 70% concentrate feed mixture (CFM) + berseem hay ad lib; UOTB, group fed 70% concentrate feed mixture (CFM) + untreated olive trees by products ad lib; OTB2, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (2%/kg DM) ad lib; OTB4, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (4%/kg DM) ad lib; OTB6, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (6%/kg DM) ad lib.

Table (5): Impact of experimental rations on ruminal ciliate protozoa count ($\times 10^4$ cell /ml rumen liquor)

Item	Experimental group					±SE
	CBH	UOTB	OTB2	OTB4	OTB6	
<i>Entodinium spp.</i>	5.988 ^c	5.782 ^d	6.182 ^b	6.693 ^a	6.325 ^b	0.049
<i>Epidinium spp.</i>	0.236 ^b	0.234 ^b	0.247 ^a	0.251 ^a	0.245 ^a	0.002
<i>Diplodinium spp.</i>	0.205 ^{bc}	0.202 ^c	0.208 ^b	0.215 ^a	0.213 ^a	0.001
<i>Ophryoscolox spp.</i>	0.246 ^{bc}	0.243 ^c	0.249 ^{ab}	0.250 ^a	0.245 ^c	0.001
<i>Polyolastron spp.</i>	0.403 ^d	0.404 ^{cd}	0.417 ^b	0.440 ^a	0.412 ^{bc}	0.002
<i>Isotrichia spp.</i>	0.281 ^{ab}	0.280 ^{ab}	0.270 ^b	0.289 ^a	0.284 ^{ab}	0.004
<i>Dasytrachia spp.</i>	0.476 ^c	0.490 ^b	0.498 ^b	0.526 ^a	0.501 ^b	0.004
Total protozoa count	7.838 ^e	7.637 ^d	8.073 ^c	8.667 ^a	8.227 ^b	0.049

*Means with different letter in the same row are significantly different at ($p < 0.05$).

CBH, group fed 70% concentrate feed mixture (CFM) + berseem hay ad lib; UOTB, group fed 70% concentrate feed mixture (CFM) + untreated olive trees by products ad lib; OTB2, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (2%/kg DM) ad lib; OTB4, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (4%/kg DM) ad lib; OTB6, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (6%/kg DM) ad lib.

highest level of ruminal true protein, with no significant differences between them. There were no significant differences in ruminal NPN concentration between the CBH and UOTB groups. However, the OTB2 group had the highest value of ruminal NPN concentration followed by OTB4 and OTB6. Ammonia N levels were gradually increased ($p < 0.05$) by increasing level of treatment with urea. The observed increase ($p < 0.05$) in ruminal NPN and ammonia N concentration in ewe's groups fed the urea treated OTB might be a direct result to urea treatment. The effects of experimental rations on ruminal ciliate protozoa ($\times 10^4$ cell /ml rumen liquor) are presented in Table (5). In general, *Entodinium spp.* was the prevailing protozoa in the rumen with the highest concentration. Ewes of UOTB group had the lowest number of ruminal *Entodinium spp.* In contrast, ewes fed urea-treated OTB had higher concentration of *Entodinium spp.* than those fed UOTB and CBH rations. The highest ($p < 0.05$) concentration of *Entodinium spp.* in the rumen was observed for OTB4 group. There were no significant differences in *Epidinium spp.* concentration between UOTB and CBH group. However, ewes fed treated OTB showed higher count for *Epidinium spp.* without significant effect for the level of urea. The experimental ewe's groups were less differed in rumen concentration of *Diplodinium spp.*, *Ophryoscolox spp.*, and *Isotrichia spp.* However, the differences were significant. OTB4 group had the highest ruminal concentration of *Polyolastron spp.* In addition, the CBH group had the lowest concentration of *Dasytrachia spp.*, while the highest concentration was for OTB4 group (0.476 vs 0.526, respectively). For total protozoa count, UOTB group had the lowest number followed by CBH group, while,

OTB4 had the highest ruminal total protozoal count. In general, ruminal protozoal count of ewes fed untreated OTB seemed to be low; however, urea treatment significantly increased the total protozoal count. This may be due to the lack of soluble carbohydrate in untreated OTB. Results are in agreement with that found by Yáñez Ruiz et. al. (1995).

Blood parameters: Blood parameters often reflect the physiological and biochemical status of the animals. The lowest blood serum total protein level was observed in the group fed UOTB, however all groups fed urea treated OTB showed significant higher levels of blood total proteins (Table 6). The same trend was observed for serum albumin level. However, UOTB and OTB4 group had almost the same blood globulin concentrations. The obtained data for serum total protein concentration was within the normal range (5.9-7.8, g/dl), reported by (Doyle and Gordon, 2008). However, urea treatment increased the serum albumin level ($p < 0.05$) compared with UOTB and CBH groups. Blood albumin adheres chemically to various substances such as amino acids in the blood, playing a role in their transport (Rivera et. al., 2005). Oh et. al. (2008) concluded that, increasing albumin level could be explained by more absorption of true protein in the small intestine. Increasing the serum urea level could be attributed to excessive tissues protein catabolism associated with protein deficiency (Njidda et. al., 2013). Therefore, urea treatment could be useful in support diets with low protein content. Serum urea concentration was markedly lower ($p < 0.05$) in all groups fed urea treated OTB compared to UOTB or CBH group. However, increasing level of urea treatment had no significant effect on blood urea concentration. There were a slight differences ($p < 0.05$) among all groups in concentrations of aminotransferases (AST and ALT) and the highest observed value was for the UOTB group. Aminotransferases in blood act as a catalyst in connecting the metabolism of amino-acids and carbohydrates. Their activity in the blood can be a consequence of their increased activity in cells (primarily liver), but also a reflection of cell structure damage (Stojević et. al., 2005). Results show no adverse effect on blood serum aminotransferases levels due to urea treatment.

Table (6): Impact of experimental rations on ewe's blood composition

Item	Experimental group					±SE
	CBH	UOTB	OTB2	OTB4	OTB6	
Total proteins, g/dl	6.77 ^c	6.36 ^d	7.14 ^b	7.73 ^a	7.19 ^b	0.107
Albumin, g/dl	3.58 ^c	3.37 ^d	3.89 ^b	4.80 ^a	4.01 ^b	0.072
Globulin, g/dl	3.19 ^{ab}	2.99 ^{bc}	3.25 ^a	2.93 ^c	3.18 ^{ab}	0.096
A/G ratio	1.12 ^c	1.13 ^c	1.20 ^{bc}	1.64 ^a	1.26 ^b	0.038
Urea, mg/dl	38.42 ^a	37.10 ^a	28.58 ^b	27.93 ^b	27.21 ^b	1.072
AST, U/L	24.83 ^{ab}	25.66 ^a	23.39 ^b	23.18 ^b	23.45 ^b	0.635
ALT, U/L	5.69 ^{ab}	6.09 ^a	5.79 ^a	4.77 ^b	5.76 ^a	0.312

*Means with different letter in the same row are significantly different at ($p < 0.05$).

CBH, group fed 70% concentrate feed mixture (CFM) + berseem hay ad lib; UOTB, group fed 70% concentrate feed mixture (CFM) + untreated olive trees by products ad lib; OTB2, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (2%/kg DM) ad lib; OTB4, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (4%/kg DM) ad lib; OTB6, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (6%/kg DM) ad lib.

Milk yield and its composition: There were no significant differences in the daily milk yield, 4% fat corrected milk (FCM), and milk constituents between the groups fed UOTB and CBH. However, all groups fed urea treated OTB produced more ($p < 0.05$) daily milk and 4% FCM (Table 7). The highest daily milk yield (g/h/d) and 4% FCM (g/h/d) were observed in OTB4 group, being 1070.95 and 1026, respectively. In addition, the OTB4 group had the highest ($p < 0.05$) milk total solids, solids not fat (SNF), fat, total protein, lactose, and ash content (%). The improvement in milk production and its composition might be due to the improvement in chemical composition and nutrient digestibility of OTB after treatment with urea. The obtained results of daily milk yield and composition are in parallel with those obtained in the digestibility trial. The current results are in line with those of (Verma and Jackson, 1984) they reported that dairy animals of low milk production showed a significant response to urea treatment. Also, Mapato et. al. (2010) noted that cows fed on urea treated rice straw had higher production of 3.5% FCM than those fed on untreated rice straw.

Table (7): Impact of experimental rations on ewe's milk yield and its composition

Item	Experimental group					±SE
	CBH	UOTB	OTB2	OTB4	OTB6	
Milk yield g/h/d	935.47 ^d	931.66 ^d	991.19 ^c	1070.95 ^a	1043.80 ^b	5.875
4% FCM g/h/d	869.21 ^d	863.77 ^d	930.71 ^c	1026.20 ^a	987.16 ^b	5.508
Total solids	12.409 ^d	12.38 ^d	12.51 ^c	13.00 ^a	12.66 ^b	0.015
Fat	3.53 ^d	3.51 ^d	3.59 ^c	3.72 ^a	3.64 ^b	0.007
Solids not fat	8.87 ^c	8.86 ^c	8.91 ^c	9.28 ^a	9.01 ^b	0.016
Total protein	3.77 ^d	3.76 ^d	3.88 ^c	4.00 ^a	3.92 ^b	0.004
Lactose	4.19 ^d	4.17 ^d	4.43 ^c	4.57 ^a	4.49 ^b	0.013
Ash	0.979 ^c	0.977 ^c	1.013 ^b	1.021 ^a	1.016 ^{ab}	0.002

*Means with different letter in the same row are significantly different at ($p < 0.05$).

CBH, group fed 70% concentrate feed mixture (CFM) + berseem hay ad lib; UOTB, group fed 70% concentrate feed mixture (CFM) + untreated olive trees by products ad lib; OTB2, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (2%/kg DM) ad lib; OTB4, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (4%/kg DM) ad lib; OTB6, group fed 70% concentrate feed mixture (CFM) + olive trees by products treated with urea (6%/kg DM) ad lib.

CONCLUSION

Treatment of olive trees by-products with urea not only increase their content of crud protein but also increase their fiber degradability by increasing hemicellulose solubilization through breaking the ester linkage between lignin and hemicellulose, and causing partial break in hydrogen bonds of cellulose structure. This treatment could be beneficial for the animal breeders as it consider as one of the cheapest and effective process to improve the nutritive value of the agriculture by-products. In the current study, feeding of lactating ewes on OTB with 4% urea solution improved their milk production and milk composition with no deleterious effects on ewe's health.

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تأثير مخلفات أشجار الزيتون المعاملة باليوريا على هضم العناصر الغذائية ونتاج اللبن من نعاج البرقي

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هدف البحث هو دراسة اثر معاملة مخلفات اشجار الزيتون بمستويات متزايدة من اليوريا واستخدامها كبديل لدريس البرسيم في علائق النعاج البرقي الحلابه ودراسة أثر ذلك على معاملات الهضم ونتاج اللبن.

تتميز مخلفات أشجار الزيتون بمحتواها المرتفع من الألياف وإنخفاض محتواها من البروتين وهذا يحد من استخدامها في التغذية. وتهدف هذه الدراسة إلى دراسة تأثير إستبدال الدريس في عليقة النعاج البرقي الحلابه بمخلفات أشجار الزيتون المعاملة بمستويات متزايدة من اليوريا على معاملات الهضم للعناصر الغذائية ونتاج اللبن. وقد أجريت هذه الدراسة على عدد 35 نعجة بعد أسبوع من الولادة، تم تقسيمهم إلى 5 مجموعات (7 حيوانات في المجموعه) وتم تغذية الحيوانات لمدة 90 يوم على النحو التالي:

1. المجموعة الأولى (BHC): تم تغذيتها على 70% علف مركز و دريس البرسيم حتى الشبع.
 2. المجموعة الثانية (UOTB): تم تغذيتها على عليقة المجموعة الأولى مع استبدال دريس البرسيم بمخلفات شجر الزيتون غير المعاملة.
 3. المجموعة الثالثة (OTB2): تم تغذيتها على عليقة المجموعة الأولى مع استبدال دريس البرسيم بمخلفات شجر الزيتون المعاملة بمحلول 2% يوريا على أساس المادة الجافة
 4. المجموعة الرابعة (OTB4): تم تغذيتها على عليقة المجموعة الأولى مع استبدال دريس البرسيم بمخلفات شجر الزيتون المعاملة بمحلول 4% يوريا على أساس المادة الجافة
 5. المجموعة الخامسة (OTB6): تم تغذيتها على عليقة المجموعة الأولى مع استبدال دريس البرسيم بمخلفات شجر الزيتون المعاملة بمحلول 6% يوريا على أساس المادة الجافة . وكانت أهم النتائج المتحصل عليها ما يلي:
 1. المعاملة باليوريا أدت إلى تحسن المحتوى البروتيني وإنخفاض محتوى الألياف لمخلفات أشجار الزيتون.
 2. إرتفاع تركيزات الأمونيا والبروتين الكلى و الأحماض الدهنية الطيارة الكلية في سائل كرش النعاج المغذاه على مخلفات شجر الزيتون بالمقارنة بتلك التي تغذت على دريس البرسيم.
 3. النعاج التي تغذت على مخلفات شجر الزيتون المعامل باليوريا عند جميع مستويات المعاملة أعطت إنتاج أعلى معنويا من اللبن واللبن المعدل نسبة الدهن وكذلك نسب مكونات اللبن.
- ويستخلص من هذه النتائج أن معاملة مخلفات شجر الزيتون باليوريا عند مستوى 4% (على أساس المادة الجافة) اعطى افضل النتائج فى تحسين التركيب الكيماوى وهضم العناصر الغذائية ونتاج اللبن وتركيبه من النعاج الحلابه مزرعيا.