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EFFECT OF DIFFERENT LEVELS OF OLIVE PULP WITHOUT OR WITH KEMZYME SUPPLEMENTATION ON LAYING HENS PERFORMANCE

BY

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Abstract: *A(4 x 2) factorial experimental design was conducted to study the effect of different levels of olive pulp (OP) (0, 5, 10 and 15 %) without or with Kemzyme(KM) supplementation (0.0 and 1.0 g/kg) diet on the performance of laying hens. A total number of 120 hens (Hy-Line Brown-egg type) at 20 weeks of age were randomly assigned into eight experimental groups. The experiment continued up to 36 weeks of age.*

Results showed that hens fed diet containing OP up to 15% recorded the significantly (P<0.01) heaviest values in BW and BWC. However, egg production, egg weight and egg mass were not significantly affected by the different levels of OP in laying diet. Moreover, increasing OP up to 15% showed significant increase (P<0.01) in feed consumption. However, hens fed control or 5% OP diets showed the insignificantly improved in feed conversion, except during the period (28-32) weeks of age feed conversion was improved significantly (P<0.01). Digestibility coefficients of OM%, CF% and NFE % decreased significantly (P<0.01) as OP increased up to 10-15 %. However, increasing OP up to 10-15% recorded the highest significant (P<0.01) values of EE digestibility Inclusion of OP at different levels recorded higher significant (P<0.01) values of yolk wt. % and decreased feed cost and improved relative economical efficiency.

Egg production and egg mass were not significantly affected while, egg weight value was significantly (P<0.05) improved and yolk index was significantly (P<0.01) lowered by KM supplementation. Daily feed consumption decreased significantly (P<0.01) while feed conversion and digestibility coefficient of nutrients were not significantly affected by KM supplementation in laying diet. Moreover, KM supplementation caused increase in feed cost slightly and decrease relative economical efficiency.

Hens fed control and 15% OP diets without KM supplementation showed the significant (P<0.05) highest values of egg production during

(28-32) and (32-36) weeks of age, respectively. Any levels of OP with KM showed the highest insignificant values of egg weight during the whole experimental period. However, 15% OP without KM showed the significant ($P<0.05$) highest values in egg mass during the period (32-36) weeks of age. Feed consumption gradually increased insignificantly with the increasing OP levels without KM supplementation in diet during the total experimental period. Moreover, hens fed control or 5% OP diets without KM showed the best insignificant values of fed conversion during the total experimental period. Digestibility coefficient of OM % gradually decreased significantly ($P<0.05$) with the increasing of OP levels without KM supplementation.

It could be recommended to use OP at a level of 15 % without KM supplementation in laying hen diets. This level had no detrimental effects on laying performance and improved relative economical efficiency.

INTRODUCTION

It is well known that feed represents the major cost of poultry production that accounts for 60-65% of the total cost. Therefore, the waste residue of fruit and vegetable after harvesting and processing could be used as sources of protein and energy in feeding animal and poultry. These waste resources could be used in formulating poultry diets to minimize the feed cost and improve the economical efficiency of production in the form of meat and eggs.

Olive by-products can be incorporated in poultry diets as a cheap nutritional feedstuff to decrease the feed cost and alleviate the pollution problems. According to **M.A.L.R. (2004)**, there are 118,697 cultivated feddans of olive in Egypt. Olive cake and Olive pulp are by-products after oil extraction. These residues are estimated to be (30-40%) of the original quantity **(Nefzaoui, 1983).** This means that about 71653 tons of olive pulp and olive cake are produced per year in Egypt.

There is a little information concerning the use of olive pulp as a non-conventional feed ingredient in poultry diets. **Hashish and Abd El-Samee, (2002),** found that the use of olive cake up to 10% in laying diet did not affect performance. **Al-Shanti, (2003)**, demonstrated that, OP up to level 10% in broiler diets showed the highest significant weight gain values, economical efficiency and also improved feed conversion. **Abdel Fadeel, (2006),** showed significant improvement in egg number and egg mass when the turkey diet contained 10-15 % olive cake. In additions, feed intake was increased significantly with the increasing of olive cake at levels more than 15%.

The high content of complex carbohydrates non-starch polysaccharides (NSPs) is one of the factors limiting the used of olive pulp in poultry feeding as an energy source. The anti-nutrition activities of (NSPs) negatively affect poultry performance **(Fuller, *et al.*, 1995)**. Enzymatic digestion of (NSPs) improves poultry performance and allows more efficient use of nutrients **(Bedford and Morgan, 1996).**

Exogenous enzymes have been used commercially for a number of years to improve nutrient digestibility in feeds and to sustain the poultry performance through improving the endogenous enzyme. **Attia *et al*. (2001)** reported that supplementing chick diets containing OP with enzyme improved growth performance of broiler chicks.

The aim of the present work was to study the effect of different levels of olive pulp without or with kemzyme supplementation on body weight, egg production, digestibility coefficient of nutrients and the economical efficiency.

MATERIALS AND METHODS

This experiment was carried out at Ras- Sudr Research Station, South Sinai to study the effect of different levels of olive pulp without or with kemzyme supplementation on performance of laying hens. A total number of 120 hens (Hy-Line Brown-egg type) from 20 up to 36 weeks of age were randomly divided into eight experimental groups; 15 hens each. Each group was sub-divided into five replicates, (three hens each). A (4 X 2) factorial experimental design which contain four levels of olive pulp (0, 5, 10 and 15 %) and two levels of Kemzyme (0.0 and 1.0 g/kg diet) were conducted. Kemzyme was composed mainly of multi enzyme systems containing alpha-amylase; β-gluccanase, protease, lipase and cellulase. All the experimental diets were iso-nitrogenous and iso-caloric according to NRC (1994). Composition and calculated analysis of the experimental diets are presented in Table, 1. The hens were offered diets ad lib while water was available along time. All hens were kept under the same managerial and environmental conditions and artificial light source was used giving a total of 17 hours of light per day through the experimental periods.

Body weights were recorded at the beginning and monthly till the end of the experiment (36 week of age). Egg weight and egg number were recorded daily to calculate the egg production percentage. Egg mass (g/hen/day) was calculated by multiplying egg number by average egg weight. Feed consumption was recorded biweekly and feed conversion values (g feed /g eggs) were calculated as the amount of feed consumed divided by egg mass.

A total number of 48 eggs (6 eggs / each treatment group) were used to study the egg quality traits. These measurements involved yolk, albumen and shell weight percentage. However, egg shell thickness was measured in µm using a micrometer. Egg shape index was calculated according to **Romanoff and Romanoff, (1949)**, as an egg diameter divided by egg length. Yolk index calculated according to **Funk, *et al.*, (1958),** as yolk height divided by yolk diameter. Haugh unit was calculated according to **Eisen, *et al.* (1962)** using the calculation chart for rapid conversion of egg weight and albumen height.

At the end of the experiment, digestibility trials were carried out to calculate the digestibility coefficients of dietary nutrients. In this respect three hens from each treatment were used and housed individually in metabolic cages. Feed consumption and excreta output were recorded quantitatively daily. Chemical analysis of diets and excreta were conducted according to **A.O.A.C. (1990)**. Faecal nitrogen was determined following the procedure outlined by **Jakobsen *et al.* (1960)**. Urinary organic matter was calculated according to **Abou-Raya and Galal (1971)**.

The economic efficiency of the experimental diet was calculated based upon the differences in both selling revenue and feeding cost.

Data were statistically analyzed using the General Linear Model Procedure (**SAS, 1994).** Duncan's multiple range test was used to test the significance (P<0.05) of mean differences **(Duncan, 1955).**

RESULTS AND DISCUSSION

Productive performance:

Effect of olive pulp levels:-

Results in Table 2, showed that hens fed diet containing OP up to 15% gave the significant (P<0.01) heaviest values in body weight (BW) and body weight changes (BWC) for 16 weeks of age when compared with the control. These results confirmed by **Abd El Maksoud, (2001)** reported that chick fed diet containing OP up to 12% had significant better body weight and body weight gain. The same results obtained by **Attai, *et al.* (2001)** in broiler fed diet containing 16% OP up to 7 weeks.

Egg production, egg weight and egg mass were not significantly (P<0.05) affected by different levels of OP during interval periods and through the whole experimental period. These results are in agreement with those reported by **Hashish and Abd El-Samee, (2002)** who found no significant differences in egg production, egg weight and egg mass as a result of feeding laying hens on a diet containing OP up to 10%. However, egg number and egg mass were significantly higher than of the control group when turkey fed diet containing 10 and 15 % olive cake **(Abdel Fadeel, 2006).**

Effect of kemzyme supplementation:-

Data in Table 2, indicated that KM supplementation at a level of g /kg diet resulted in the insignificant heaviest BW and BWC of laying hens. These results are in accordance with those of **Soliman, (1997) and Hashish, *et al.* (1998)** who found that multi-enzyme supplementation had no significant effect on BW of laying hens. Moreover, **Shehata, (2000),** demonstrated that, supplemented diets by 0.5 or 1.0 g/kg KM in laying diet resulted in the insignificant heaviest BW and BWC.

The results indicated that hens fed a diet without KM showed insignificant improvement in egg production and egg mass during the different interval period and the whole experimental period. However, egg weight values were significantly (P<0.05) improved by KM preparation during the whole experimental period. These results agreed with the findings of **Abdel- Ghany, *et al.* (1997) and Shehata, (2000)** who demonstrated that KM preparation at a level 0.5 g/kg in laying diet had the insignificant better value of egg production during the whole experimental period, while egg weight was increased significantly as KM supplementation up to 1.0g/kg diet.

Interaction effect (OP X KM):-

Results in Table 3, indicated that interaction effect between OP and KM was not significant on BW and BWC. However, hens fed diet containing 15% OP with 1.0 g/kg diet KM showed the insignificant heaver values in their BW and BWC when compared to the other treatment groups. This may be due to KM containing multi-enzymes could exert a partial hydrolysis for some of anti-nutritional factors in OP (pentosans and cellulose) and hence, increase the availability of nutrients causing an improvement in BW and BWC of hens **(Abdel Fadeel, 2006)**.

In the early production periods (20-24 and 24-28 week of age) and total experimental period (20-36weeks) results showed insignificant effect due to interaction between P and KM. However, control diet without KM supplementation showed the higher value of egg production (90.18%) during the period (28-32) weeks of age, while 15% OP without KM diet showed the higher value (87.59%) during the period (32-36) weeks of age with significant (P<0.05) differences among groups. Supplementing specific diets with enzyme Mixtures may play a significant role in improving the efficiency of laying hens **(Makled, 1993)**. Although, the results were variable, it appears that enzyme supplementation may be beneficial during the peak of production when there is an extremely high demand for nutrients to maintain body weight and high egg production. **(Wyalt and Goodman, 1993)**.

No significant effects were found on egg weight as a result to interaction between OP and KM in laying diet during the interval and the whole experimental periods. However, hens fed diets containing any levels of OP with 1.0 g/kg diet KM showed the highest insignificantly values of egg weight during the whole experimental period.

Hens fed a diet containing 15% OP without KM showed the significant (P<0.05) highest values in egg mass during the period (32-36) week of age due to the increasing of egg production during the same period (Table 2).

Feed utilization:

Effect of olive pulp levels:-

Results in Table 4, indicated that increasing OP up to 15% in laying diet showed a significant increase (P<0.01) in feed consumption compared to the other treatment groups during the different periods (24-28, 28-32 and 20-36) weeks of age, while the decrease was insignificantly in feed consumption during the period from (20-24) weeks of age. These results agreed with that obtained by **Taklimi, *et al.* (1999)** who found that olive cake at 15 and 20 % in laying hen diets increased crude fiber content and resulted in higher feed intake. Also, **Attia, *et a*l. (2001)** and **Abd El-Maksoud**, **(2001)** in broiler chicks and **Abdel Fadeel, (2006)**, in laying turkey diet obtained a significantly increased feed consumption compared to control diet.

Hens fed control or 5% OP diets showed the insignificantly improvement in feed conversion, except during the period (28-32) weeks of age improvement was significant (P<0.01). Similarly **Taklimi, *et al.* (1999)** reported that feed conversion improved at 5% OP inclusion but the differences were not significant at higher levels (10, 15 and 20%) in laying diets. However, hens fed diet containing 10% OP in laying diet did not affect significantly feed conversion **(Hashish and Abdel- Samee, 2002)**.

Effect of kemzyme supplementation:

Hens fed a diet supplemented with KM showed a significant (P<0.01) decrease in daily feed consumption during interval and total experimental period, while during the period (28-32) week of age, feed consumption was insignificantly influenced by KM supplementation. These results were previously confirmed by **Conrod and Cary, (1993)** who found that feed intake of Leghorn strains chicks decreased with enzyme supplementation to growing diets at 18 weeks. Moreover, increasing the KM preparation in Mandara Pullets diets to (0.5 or 1.0 g/kg KM) decreased significantly the daily feed consumption. Enzyme preparation may improve the efficiency of feed utilization and thus decrease feed intake **(Shehata, 2000)**.

Feed conversion was not significantly affected by KM supplementation in laying diets during interval and total experimental periods. Similar results were obtained by **Brake, (1992)** who reported that KM supplementation in pullets diets showed insignificant effect on feed conversion during all the experimental period.

Interaction effect (OP X KM):-

Results in Table 5, the average feed consumption (g feed/ hen/ day) gradually increased insignificantly with the increasing of OP without KM supplementation in diet during the total experimental period (20-36) weeks of age. No significant effects were found on feed conversion as a result of interaction between (OP X KM) in laying diet during the interval and the whole experimental periods. However, hens fed control or 5% OP diets without KM supplementation showed that the best insignificant values of feed conversion as compared to the other treatment groups for the total experimental period.

Egg quality measurements:

Data in Table 6, indicated that 5, 10 and 15 % OP in laying hen diets recorded higher significant ($P<0.01$) values of yolk wt.%. While, control diet and 10 % OP recorded significant ($P<0.01$) higher values of yolk index. However, Albumen wt. %, shell wt. %, shape index%, shell thickness and Haugh unit were not significantly influenced by OP levels. However, KM supplementation showed that a significant ($P<0.01$) lower values of yolk index, while it did not affect significantly albumen wt. %, yolk wt. %, shell wt. %, shape index, shell thickness and Haugh unit. Interaction between OP levels and KM supplementation had no significant effects on all egg quality measurements. These results were in accordance with those of **Attia *et al* (1997)** who found that egg quality was not affected by the levels of KM supplementation in laying diets. **Hashish and Abd El-Samee (2002)** reported that laying diet containing 5 % or 10 % olive cake did not affect significantly shell percentage, shape index% and yolk index%.

Digestibility coefficient of nutrients:

Results in Table 7, indicated that, increasing OP up to 10-15 % levels in laying diet decreased significantly ($P<0.01$) the digestibility coefficient of OM%, CF% and NFE %. In this connection, increasing OP up to 10-15% levels in diets recorded the highest significant (P<0.01) values of EE% digestibility coefficient compared to control diet or 5 %OP level. Results obtained are similar to those obtained by **Hashish and Abd El-Samee (2002)** who found that laying diet containing 10 % olive cake improved significantly the value of ether extract digestibility coefficient, while it resulted in significant lower values of CF % and OM% digestibility coefficient as compared to control group.

The KM supplementation in laying diet did not cause any significant changes in the digestibility coefficient values of OM%, CP%, EE%, CF% and NFE%.

The results showed the lower significant value OM% and insignificantly decreased of CP%, CF% and NFE% digestibility coefficient with the increasing of OP levels up to 15% without or with KM in laying diet. However, hens fed a diet containing 10-15 % OP without or with KM recorded the highest insignificant values of EE% digestibility coefficient. **Al-Shanti (2003)** found that the digestibility coefficients of CP and CF significantly decreased when olive cake was incorporated at 15 or 20 % of the rabbit diets. The reduction in digestibility coefficients due to the increasing of olive cake was explained by **Sandford *et al.*, (1979)** who indicated that as the proportion of fiber rises, the dry matter digestibility falls. Moreover, fiber tends to protect the nutrients from digestive enzymes; hence lower digestibility coefficients of nutrients could occurred **(Zaki El-Din, 1996).**

Economical evaluation:

Data in Table 8, showed that inclusion of OP at different levels decreased feed cost and improved relative economical efficiency. On the other hand, KM supplementation increased fed cost slightly and decreased relative economical efficiency**.** Generally the incorporation of OP up to 15% levels in laying diet improved relative economical efficiency and reduce feed cost to achieve good return for hens. **Ahmed (1998)** found that inclusion of OP up to 8 % in broiler diets was economically effective. Moreover, Inclusion of olive cake at level 5% in laying diets improved relative economical efficiency, **(Hashish and Abd El-Samee, 2002). Abdel Fadeel, (2006)** reported that laying turkey fed a diet with 10 % olive cake followed by those fed 15 % olive cake gave the best relative economical efficiency.

Finally, it could be recommended to use OP at a level of 15 % without KM in laying hen diets. This level had no detrimental effects on body weight change, egg production, egg quality, feed utilization and digestibility of nutrients.

Table 1. Composition and calculated analysis of the experimental diets.

Ingredients	Olive pulp (OP) %			
	0	5	10	15
Yellow corn	64.10	59.20	53.90	48.50
Soy bean meal (44%)	16.00	16.00	16.00	16.00
Concentrate[1](48%)	10.00	10.00	10.00	10.00
Olive pulp meal[2]	--	5.00	10.00	15.00
Vegetable oil	--	0.50	1.10	1.60
Wheat bran	0.50	--	--	--
Limestone	7.80	7.70	7.40	7.30
Dicalcium Phosphate	1.00	1.00	1.00	1.00
Salt (NaCl)	0.30	0.30	0.30	0.30
Vit.&Min. premix[3]	0.30	0.30	0.30	0.30
Total	100	100	100	100
Calculated analysis:				
ME, Kcal/Kg	2753	2750	2750	2737
CP%	17.55	17.53	17.55	17.55
EE%	3.03	3.57	4.41	5.16
CF%	2.88	4.21	5.58	6.96
Ca%	3.57	3.57	3.50	3.50
Total P%	0.65	0.65	0.67	0.68
Lysine%	0.90	0.90	0.89	0.89
TSAA[4] %	0.69	0.68	0.67	0.66
Price LE /Kg، diet	0.961	0.948	0.939	0.923

1-Concentrate composition: 48% CP, 2422 ME Kcal /Kg, 2.5% CF, 2.4% EE, 3.23% Calcium, 1.76%Phosphorus,1.78% Methionine, 2.47%, Methionine & Cystine and 2.7% Lysine.

2- Chemical composition of olive pulp: 2463 kcal ME/kg, 9.67% CP, 9.04 % EE, 29.80 % CF, 0.80% Ca, 0.50 % P, 0.15 % lysine, 0.16 % methionine & cystine.

3- Vit. and Min. premix per Kg of diet: 12000 IU. Vit. A, 2000 IU. Vit. D3, 10 mg Vit. E, 4 mg riboflavin, 10mg pantothenic acid, 0.01 mg, Vit. B12, 500 mg choline, 2 mg Vit. K, 1 mg. Vit. B1, 1.5 mg Vit. B6 1،mg folic acid, 20 mg niacin, 0.05 mg biotin, 10 mg Cu, 1 mg I, 30 mg Fe, 55 mg Mn, 55 mg Zn and 0.1 mg Se.

4-- TSAA = total sulphur amino acid

Table 2: Means ± SE of body weight changes , egg production, egg weight and egg mass of laying hens as affected by olive pulp without or with kemzyme supplementation.

Items	Olive pulp levels				S	Kemzyme g/Kg diet		S
	0%	5%	10%	15%		0	1	
Initial body wt. (kg)	1.559± 0.021	1.567±0.036	1.544±0.031	1.551±0.025	NS	1.557±0.023	1.554±0.020	NS
Final body wt.(kg)	1.669^{b}±0.032	1.785^{ab} ±0.022	1.790^{a}±0.054	1.873^{a}±0.042	**	1.745±0.030	1.812±0.040	NS
Body wt. changes (g)	110.16^{b}±0.03	218.17^{ab}±0.03	246.00^{a}±0.05	322.50^{ab}±0.03	**	188.25±0.03	259.17±0.03	NS
Egg production %								
20-24 weeks	46.73±5.53	45.54±3.18	43.07±4.36	43.90±2.14	NS	47.01±3.14	41.52±2.03	NS
24-28 weeks	84.07±2.45	85.86±2.47	78.13±1.36	81.99±1.86	NS	83.11±1.42	81.91±1.85	NS
28-32 weeks	88.47±1.51	84.82±2.01	86.01±2.03	84.27±2.02	NS	85.82±1.47	85.96±1.26	NS
32-36 weeks	77.82±2.71	80.17±2.98	80.83±2.82	81.44±2.94	NS	82.11±1.87	78.03±1.89	NS
20-36weeks	74.26±1.74	74.09±1.74	72.01±1.08	72.91±1.83	NS	74.51±2.49	71.86±1.50	NS
Egg weight(g)								
20-24 weeks	49.81±0.45	50.73±0.55	51.37±0.49	49.52±1.80	NS	49.72±0.87	50.38±0.55	NS
24-28 weeks	56.05±0.19	56.19^{b} ±0.3	56.43±0.21	57.04±0.15	NS	56.42±0.22	56.44±0.15	NS
28-32weeks	56.83±1.17	57.83±0.26	58.33±0.23	58.67±0.40	NS	57.55±0.62	58.27±0.24	NS
32-36weeks	58.86±0.44	58.46±0.17	58.94±0.21	59.08±0.41	NS	58.60±0.20	59.0.7±0.24	NS
20-36weeks	55.39±0.41	55.80±0.17	56.27±0.33	56.08±0.55	NS	55.57^{b}±0.32	56.04^{a}±0.14	*
Egg mass (g/d)								
20-24 weeks	23.28±2.88	23.08±1.53	21.06±2.15	20.75±1.19	NS	22.95±1.68	21.14±0.97	NS
24-28 weeks	47.14±1.47	48.26±1.50	44.16±0.70	46.77±1.01	NS	46.72±0.81	46.24±1.06	NS
28-32weeks	50.22±1.14	49.06±1.22	50.18±1.23	49.36±1.25	NS	49.33±0.89	50.09±0.75	NS
32-36weeks	45.77±1.52	46.84±1.74	47.66±1.74	48.08±1.66	NS	48.12±1.14	46.08±0.89	NS
20-36weeks	41.60±0.64	41.81±0.95	40.76±0.56	41.24±0.93	NS	41.78±0.49	40.88±0.56	NS

^{a,b} means with different superscripts in the same row are significantly different ($p<0.05$)
S= significance NS= non significance *= ($p<0.05$) **= ($p<0.01$)

Table 3. Means ± SE of body weight changes, egg production, egg weight and egg mass of laying hens as affected by interaction between olive pulp without or with kemzyme supplementation .

Items	0% (OP)		5% (OP)		10% (OP)		15% (OP)		S
Kemzyme g/kg	0	1	0	1	0	1	0	1	
Initial BW.(kg)	1.573± 0.031	1.546± 0.055	1.553± 0.051	1.580± 0.052	1.528± 0.043	1.559± 0.040	1.872± 0.040	1.529± 0.043	NS
Final BW(kg)	1.674±0.033	1.664±0.072	1.759±0.034	1.810±0.033	1.705±0.041	1.875±0.062	1.843±0.062	1.903±0.042	NS
BWC (g)	101.67±0.05	117.67±0.05	206.67±0.07	229.67±0.04	176.67±0.09	315.30±0.03	271.00±0.03	374.00±0.01	NS
Egg production %									
20-24 weeks	50.00±10.65	43.45±5.29	46.43±4.49	44.66±5.43	46.43±7.79	35.71±2.36	45.53±4.13	42.26±1.81	NS
24-28 weeks	84.82±2.36	83.33±4.89	87.50±1.85	84.22±4.90	78.27±2.14	77.98±2.14	81.85±2.64	82.14±3.22	NS
28-32 weeks	90.18^{a}±0.0	86.69^{abc}±2.88	81.55^{bc}±2.65	88.09^{abc}±1.58	83.63^{abc}±3.62	88.39^{ab}±1.36	87.89^{abc}±2.12	80.65^{c}±1.66	*
32-36 weeks	82.42^{abc}±3.84	73.22^{c}±0.89	81.77^{abc}±5.17	78.57^{abc}±3.89	76.65^{bc}±0.14	85.03^{ab}±4.70	87.59^{a}±2.30	75.30^{bc}±0.59	*
20-36 weeks	76.86±2.49	71.67±1.50	74.31±1.53	73.88±3.58	71.24±1.87	71.78±1.48	75.72±2.71	70.09±1.23	NS
Egg weight (g)									
20-24weeks	49.23±0.63	50.38±0.55	50.77±1.14	50.69±0.44	51.11±0.38	51.63±0.94	47.76±3.38	51.27±1.33	NS
24-28 weeks	55.77±2.26	56.34±0.17	56.39±0.63	56.00±0.14	56.56±0.37	56.29±0.26	56.94±0.25	57.14±0.19	NS
28-32 weeks	55.52±2.26	58.14±0.22	57.81±0.31	57.86±0.49	57.98±0.06	58.68±0.37	58.90±0.33	58.42±081	NS
32-36 weeks	58.09±0.51	59.64±0.35	58.63±0.17	58.28±0.28	58.85±0.36	59.03±0.28	58.83±0.55	59.33±0.67	NS
20-36 weeks	54.66±0.51	56.13±0.17	55.90±0.33	55.71±0.14	56.13±0.54	56.41±0.22	55.61±1.08	56.54±0.36	NS
Egg mass (g/d)									
20-24 weeks	24.73±5.55	21.84±2.45	23.49±1.88	22.65±2.83	23.68±3.86	18.43±1.15	19.87±2.49	21.62±0.42	NS
24-28 weeks	47.31±1.54	46.96±2.90	49.36±1.57	47.17±2.75	44.41±1.05	43.89±1.12	46.59±1.46	46.94±1.98	Ns
28-32 weeks	50.06±2.00	50.39±1.54	47.16±1.58	50.97±1.17	48.51±2.15	51.84±0.52	51.57±0.82	47.14±1.48	NS
32-36 weeks	47.92^{ab}±2.04	43.64^{b}±0.28	47.94^{ab}±3.13	45.75^{ab}±2.05	45.11^{ab}±0.22	50.20^{ab}±0.94	51.51^{a}±1.31	44.66^{b}±0.61	*
20-36 weeks	42.50±0.76	40.71±0.84	41.99±0.62	41.63±2.03	40.42±0.82	41.09±0.80	42.39±1.47	40.09±0.92	NS

^{a,b} means with different superscripts in the same row are significantly different ($p<0.05$)
S= significance NS= non significance *= ($p<0.05$) **= ($p<0.01$)

Table 4. Means ±SE of feed utilization of laying hens as affected by olive pulp without or with kemzyme supplementation**.**

Items	Olive pulp levels				S	Kemzyme g/Kg diet		S
	0%	5%	10%	15%		0	1	
Feed consumption (g/day)								
20-24 weeks	95.99 ±1.23	95.01±1.46	92.04±2.01	93.82±1.22	NS	96.25^{a}±0.83	92.18^{b}±1.02	**
24-28 weeks	108.15^{b}±1.83	113.89^{a}±0.99	106.51^{c}±1.11	$109.30b^{c}$±0.85	**	111.07^{a}±1.03	107.86^{b}±0.68	**
28-32 weeks	102.71^{c}±0.76	110.09^{b}±1.36	115.77^{b}±0.35	117.34^{a}±1.75	**	111.43±2.32	111.57±1.35	Ns
32-36 weeks	111.07^{b}±1.28	110.56^{b}±1.28	113.18^{a}±1.14	113.38^{a}±1.57	**	113.88^{a}±0.69	110.92^{b}±0.89	**
20-36 weeks	104.48^{c}±0.91	107.38^{b}±0.50	106.87^{b}±0.53	108.46^{a}±0.57	**	108.16^{a}±0.41	105.63^{b}±0.56	**
Feed conversion g feed/g egg								
20-24 weeks	4.12±0.49	4.11±0.21	4.37±0.49	4.52±0.12	NS	4.20±0.27	4.36±0.25	NS
24-28 weeks	2.30±0.07	2.36±0.08	2.42±0.05	2.34±0.06	NS	2.37±0.03	2.33±0.06	NS
28-32 weeks	2.05^{b}±0.04	2.25^{a}±0.04	2.31^{a}±0.06	2.38^{a}±0.04	**	2.26±0.05	2.24±0.04	NS
32-36 weeks	2.43±0.06	2.36±0.08	2.37±0.08	2.36±0.05	NS	2.38±0.05	2.40±0.05	NS
20-36 weeks	2.73±0.10	2.77±0.10	2.87±0.09	2.90±0.10	NS	2.80±0.06	2.83±0.06	NS

^{a,b} means with different superscripts in the same row are significantly different (p<0.05)
*= (p<0.05) **= (p<0.01) NS= non significance S= significance

Table 5. Means ± SE of feed utilization of laying hens as affected by interaction between olive pulp without or with kemzyme supplementation.

Items	0% (OP)		5% (OP)		10% (OP)		15% (OP)		S
Kemzyme	0	1	0	1	0	1	0	1	
Feed consumption (g/day)									
20-24	98.21±0..52	93.76±1.54	97.97±1.38	92.05±0.09	95.55±2.14	88.53±1.80	93.25±0.34	94.38±2.64	NS
24-28	112.11^{b}±0.68	104.20^{d}±0.83	116.06^{a}±0.36	111.73^{b}±0.29	108.57^{c}±0.21	104.45^{d}±1.35	107.53^{c}±0.68	111.07^{b}±0.24	**
28-32	101.49^{g}±1.07	104.09^{f}±0.08	107.14^{e}±0.68	113.04^{d}±0.29	116.07^{b}±0.68	115.48^{bc}±0.21	121.02^{a}±0.97	113.66^{cd}±0.89	**
32-36	113.99^{bc}±0.09	108.22^{e}±0.18	113.39^{bc}±0.36	107.74^{e}±0.30	111.53^{dc}±1.51	114.83^{ab}±1.24	116.67^{a}±1.19	110.09^{dc}±0.27	**
20-36	106.44±0.28	102.57±0.57	108.64±0.86	106.14±0.13	107.93±0.46	105.82±0.45	109.62±0.08	107.15±0.53	NS
Feed conversion g feed/g egg									
20-24	3.97±0.96	4.29±0.53	4.21±028	4.06±0.56	4.04±0.76	4.80±0.64	4.69±0.18	4.37±0.20	NS
24-28	2.37±0.07	2.23±0.12	2.36±0.07	2.37±0.17	2.45±0.05	2.38±0.88	2.32±0.07	2.37±0.10	NS
28-32	2.03±0.07	2.07±0.06	2.27±0.08	2.22±0.06	2.40±0.09	2.23±0.03	2.35±0.05	2.42±0.06	NS
32-36	2.39±0.12	2.48±0.02	2.38±0.14	2.36±0.11	2.47±0.04	2.29±0.15	2.27±0.08	2.47±0.03	NS
20-36	2.69±0.21	2.77±0.10	2.81±0.09	2.75±0.21	2.84±0.18	2.92±0.11	2.90±0.09	2.91±0.07	NS

^{a,b} means with different superscripts in the same row are significantly different ($p<0.05$)
S= significance NS= non significance *= ($p<0.05$) **= ($p<0.01$)

Table 6. Means ±SE of egg quality measurements of laying hens as affected by olive pulp without or with kemzyme supplementation and their interaction.

Parameters		Egg weight ,g	Albumen wt.%	Yolk wt.%	Shell wt.%	Shape index	Yolk index	Shell thickness (μm)	Haugh unit
Olive pulp%	Kemzyme g/kg diet								
0.0		57.33^{ab}±1.16	66.80±0.74	21.53^{b}±0.65	10.77±0.51	76.05±0.76	48.32^{a}±0.81	343.66±8.34	98.26±1.61
5		54.67^{b}±1.56	65.17±.71	24.37^{a}±0.57	10.46±0.55	76.42±0.82	45.21^{b}±1.15	350.08±8.94	96.97±1.43
10		59.00^{a}±1.45	59.80±4.89	24.07^{a}±0.82	11.11±0.39	75.45±0.49	47.45^{ab}±0.86	353.75±8.58	96.78±1.81
15		60.83^{a}±0.97	65.59±0.32	23.61±^{a}0.29	10.99±0.27	76.28±0.69	45.53^{b}±0.51	335.50±6.50	96.82±1.74
	0.0	56.75±1.01	65.50±2.51	23.38±0.57	10.88±0.31	76.57±0.41	47.64^{a}±0.49	346.25±4.84	98.18±1.03
	1	59.17±0.96	65.50±0.44	23.41±0.38	10.79±0.31	75.53±0.54	445.61^{b}±0.73	345.25±6.64	96.23±1.23
0.0	0.0	57.67±1.89	66.91±0.97	20.86±0.88	11.58±0.70	76.67±1.00	49.82±0.76	344.17±14.55	100.30±2.30
	1	57.00±1.53	66.68±1.19	22.19±.0.95	9.96±0.63	75.43±1.18	46.81±1.19	343.17±9.70	96.22±2.09
5	0.0	51.67±0.57	65.78±1.05	23.84±0.99	10.38±0.79	77.45±0.84	46.61±0.49	342.83±3.51	97.22±2.49
	1	57.67±2.60	64.57±0.97	24.90±0.58	10.53±0.82	75.39±1.34	43.81±2.19	357.33±17.84	96.72±1.66
10	0.0	57.00±2.18	53.98±0.55	25.13±1.46	10.89±0.64	75.39±0.60	47.89±1.35	358.33±5.29	97.26±1.35
	1	61.00±1.69	65.63±0.79	23.01±0.63	11.34±0.48	75.51±0.85	47.00±1.18	349.17±16.95	95.80±3.44
15	0.0	60.67±1.33	66.04±0.46	23.71±0.36	10.67±0.21	76.76±0.74	46.25±0.38	339.67±11.75	97.47±2.22
	1	61.00±1.52	65.14±0.38	23.51±0.47	11.33±0.49	75.80±1.22	44.83±0.89	331.33±6.43	96.18±2.88
S T		**	NS	**	NS	NS	**	NS	NS
S E		NS	NS	NS	NS	NS	*	NS	NS
S T*E		NS	NS	NS	NS	NS	NS	NS	NS

a,b means with different superscripts within each class in the same column are significantly different (p<0.05)

T= treatments (olive pulp) E= Kemzyme T*E= interaction S= significance N.S= non significance *= (p<0.05) **= (p<0.01)

Table 7. Means ±SE of digestibility coefficients of nutrients as affected by olive pulp without or with Kemzyme supplementation and their interaction of laying hens.

Parameters		OM%	CP%	EE%	CF%	NFE%
Olive pulp%	Kemzyme g/kg diet					
0.0		76.15±1.35 ^{a}	90.40±0.82	85.25±1.75 ^{b}	21.28±0.67 ^{a}	76.29±1.55 ^{a}
5		73.63±104 ^{a}	90.00±1.86	83.95±0.46 ^{b}	22.34±0.72 ^{a}	73.06±0.67 ^{ab}
10		72.61±0.67 ^{ab}	90.63±0.35	90.15±0.95 ^{a}	19.38±0.46 ^{b}	72.93±0.77 ^{ab}
15		69.45±1.20 ^{b}	90.28±0.89	90.55±0.96 ^{a}	18.88±0.26 ^{b}	69.81±1.90 ^{b}
	0.0	72.99±1.16	90.18±0.62	88.23±1.18	20.69±0.56	73.15±1.85
	1	72.93±0.90	90.47±0.30	86.72±1.09	20.22±0.57	72.89±0.97
0.0	0.0	76.11±2.84 ^{a}	90.35±1.66	86.48±2.84	22.20±0.40	77.16±4.59
	1	76.19±1.41 ^{a}	90.46±0.79	84.03±2.42	20.36±1.12	75.41±1.21
5	0.0	73.75±1.34 ^{ab}	88.85±1.01	84.27±0.29	22.34±1.25	72.26±0.74
	1	73.51±1.91 ^{ab}	91.15±0.06	83.63±0.94	22.33±0.99	73.86±1.03
10	0.0	72.57±1.30 ^{ab}	90.87±0.30	91.77±0.04	19.36±0.38	72.90±0.89
	1	72.66±0.75 ^{ab}	90.38±0.70	88.53±1.31	19.32±0.56	72.96±1.46
15	0.0	69.53±2.67 ^{b}	90.64±1.86	90.39±2.12	18.88±0.35	70.29±3.45
	1	69.37±0.34 ^{b}	89.91±0.66	90.70±0.26	18.87±0.46	69.34±2.43
S T		**	NS	**	**	*
S E		NS	NS	NS	NS	NS
S T*E		*	NS	NS	NS	NS

[a,b] means with different superscripts within each class in the same column are significantly different ($p<0.05$)
N= non significance *= ($p<0.05$) **= ($p<0.01$) T= treatments (olive pulp) E= Kemzyme T*E= interaction S= significance

Table 8. Economical evaluation of laying hens as affected by olive pulp levels without or with kemzyme supplementation and their interaction.

Parameters		Feed intake Kg/hen	Price of 1.0Kg diet LE .	Total feed cost,LE.	Egg mass, Kg/hen	Total revenue	Net revenue	Economical efficiency	Relative economical efficiency
Olive pulp%	Kemzyme g/kg diet								
0.0		11.704	0.961	11.25	4.660	20.64	9.39	0.835	100.00
5		11.968	0.948	11.35	4.683	20.72	9.40	0.828	99.16
10		11.930	0.939	11.20	4.563	20.21	9.01	0.804	96.29
15		12.147	0.923	11.21	4.619	20.46	9.25	0.825	98.80
	0.0	12.071	0.961	11.600	4.683	20.75	9.15	0.789	94.49
	1	11.804	0.986	11.64	4.579	20.28	8.64	0.758	90.78
0.0	0.0	11.920	0.961	11.46	4.760	21.09	9.63	0.840	100.80
	1	11.487	0.986	11.33	4.559	20.20	8.87	0.783	93.77
5	0.0	12.047	0.948	11.42	4.702	20.83	9.41	0.824	98.68
	1	11.889	0.973	11.57	4.663	20.66	9.09	0.786	94.13
10	0.0	12.041	0.939	11.31	4.524	20.04	8.73	0.772	92.46
	1	11.810	0.964	11.38	4.602	20.38	8.85	0.778	93.17
15	0.0	12.277	0.923	11.33	4.747	21.03	9.70	0.856	102.51
	1	12.017	0.948	11.39	4.490	19.89	8.50	0.776	89.34

Price of 1.0Kg Egg was 4.43 LE at the time of the experimental period.
Price of 1.0Kg Kemzyme was 25 LE

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الملخص العربي

تأثير المستويات المختلفة من تفل الزيتون بدون أو مع الأمداد بالكيمزيم على معدل أداء الدجاج البياض

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قسم تغذية الحيوان والدواجن-مركز بحوث الصحراء –المطرية القاهرة

أجريت هذه الدراسة بمحطة بحوث رأس سدر لدراسة تأثير المستويات المختلفة من تفل الزيتون (0-5-10-15%) بدون أو مع الأمداد بالكيمزيم (0.0 أو 1جم/كجم عليقه) على أداء الدجاج البياض. أستخدم عدد 120 دجاجة هاى لاين أحمر عمر 20 أسبوع وزعت عشوائيا على 8 مجاميع تجريبية(2×4) تصميم فاكتوريل حتى عمر 36 أسبوع.

أشارت النتائج إلى أن مستوى 15% تفل زيتون في عليقه الدجاج البياض أعطى أعلى زيادة معنوية لوزن الجسم النهائي ومعدل التغير في وزن الجسم مع زيادة معنوية للاستهلاك العليقة. بينما لم يتأثر معنويا كلا من إنتاج البيض، ووزن البيض،وكتلة وزن البيض بالمستويات المختلفة لتفل الزيتون.أدت عليقه الكنترول و5% تفل زيتون إلى تحسن غير معنوي في معامل التحويل الغذائي.قلت قيم معامل هضم المادة العضوية والألياف الخام والمستخلص الخالي من النتروجين تدرجيا بصورة معنوية بزيادة مستوى تفل الزيتون حتى مستوى 10-15% بينما زاد معنويا معامل

هضم الدهن. كما أن زيادة مستويات تفل الزيتون في علائق الدجاج البياض تزيد معنويا قيم وزن الصفار وتقلل تكاليف العليقة وتزيد الكفاءة الاقتصادية النسبية.

إنتاج البيض وكتلة وزن البيض لم تتأثر معنويا بينما وزن البيض تأثر معنويا ودليل الصفار قل معنويا بالإمداد بالكيمزيم.استهلاك العليقة اليومي قل معنويا بينما لم يتأثر معنويا كلا من معامل التحويل الغذائي ومعامل هضم المواد الغذائية بالإمداد بالكيمزيم.إن الإمداد بالكيمزيم يسبب زيادة طفيفة لتكاليف العليقة ويقلل الكفاءة الاقتصادية النسبية.

الدجاج المغذى على عليقه الكنترول أو15% تفل زيتون بدون الإمداد بالكيمزيم أعطى أعلى قيم معنوية لإنتاج البيض خلال الفترة (28-32)و(32-36) أسبوع من العمر.كما أن إي مستوى من تفل الزيتون مع الإمداد بالكيمزيم أظهر أحسن قيم غير معنوية لوزن البيض خلال الفترة الكلية للتجربة.إن مستوى 15% تفل زيتون بدون الإمداد بالكيمزيم أظهر أعلى قيم معنوية لكتلة وزن البيض خلال الفترة (32-36) أسبوع من العمر.الغذاء المستهلك يزداد زيادة غير معنوية مع زيادة مستويات تفل الزيتون بدون الإمداد بالكيمزيم في العليقة خلال الفترة الكلية للدراسة. تحسن معنويا قيم معامل التحويل الغذائي للدجاج المغذى على عليقه الكنترول أو 5% تفل زيتون بدون الإمداد بالكيمزيم خلال الفترة الكلية للدراسة. كما أن معامل هضم المادة العضوية يقل معنويا مع زيادة مستوى تفل الزيتون بدون الكيمزيم.

توضح نتائج هذه الدراسة: أنة يوصى باستخدام تفل الزيتون حتى مستوى 15% بدون الإمداد بالكيمزيم في علائق الدجاج البياض. وأن هذا المستوى لم يؤثر سلبيا على معدل أداء الدجاج البياض وحسن الكفاءة الاقتصادية النسبية.