Effect of Adding Dietary Date Pits and β-mannanase on Performance of Local Saudi Hens

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ABSTRACT

Date pits meal, a by-product obtained from date processing, can be used as a feed ingredient in poultry diets. To determine the effects of adding dietary date pits meal with/without β- mannanase on productive performance and egg quality parameters, in iso-energetic and iso-nitrogenous diets in a 3 × 3 factorial experimental design with three levels of date pits meal (0, 5, and 10%) and three levels (0 or 330, 660 g/ton feed) of β- mannanase were fed to a total of 162 local Saudi hens (black feather line, $Hajar_1$) randomly distributed in 54 cages.. Each dietary treatment was fed to nine cages (3 hens/cage) for 8 weeks (25 to 33 weeks of age). The results showed that hen fed diets containing 0 or 5% date pits meal without β-mannanase had better feed conversion ratio, higher egg mass, egg production, and egg specific gravity than those fed diets containing 10% date pits meal. In contrast, hens fed diets containing 10 % date pits meal without β-mannanase showed higher Haugh unit than those fed diets containing 0% date pits meal without β-mannanase. Furthermore, hens fed diets containing 0 % date pits meal with 660 g β-mannanase produced lower egg mass and egg production than those fed diets containing 0% date pits meal with 0 g β-mannanase. Meanwhile, hens fed diets containing 0 % date pits meal with 330 g β-mannanase had higher eggshell thickness than those fed diets containing 5% date pits meal with 330 g β-mannanase or those fed diets containing 10% date pits meal with 330 or 660 g β-mannanase. It is concluded that date pits meal could be added to 25 to 33 weeks old local Saudi hen diets up to 5% without β-mannanase with no negative effects on productive performance and egg quality parameters.

Key Words: β-mannanase, Date pits meal, Egg quality, Local Saudi hens, Productive performance

INTRODUCTION

The shortage of conventional poultry feed ingredients is a major problem facing poultry industry development in many tropical and sub-tropical countries. Therefore, poultry nutritionists have been searching suitable poultry unconventional local feed ingredients to replace some expensive common feed ingredients in order to reduce poultry feed cost (Al-Harthi *et al*., 2009).

Date palm (*Phoenix dactyliferous*, L.) is a drought-tolerant woody plant cultivated in tropical and subtropical countries for human consumption (Al-Homidan 2003; Aldhaheri *et al*., 2004). Egypt, Saudi Arabia, Iran, Iraq, United Arab Emirates, Algeria, and Pakistan produce more than 70-90% of the world date production (Al-Homidan 2003; El-Habba and Al-Mulhim, 2013). Saudi Arabia alone grows more than 25 million date palm tree producing about one million ton of date annually. This number is expected to increase gradually in the coming years.

Date pit meal is a byproduct obtained after oil extraction and manufacturing of dates that represents about 10% of whole date weight. Date pit meal is inedible for human consumption. It contains a small amount of crude protein (2.30 -8.20%) and nitrogen-free extract (55.0 – 75.4%). These values are somewhat similar to those of corn that contains 9.89% and 81.86%; or barley that contains 12.1% and 76.6% of these two constituents, respectively (Kamel *et al*., 1981; Al-Homidan 2003; Aldhaheri *et al*., 2004).

Each kilogram of date pits meal contains about 89.70 - 97.5% dry matter, 1,350 - 2,000 kcal metabolizable energy, 56.0 - 68.9% total carbohydrates, 3.8 - 5.8% total sugars, 2.30 -8.20% crude protein, 1.60 – 13.50% either extract (crude fat), 13.0 – 80.20% crude fiber, 0.90 - 3.95% crude ash, 29.56 – 75.4% nitrogen free extract, 38.5 – 73.1% neutral detergent fiber, 17.2 – 51.0% acid detergent fiber, 0.08% methionine, 0.17 % cysteine, 0.25% methionine and cysteine, 0.19– 0.30% lysine, 0.021 - 0.91% calcium, 0.088 - 0.096% total phosphorus, 0.03% available phosphorus, 0.043 - 0.0087% phytate phosphorus, and 0.155 - 0.179% physic acid (Salem and Hegazi, 1971; Kamel *et al*., 1981; Attalla and Harraz, 1996; Hamada *et al*., 2002, Aldhaheri *et al*., 2004; Najib and Al-Yousef, 2012; Al Saffar *et al*., 2013; Kashani *et al*., 2013; Ghasemi *et al*., 2014). Najib and Al-Yousef, (2012) reported that the date pits meal from different geographical area differed in their nutritional and chemical contents.

In the last few years, several studies reported that date pits meal can be partially used as an alternative feed ingredient for poultry nutrition to overcome traditional poultry feedstuffs shortage, reduce feed costs, and reduce pollution problems (Sawaya *et al.*, 1984; Hussein *et al*., 1998; Al-Homidan 2003; Aldhaheri *et al*., 2004; Al- Harthi, 2006; Najib and Al-Yousef, 2012; Ghasemi *et al*. 2014).

Several studies reported that high crude fiber content forms a limiting factor for using date pits meal in poultry diets (Jackson *et al*., 1999; Hamada *et al*., 2002; Najib and Al-Yousef, 2012). Date pits meal contained about 71.8% mannose, 26.6% galactose, and 9.8-22.3% β-galactomannan polysaccharides (Magdel-Din Hussein *et al*., 1998; Ishrud *et al*., 2001; Hamada *et al*., 2002). Date pit meal crude fiber (non-starch β-galactomannan polysaccharides) is recognized as a poultry hard to digest anti-nutritional factor difficult to digests that requires breaking down by specific exogenous enzymes to improve its nutritional value (Almirall *et al*., 1995; Cowieson and Ravindran 2008). The beneficial effect of enzymatic degradation of *β*-galactomannan polysaccharide by adding the *β*-mannanase into poultry diets has been reported in layer hens (Lee *et al*., 2003; Daskiran *et al*., 2004; Wu *et al*., 2005; Kong *et al*., 2011; Cho and Kim, 2013).

Few research was conducted to investigate the effect of adding different dietary levels of date pits meal with/without β-mannanase on the productive performance and egg quality parameters of local Saudi hens. Therefore, this study was conducted to evaluate the effects of adding three levels (0, 5, and 10%) of date pits meal supplemented with three levels (0, 330, and 660g/ton feed) of β-mannanase on the productive performance and egg quality parameters of local Saudi hens from 25 to 33 weeks of age.

MATERIALS AND METHODS

The β-mannanase was obtained from Elmo Hemi cell®. Date pits used in this study was purchased from local market in Al-Hassa, Saudi Arabia.

Preparation of the Ground Date Pit Meal

Date pits was ground in a heavy-duty high rotation hammer mill to pass through 1.2 mm mesh sieve screen suitable for poultry nutrition and chemical analysis. Proximate chemical analysis including the moisture, crude fat, crude protein, crude ash, and crude fiber of date pits meal was determined using standard analytical procedures according to AOAC (2004**.** Date pits meal used in the present study contained about 97.45% dry matter. Its main constituents' percentages are shown in Table 1. The metabolizable energy content of date pits meal used was calculated according to the equation developed by Carpenter and Clegg (1956).

Table (1): Chemical and nutritional analysis of date pit meal

Moisture (%)	2.55
Energy (Kcal ME/kg feed)	2699.50
Crude protein (%)	6.40
Crude fat (%)	5.58
Crude fiber (%)	30.40
Nitrogen free extract (sugar + Starch) (%)	46.08
Crude ash (%)	1.15

Experimental Design

The current study was carried out during the period from May to June, 2015 at the Agriculture Research and Training Station of King Faisal University, Al Hasa, Kingdom of Saudi Arabia.

A total of 162 local Saudi hens (black

feather line, Hajar$_1$, described by Ahmed and Alabbad, 2013) were used in an 8-week period trial from 25 to 33 weeks of age. Hens were weighed and randomly distributed in battery group cages (50 × 30 × 30 cm^3) separated by a 1.0 m aisle, equipped with galvanized-iron trough feeders covering the entire front length of metal cages and nipple drinkers. Hens were fed nine different dietary treatments with three date pits meal levels (0, 5, and 10%) supplemented with three β-mannanase levels (0, 330, and 660g/ton feed) with six replicates of three hens each.

The local Saudi hen diets used in this study were formulated to be isochoric contained 2762 Kcal metabolizable energy per kg of feed and isonitrogenus contained 16.89% crude protein as shown in Table 2. The analysis was carried out before adding the enzyme. At 25 weeks of age, each hen was fed 100 g once daily at 8 h and water was provided *ad libtum* and subjected to a 16L: 8D light program throughout the whole experimental period.

Table (2): Composition experimental diets

Ingredients	Date pits level (%)		
	0	5	10
Yellow corn	62.00	55.80	50.20
Oil	1.00	1.80	2.00
Soybean meal (44.5% CP)	26.40	26.80	27.20
Date pits meal	0.00	5.00	10.00
Limestone	8.70	8.70	8.70
Dicalcium Phosphate	1.00	1.00	1.00
Antioxidant	0.10	0.10	0.10
L-Lysine	0.10	0.10	0.10
Choline	0.10	0.10	0.10
DL-Methionine	0.10	0.10	0.10
Vitamin-mineral Premix*	0.25	0.25	0.25
Salt	0.25	0.25	0.25
Calculated nutritional composition			
Dry matter (%)	90.27	90.82	91.26
Energy (Kcal ME/kg feed)	2762	2775	2748
Crude protein (%)	16.89	16.86	16.88
Crude fat (%)	2.65	2.69	2.76
Crude fiber (%)	3.30	4.72	6.15
Linolenic acid (%)	1.57	1.43	1.31
Calcium (%)	3.62	3.62	3.62
Available phosphorus (%)	0.31	0.30	0.30

* Vitamin-mineral premix added at this rate yields: 149.60 mg Mn, 16.50 mg Fe, 1.70 mg Cu, 125.40 mg Zn, 0.25 mg Se, 1.05 mg I, 11,023 IU vitamin A, 46 IU vitamin E, 3,858 IU vitamin D_3, 1.47 mg minadione, 2.94 mg thiamine, 5.85 mg riboflavin, 20.21 mg pantothenic acid, 0.55 mg biotin, 1.75 mg folic acid, 478 mg choline, 16.50 µg vitamin B_{12}, 45.93 mg niacin, and 7.17 mg pyridoxine per kg diet.

Measurements

Initial body weight at the beginning and the final body weight at the end of the experiment for hens were measured and the average body weight gain was calculated by the differences between the two body weights.

Feed and egg produced percentage per hen were recorded on daily basis. The feed leftovers from feeders were weighed to calculate feed intake. Egg weight, egg mass, eggshell weight, eggshell thickness, egg specific gravity, Haugh units, and egg yolk colour for each replicate were calculated at the last 3 consecutive days each 2 weeks. For egg mass calculation, the average egg production was multiplied by the average egg weight divided by 100. Feed conversion ratio per egg mass was obtained and expressed as kilogram using the ratio between total feed consumed per hen and total egg mass produced per hen throughout the experimental period.

Collected eggs were stored overnight in the same room before egg specific gravity was determined. Egg specific gravity was determined using the saline flotation methods as described by Hempe *et al*. (1998). After determining egg specific gravity, the same eggs were subsequently broken, their components were separated, and then eggshell with shell membranes were washed and left to dry in the air before being individually weighed.

The eggshell thickness including its membranes was measured using an electronic digital caliper scale (pachymeter) with 0.01 mm precision. Three readings performed at three separate different sites (air cell, equator, and sharp end) of the equatorial region of the same eggshell were taken and the average of the three sites reading was calculated. Eggshell weight per surface area expressed in mg/cm² was determined according to Abdullah *et al*. (1993). The following formula was used:

$$ESWSA = \{ESW/ [3.9782 \times (EW^{0.7056})]\} \times 1000$$

Where: ESW=eggshell weight, EW=egg weight, ESWSA=Eggshell weight/surface area.

Albumen height was measured with an Ames micrometer (model S-6428, Ames, Waltham, MA) at the point halfway between the yolk and the edge of the widest expanse of albumen. Haugh units were calculated as follows:

$$\text{Haugh unit} = 100 \times \log(H + 7.57 - 1.7W0.37)$$

Where H is albumin height (mm), and W is egg weight (Panda, 1996). The egg yolk colour was measured using a Roche colorimetric fan (DSM nutritional products Co.). Colour scales ranged from 1 (pale yellow) to 15 (intense orange) according to Well (1968).

Statistical Analysis

Data were analyzed according to two - way analysis of variance (ANOVA) using the generalized linear model (GLM) procedure of a statistical software package (SPSS 22.0, SPSS Inc. Chicago, IL). A factorial experiment design was used to determine the significance of the main effects (date pits meal and enzyme supplementation) and their interactions. Treatment means were expressed as mean ± standard error of means (SEM) and compared (for significant treatments) using Duncan's multiple range test at $P \leq 0.05$ significant level (Duncan, 1955).

RESULTS AND DISCUSSION

Results obtained from the present study indicated that hens fed diets containing 5% date pits meal without β-mannanase showed higher body weight gain than those fed diets containing 0% date pits meal supplemented with either 330 or 660 g β-mannanase, but these particular treatments did not differ from the remained treatments. In addition, hens fed diets containing 5% date pits meal supplemented with 330 g β-mannanase exhibited the highest daily feed intake compared to the remaining treatments. However, hens fed diets containing either 0 or 5% date pits meal without β-mannanase showed lower (better) feed conversion ratio than those fed diets containing 10% date pits meal without β-mannanase supplementation, those fed diets containing 0, 5, or 10% date pits meal supplemented with 660 g β-mannanase, and those fed diets containing either 5 or 10% date pits meal supplemented with 330 g β-mannanase, but were not different from those fed diets containing 0% date pits meal supplemented with 330 g β-mannanase. In addition, hens fed diets containing 0% date pits meal supplemented with 660 g β-mannanase resulted in heavier egg weight than those fed diets containing either 5 or 10% date pits meal supplemented with 660 g β-mannanase and those fed diets containing 0% date pits meal supplemented with 330 g β-mannanase, but were not different from the other treatments.

On the other hand, hens fed diets containing either 0% date pits meal without β-mannanase showed higher egg mass than the other treatments, but were not different from those fed diets containing 5% date pits meal without β-mannanase. However, hens fed diets containing 0% date pits meal without β-mannanase significantly improved the egg production percentage per hen compared with than the other treatments, but were not different from those fed diets containing 0% date pits meal supplemented with 330 g β-mannanase and those fed diets containing 5% date pits meal without β-mannanase supplementation (Table 3).

Table (3): Effect of adding three dietary levels (0, 5, and 10%) of date pits meal with three levels (0, 330, and 660 g/ton feed) of β-mannanase on productive performance parameters of local Saudi hens from 25 to 33 weeks of age.

Treatments DPM	Treatments EZ	BWG	DFI	FCR	EW	EM	EP
0	0	243.33 ^{abc} ±1.92	95.36^{c}±0.45	10.14^{e}±0.35	47.32 ^{ab} ±0.01	0.53^{a} ±0.01	19.94^{a} ±0.51
	330	123.33 ^{bc} ±51.96	94.11^{e}±0.00	12.27^{de} ±0.87	41.96 ^{bc} ±1.28	0.44^{bc} ±0.03	18.75^{ab} ±1.89
	660	83.33^{c} ±28.87	94.64^{d}±0.35	19.16^{ab} ±1.69	48.41 ^{a} ±3.81	0.28^{de} ±0.04	10.42^{d} ±0.17
5	0	360.00 ^{a}±111.62	93.93^{ef}±0.01	11.01^{e} ±0.08	43.76 ^{abc} ±2.18	0.48^{ab} ±0.00	19.64^{ab} ±1.03
	330	236.67 ^{abc}±36.56	97.14^{a}±0.03	15.34 ^{bcd} ±0.13	44.43 ^{abc} ±0.91	0.36^{cd} ±0.00	14.29^{c} ±0.35
	660	233.33 ^{abc}±19.33	95.00^{cd}±0.13	16.52^{bc} ±3.15	40.79 ^{c} ±0.75	0.36^{cd} ±0.06	15.77^{bc} ±2.92
10	0	200.00 ^{abc} ±28.87	95.89^{b}±0.01	21.19^{a}±0.20	46.11 ^{abc} ±1.29	0.25^{e} ±0.01	9.82^{d} ±0.17
	330	153.33 ^{abc}±80.83	92.68^{g}±0.02	14.98^{cd}±0.55	43.13^{abc} ±2.18	0.35^{d} ±0.01	14.58^{c} ±1.20
	660	316.67^{ab}±105.85	93.57^{f}±0.06	15.76^{bcd} ±0.35	40.74 ^{c}±0.04	0.33^{de} ±0.01	14.58^{c} ±0.17
Mean EZ	0	267.78±47.47	95.06^{a}±0.16	14.11±0.20	45.73±1.16	0.42 ^{a} ±0.01	16.47 ±0.42
	330	171.11±56.45	94.64^{b}±0.02	14.20 ±0.52	43.17±1.46	0.38 ^{ab} ±0.01	15.87 ±1.14
	660	211.11±51.35	94.40^{b}±0.08	17.15 ±1.73	43.31±1.53	0.32^{b} ±0.04	13.59 ±1.09
Meam DPM	0	150.00±27.59	94.70^{b}±0.16	13.87 ^{b} ±0.97	45.90 ±1.70	0.42 ^{a} ±0.03	16.37 ±0.86
	5	276.67±55.84	95.36^{a}±0.05	14.29 ^{ab} ±1.11	42.99±1.28	0.40 ^{a} ±0.00	16.57 ±1.43
	10	223.33±71.85	94.05^{c}±0.17	17.31 ^{a} ±0.36	43.33±1.17	0.31 ^{b} ±0.01	13.22 ±0.51

$^{a-g}$ Means ± standard error of mean within a column that do not share a common superscript are significantly different ($P \leq 0.05$).

DPM= Date pits meal (%) into diet; EZ= g β-mannanase/ton feed; BWG= body weight gain (g), DFI=daily feed intake (g feed/hen/day); FCR=feed conversion ratio (kg feed/kg EM/hen); EW= egg weight (g); EM=egg mass (kg); EP=egg production (%).

The results of adding different dietary levels of β-mannanase, as a main factor, on productive performance parameters indicated that hens fed diets without β-mannanase supplementation significantly had higher daily feed intake compared to those fed diets containing either 330 or 660 g β-mannanase. On the other hand, hens fed diets containing 0 g β-mannanase supplementation showed higher egg mass than those fed diets containing 660 g β-mannanase, but were not different from those fed diets containing 330 g β-mannanase (Table 3).

Najib and Al-Yousef (2012) reported that layer hens fed 10% date pits meal without enzymes increased egg production, feed intake, egg mass and improved feed conversion ratio compared to those fed 15% date pits meal without enzymes. They noted that 10% date pits meal can be added safely into layer hen diets if enzymes were supplemented without adverse effect on productive performance of layer hens.

However, some other studies found that adding enzymes into layer hen diets improved feed conversion ratio by improving energy utilization (Wyatt and Goodman 1993; Benabdeljelil and Arbaoui 1994). In addition, other studies reported an improvement in egg production by adding multi-enzymes into layer hen diets due to the enhancement in the nutrient supply (Yakout *et al*., 2004; Gracia *et al*., 2009). Others reported improvement in the gut absorptive capacity and a reduction in digesta viscosity (Wu *et al*., 2005). However, Al-Saffar *et al*. (2013) reported that adding of 0.1% phytase, multi enzymes (mixture containing protease, amyloglucoidase, xylanase, betaglucanase, and cellulose), and hemicellulose into layer hen diets supplemented with 15% date pits meal improved egg production compared to 15 and 30% date pits meal without enzyme supplementation.

Adding different dietary levels of date pits, as a main factor, affected productive performance parameters in hens fed diets containing 5% date pits meal without β-mannanase supplementation significantly as it increased daily feed intake compared to adding 0 or 10% date pits meal without β-mannanase. On the other hand, hens fed diets containing 0% date pits meal without β-mannanase had lower (better) feed conversion ratio than those fed diets containing 10% date pits meal without β-mannanase, but were not different from those fed diets containing 5% date pits meal without β-mannanase. However, egg mass produced by hens fed diets containing 10% date pits meal without β-mannanase supplementation compared to those fed diets containing either 0 or 5% date pits meal without β-mannanase (Table 3).

These results are in agreement with previous observations obtained by El-Bogdady (1995), and Kashani *et al*. (2013), who reported no significant effect on body weight and egg weight due to adding different levels of date pits meal into layer hen diets. However, Radwan *et al*. (1997) reported a negative effect on productive performance parameters due to adding date pits meal into layer hen diets. Najib *et al.* (1994) reported that adding date pits meal into layer hen diets up to 28% decreased egg production and egg mass. Recently, Ghasemi *et al*. (2014) showed that adding date pits meal into layer hen diets caused significant reduction in egg weight and feed conversion ratio of layer hens fed date pits meal compared to control groups.

However, El-Bogdady (1995), and Kashani *et al*. (2013) observed no significant effect on feed intake by adding different levels of date pits meal into layer hen diets. Also, Kashani *et al*. (2013) reported that egg production, feed conversion ratio, and egg mass were not significantly affected by adding date pits meal up to 21% into layer hen diets. In addition, Ghasemi *et al*. (2014) noted that adding date pits meal up to 20% into layer hen diets had no negative effects on productive performance.

In contrast, Hermes and Al-Homidan (2004) found an improvement in egg production, egg weight, egg mass and feed conversion ratio per egg mass (kg feed/kg egg) for layer hens fed diets containing 10% date pits meal. In addition, Ghasemi *et al*. (2014) showed that adding date pits meal into layer hen diets increased feed intake and egg mass of layer hens fed date pits compared to control groups.

The worst feed conversion ratio obtained from hens fed diets containing 10% date pits meal supplemented with 0 g β-mannanase/ton feed might be due to the lowest egg mass observed. Also, it may be related to the adverse effect of anti-nutritional substances as one component of the date pits meal. In addition, the negative effect of adding

10% date pits meal into hen diets on feed conversion ratio compared to those fed diets containing 0 or 5% date pits meal might be clearly associated with the presence of non-starch polysaccharide in date pits meal (Ghasemi *et al*., 2014). This type of carbohydrate is known for increasing the viscosity of the gut contents. Other studies noted that adding high levels of date pits meal into layer hen diets reduced metabolizable energy and amino acid availability (Radwan *et al*., 1997) due to increasing feed passage rate through the gastrointestinal tract and lowered the digestibility of nutrients and utilization of minerals particularly calcium (Roberts, 2004).

Hens fed diets containing 0% date pits meal with 330 g β-mannanase supplementation significantly improved eggshell thickness compared with those fed diets containing either 5 or 10% date pits meal without β-mannanase, those fed diets containing 10% date pits meal with 330 g β-mannanase, and those fed diets containing 0, 5, or 10% date pits meal with 660 g β-mannanase. However, this diet (0% date pits meal with 330 g β-mannanase) observation was similar to that resulted from hens fed control diets, or those fed diets containing 5% date pits meal with 330 β-mannanase. On the other hand, hens fed diets containing 10 % date pits meal without β-mannanase supplementation produced eggs with higher Haugh unit than those fed diets containing 0 or 5% date pits meal without β-mannanase, those fed diets containing 0 % date pits meal with 330 g β-mannanase, or those fed diets containing 5% date pits meal with 660 β-mannanase. However, they did not differ from those fed 0 or 10% date pits meal with 660 g β-mannanase and those fed 5 or 10% date pits meal with 330 g β-mannanase. Hens fed diets containing 0 % date pits meal without β-mannanase supplementation produced eggs with darker yolk color than those fed diets containing 0 % date pits meal with 660 β-mannanase, those fed diets containing either 0 or 5% date pits meal with 330 g β-mannanase, but were not different from the remaining treatments (Table 4).

There were no significant effect for adding different dietary levels of β-mannanase as a main factor on egg quality parameters. However, there were significant effects for adding different dietary levels of date pits meal as a main factor on eggshell thickness and Huagh unit. Eggshell thickness of hens fed diets containing 0 % date pits meal without β-mannanase were significantly higher than those fed diets containing 10 % date pits meal without β-mannanase, but were not different from those fed diets containing 5 % date pits meal without β-mannanase. In contrast, eggs produced by hens fed diets containing 0 % date pits meal without β-mannanase showed lower Huagh unit than those fed diets containing 10 % date pits meal without β-mannanase, but were not different from those fed diets containing 5 % date pits meal without β-mannanase (Table 4).

Table (4): Effect of adding three dietary levels (0, 5, and 10%) of date pits meal with three levels (0, 330, and 660 g/ton feed) of β-mannanase on egg quality parameters of local Saudi hens from 25 to 33 weeks of age.

Treatments		ESG	EST	HU	EYC	ESWSA
DPM	EZ					
0	0	1.080 ±0.00	0.33^{ab} ±0.01	67.96^{c} ±1.03	6.54^{a} ±1.28	11.09 ±0.29
	330	1.079 ±0.00	0.35^{a} ±0.02	73.80^{b} ±1.46	4.13^{bc} ±0.22	10.01±0.69
	660	1.074 ±0.00	0.30^{c} ±0.01	75.56^{ab} ±0.48	3.50^{c} ±0.58	9.79±0.36
5	0	1.073 ±0.00	0.30^{c} ±0.01	72.65^{bc} ±2.08	5.00^{abc} ±0.58	9.74±0.76
	330	1.068 ±0.00	0.33^{ab} ±0.00	76.32^{ab} ±1.09	4.33^{bc} ±0.19	10.58±0.26
	660	1.063 ±0.00	0.30^{c} ±0.01	74.02^{b} ±2.36	4.63^{abc} ±0.22	11.04 ±0.54

Table (4): Cont.

Treatments		ESG	EST	HU	EYC	ESWSA
DBM	EZ					
10	0	1.067 ±0.00	0.31^{bc} ±0.01	79.99^{a} ±2.99	4.96^{abc} ±0.75	10.18±0.52
	330	1.066 ±0.00	0.29^{c} ±0.01	77.79^{ab} ±1.46	4.92^{abc} ±0.34	10.47 ±0.45
	660	1.060 ±0.00	0.29^{c} ±0.01	78.02^{ab} ±1.62	5.50^{ab} ±0.10	11.02 ±0.14
Mean EZ	0	1.073±0.00	0.31±0.01	73.53±2.03	5.50±0.87	10.34 ±0.53
	330	1.071±0.00	0.32±0.01	75.97 ±1.33	4.46±0.25	10.36 ±0.43
	660	1.066±0.00	0.30±0.01	75.87 ±1.48	4.54±0.30	10.62 ±0.35
Mean DPM	0	1.078 ±0.00	0.33^{a} ±0.01	72.44^{b} ±0.99	4.72±0.69	10.30 ±0.45
	5	1.068 ±0.00	0.31^{ab} ±0.01	74.33^{ab} ±1.84	4.65±0.33	10.46±0.53
	10	1.064 ±0.00	0.30^{b} ±0.01	78.60^{a} ±2.02	5.13±0.39	10.56±0.40

$^{a-c}$ Means ± standard error of mean within a column that do not share a common superscript are significantly different ($P \leq 0.05$).

DPM= Date pits meal (%) into diet; EZ=g β-mannanase/ton feed; ESG= egg specific gravity (g/cm^3), EST=eggshell thickness (mm); HU=Huagh unit; EYC= egg yolk colour; ESWSA=eggshell weight per surface area.

These results disagree with the findings of Abd El-Rahman *et al*. (1999), who found that adding date pits meal up to 30% into layer hen diets had no effect on eggshell thickness. Also, Najib and Al-Yousef (2012) found that egg specific gravity and egg yolk coulor were significantly increased by adding date pits meal level up to 21% in layer hen diets. However, Najib and Al-Yousef (2012) noted that Haugh unit was significantly increased by adding date pits meal level up to 21% in layer hen diets. In contrast, Sawaya *et al*. (1984) noted an improvement in hens' eggshell thickness when fed diets containing 5 or 10% date pits meal compared with those fed diets containing 0% date pits meal. They attributed this increase to the improved shell matrix composition by increasing potassium, phosphorus, magnesium, calcium, sodium, iron, manganese, zinc, and copper contents in the eggs. In addition, Kaskani *et al*. (2013) observed a reduction in the eggshell thickness and egg yolk colour by adding date pits meal into layer hen diets up to 30%. The differences in the effects of adding date pits meal at 10% level on egg quality parameters obtained from the present study compared to those studies could be due to the differences in the breed, variety, physiological condition, feed composition, and origin of date pits meal used. Moreover, another reason may be associated with the fact that the low metabolizable energy of date pits meal diets for layer hens was compensated by adding dietary oil to neutralize their negativity in this work.

In general, the reduction in the productive performance of the local Saudi hens used in the current study compared to the other commercial and local Saudi hens may be due to the fact that these hens have never been exposed or subjected to any type of genetic improvement. Another possible reason could be inbreeding depression of the local Saudi hens. Therefore, their productive performance were mostly similar to the productive performance of their genetically unimproved ancestors. These suggestions were supported with the survey reported by Al-Yousef (2007).

The lack or the negative effects of adding β-mannanase into local Saudi hen diets containing 5 or 10% date pits meal on productive performance and egg quality parameters in the present study might be attributed to the presence of different type of non-starch polysaccharide in pits (Hussein and Alhadrami, 2003). The differnces between among the effects of the treatments obtained in the present study and that of other studies might be attributed to the differences in the strain and age of layer hens, diet characteristics, feeding duration, the level and type of enzyme, and date pits meal characteristics.

Results obtained from the present study indicated that adding 10% date pits meal into local Saudi hen diets might be high enough to exhibit some negative effects on both productive performance and egg quality parameters. It can be concluded that date pits meal could be added into diets up to 5% without β-mannanase supplementation without negative effects on productive performance and egg quality characteristics of local Saudi hens at the age of 25 to 33 weeks. These findings justify further research on the effects of adding different levels of date pits meal supplemented with higher levels of β-mannanase and/or other enzymes at different ages to detect the effects on productivity and egg quality of local Saudi hens.

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تأثير إضافة مسحوق نوى التمر والبيتامننانيز غذائيًّا على أداء الدجاج المحلي السعودي

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الملخص

يمكن استخدام مسحوق نوى التمر كمنتج ثانوي ناتج عن صناعة التمر كمادة علف غير تقليدية في أعلاف الدواجن. لتقدير تأثير إضافة مسحوق نوى التمر مع/ أو بدون المننانيز لعلائق الدجاج المحلي على مقاييس الأداء الإنتاجي وجودة البيض وزعت (162) دجاجة محلية (خط أسود الريش (هجر1)) عشوائيًا فيما بين (54) قفصًا. استخدمت (9)علائق متماثلة الطاقة والبروتين في تجربة عاملية بثلاثة مستويات من مسحوق نوى التمر (صفر، 5، 10 %) وثلاثة مستويات من البيتامننانيز (صفر، 330، 660 جرام لكل طن علف). كل معاملة غذائية اشتملت على تسعة أقفاص (ثلاث دجاجات لكل قفص) لمدة (8)أسابيع من 25 - 33 أسبوعًا من العمر. النتائج أظهرت أن الدجاج الذي تغذى على علائق احتوت على صفر أو 5 % مسحوق نوى تمر بدون البيتامننانيز له معامل تحويل علف أفضل وكتلة بيض وإنتاج بيض وكثافة نوعية للبيض أعلى من الدجاج الذي تغذى على علائق احتوت على 10 % مسحوق نوى تمر بدون البيتامننانيز. على العكس فإن الدجاج الذي تغذى على علائق احتوت على 10 % مسحوق نوى تمر بدون البيتامننانيز أظهر وحدة هوف أعلى من الدجاج الذي تغذى على صفر % مسحوق نوى تمر بدون البيتامننانيز. بينما الدجاج الذي تغذى على علائق احتوت على صفر % مسحوق نوى تمر مضاف إليها 660 جرام بيتامننانيزكانت كتلة البيض وإنتاج البيض عنده أقل من الدجاج الذي تغذى على صفر % مسحوق نوى تمر بدون إضافة البيتامننانيز. في حين أن الدجاج الذي تغذى على علائق احتوت على صفر % مسحوق نوى تمر مضاف إليها 330 جرام بيتامننانيز أنتج قشرة بيض أسمك من إنتاج الدجاج الذي تغذى على 5 % مسحوق نوى تمر مضاف إليها 330 جرام بيتامننانيز، والدجاج الذي تغذى على 10 % مسحوق نوى تمر مضاف إليها 330 أو 660 جرام بيتامننانيز. هذه الدراسة توصي بإمكانية إضافة مسحوق نوى التمر لعلائق الدجاج المحلي حتى 5 % بدون إضافة البيتامننانيز دون تأثيرات سلبية على مقاييس الأداء الإنتاجي وجودة البيض من 25 – 33 أسبوعًا من العمر.

الكلمات المفتاحية: الأداء الإنتاجي، البيتامننانيز، جودة البيض، الدجاج المحلي، مسحوق نوى التمر.