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EFFECTS OF USING DATE WASTE (WHOLE DATES AND DATE PITS) ON PERFORMANCE, EGG COMPONENTS AND QUALITY CHARACTERISTICS OF BALADI SAUDI AND LEGHORN LAYING HENS

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SUMMARY

Dates are very rich in carbohydrates. Their high contents of carbohydrates enable them to replace energy source ingredients in the poultry diets. This research was conducted to determine the use of date waste meal (DWM) and date pits meal (DPM) as a partial replacement of yellow corn in the diets of layers. Seven levels were used representing 0.0 (control), 8, 16, 24% (DWM) and 5,10 and 15% (DPM). All experimental diets (T1-7) were iso-caloric and iso-nitrogenous and were based on the recommendations of NRC (1994) for white egg layers. To evaluate the experimental layer diets compared to that used in the layer industry, it was designed to use commercial diet (T8), which was brought, from a local mill. Feed and water supplied *ad Lipitum*. Number of 208 hens from two layer breeds (30 wks of age), White Leghorn (WL) and crossbred (SL) = {Baladi Saudi X White Leghorn} were individually housed in individual cages in close house. During the experimental period, which lasted 12 weeks, layers were distributed equally into 8 dietary treatments (8 treatments X 13 hens/treatment X 2 breeds =208 layers). During the experimental period the eggs from each individual hen were collected every week, weighed and egg mass was calculated. Every 2 weeks, 2 eggs from each hen of each experimental treatment were collected for determination of egg components, chemical composition and quality characteristics of egg according to AOAC (1990).

Results could be summarized as follows: 1) Under the condition of the present study, layer hens fed commercial diets (T8) gave the lowest significant performance compared with other treatments (T1-7). 2) Hens fed diets containing 16% % DWM or 10% DPM improved productive performance {egg production (H.D%), egg weight (g), egg mass and feed conversion ratio (kg Feed/kg Egg)} comparable or better than other treatments (T2-7) and control (T1). 3) Similar trends were observed regarding the effect of previous dietary treatments on egg components (yolk %, albumen % and shell % in relation to egg weight), while the chemical composition of egg (protein, fat and ash) as percentages on dry matter basis was not affected. 4) Egg quality parameters (Shell thickness, shell density, shell surface area, shell weight per unit of surface area, blood and meat spots and Haugh unit) showed in most cases the highest significant figures when layers fed diets containing 16% % DWM (T3) or 10% DPM (T6) compared to those fed other levels or control. 5) In most cases, differences between treatments were significant, for studied parameters. 6) Exotics breed (WL) had significant superior performance (body weight gain, productive performance, egg components and quality characteristics) compared to the crossbred (SL). 7) Generally, in most cases, the interaction (TXB) between treatment (T) and breeds (B) for studied performance were significant. It is obvious that, the best performance was seen when 16 DWM or 10% DPM could be replaced yellow corn without any adverse effect on productive performance, egg components and quality characteristics.

Keywords: ***Whole dates, date pits, Baladi Saudi hens, Leghorn laying hens, productive performance, egg components, egg quality characteristics.***

INTRODUCTION

In developing countries, the demand for importing corn grains as an ingredient for poultry industry has been increasing under the intensive production systems, leading to an increase in its price in the world market. Alternate sources for feed energy have been investigated in many developing countries. For example, under tropic conditions, cassava meal (*Manihot esculenta)* has been looked at as a potential cheaper energy source, but its use in poultry rations was limited to 10% of the final diet due to its high content of hydrocyanic acid (Vogt and Penner, 1963 and Yoshida *et al.*, 1966).

Dates are very rich in saccharides, their total sugars may reach up to 87% in the tamar stage and the monosaccharides are mainly 44% glucose and 50% fructose and some sucrose (Sawaya *et al.*, 1983). Therefore, dates are considered the highest in energy content among all the fruits, for example 1 Kg of dates provides over 3000 Kcal/kg gross energy, while 1 Kg of orange provides 500 Kcal/kg, (Yousif 1990). For this reason, dates that are not suitable for human consumption are considered a good source of energy for animals and poultry.

Dates *(Phoenix dactylifera L.*) are very popular in most of the Middle Eastern countries. Over 70% of the total world production are produced in this area and are considered an important national crop in Saudi Arabia. There are about 400 varieties of dates, most of which are consumed by Saudis, while others are exported (Sawaya *et al.,* 1983). According to the published statistics of the Ministry of Agriculture and Water (1997), during the past 20 years (1977-1997), number of palm trees and their production had increased. In year 1997, the number of palm trees was around 18 million, with date production around 600 thousands tons. In year 2003, the estimated and expected date production is around 700 thousands tons, and this development made Saudi Arabia to be the first country of the world in date production.

A considerable amount (20%) of produced dates is inedible and is not beneficial for human consumption due to poor quality. Besides, the average weight of date pits is 10% of the date's weights. According to these figures, the yearly estimated and calculated dates waste (Whole inedible dates + date pits) may reach neighborhood figure, 210 thousands tons, which is not utilized by mankind. Currently, very little uses are made out of these waste amounts of date in Saudi Arabia. It is possible from the economic point of view, and in order to reduce the environmental pollution, that dates waste may be considered as an alternative, in part of the imported yellow corn and as a good source of energy in poultry feed.

Many investigators reported that feeding broilers date waste in replacement of yellow corn resulted in a improvement in broiler productive performance (body weight and feed conversion) when compared to those fed the control diet (AL-Hiti and Rous, 1978; Petkov *et al.,* 1979, Kamel *et al.,* 1981, Al-Yousef 1985, Gualtieriand Rapaccini 1990, Panigrahi and Powell 1991, Hmeidan *et al.,* 1993; Radwan *et al.,* 1997, Hussein *et al.,* 1998 and AL-Homidan 2003).

On the other hand, there is not enough available published literature dealing feeding dates to layers compared with those by broiler feeding. AL-Hiti (1971) concluded that it was possible and suitable to use date waste without stones in turkey and layer diets. Radwan *et al.,* (1997) showed that date pits meal can be used in laying diets up to 30% with no adverse effect on productive performance of Golden-Montazah (Egyptian local strain). Al-Yousef (1985), using breeder quails observed that feeding dates at 8 to 24% supported good production (egg production, egg weight, fertility and hatchability). Vandepopuliere *et al.,* (1995) found that Quail breeder diet had ingredient ranges of 10 to 30% dates, 8 to 24% date meat and 5 to 15% date pits and the results showed that egg production and egg weight on all date and date part diets were equal to those of the control. The same trend was observed in quail diets (EL-Bogdady *et al.,* 1995).

Contrary to that, Huthail *et al.,* (1993) showed that inclusion of dates (20, 24 and 28%) in the layer diets reflected a negative effect on the performance of the White Leghorn layers (20 wks of age). They concluded that inclusion of dates in the layer diets might not be of benefit to the producers. Similarly, many investigators reported that date waste was poorly digested by poultry and resulted in relatively poor performance (Yeong *et al.,* 1981, Sawaya *et al.,* 1984, El-Boushy and Van der Poel 1994).

However, there are numerous inconsistent and conflicting findings surrounding the effect of using date waste as feed ingredients on layers productive performance.

The objective of this study is to assess the effect of adding date waste (date waste meal and date pits meal) as a partial replacement of yellow corn in the diet of layer on productive performance, egg components and quality characteristics of Baladi Saudi and White Leghorn laying hens.

MATERIALS AND METHODS

This experiment was carried out in the Poultry Farm of the Agricultural Research Experiment Station, College of Agriculture & Veterinary Medicine, King Saud University (AL-Qaseem Branch), Saudi Arabia, during the period from September 2001 till June 2002.

Date waste (whole dates and date pits) preparation

Mature dried Sukarry whole inedible dates were collected as waste from a date market in AL-Qaseem region, Saudi Arabia, during September 2001. Whole dates used in this study consisted of date meat (about 85-87% of total weight), which is the edible part surrounding the pits (stones). At the same time, Sukarry date pits (stones) were collected from the same place. Dried date pits are known to be very hard with a low moisture percentage (8-9%) and are difficult to grind in an ordinary hammer mill (El-Boushy and Van der Poel 1994). For this reason, nowadays heavy-duty high rotation hammer mills are available in Saudi market for date pits. These hammer mills firstly crushed the pits in a disc crusher followed by fine grinding in a grain-grinding stone mill. The experimental whole dates and date pits were crushed in specially date pits hammer mill to 3 mm in size without any special treatments (physical or chemical). As shown in Table (1), proximate

Table (1) : Chemical analysis and nutritive value of Sukarry date waste (Date waste meal = DWM and date pits meal = DPM) in comparison with yellow corn.

Assay	DWM	DPM	Yellow corn[1]
Determined analysis (%):			
Moisture	7.71	5.31	11.00
Crude protein (Nx6.25)	2.90	5.64	8.50
Ether extract	3.95	5.10	3.80
Crude fiber	16.00	22.00	2.20
Crude ash	2.58	1.59	1.15
NFE (by difference)	74.57	65.67	84.35
Calculated values[2]:			
Methionine	0.05	0.09	0.18
Cystine	0.07	0.10	0.18
Methionine + Cystine	o.12	0.19	0.36
Lysine	0.12	0.27	0.26
Calcium	0.76	0.57	0.02
Total- phosphorus	0.52	0.31	0.28
ME (Kcal/kg)	2512	1126	3350

(1)The figures for Yellow corn were calculated according to NRC (1994).
(2)The figures for Sukarry date waste (DWM and DPM) were calculated according to Hussein et al., (1976), Kamel et al., (1981), Sawaya et al., (1984), AL-Yousef (1985), Vandepopuliere et al., (1995) and Hussein et al., (1998). The metabolizable energy (ME) was calculated on the basis of its chemical composition according to Carpenter and Clegg (1956).

analysis according to AOAC (1990) was done on samples from date waste meal (DWM) and date pits meal (DPM). The ME content was calculated on the basis of its chemical composition according to Carpenter and Clegg (1956).

Experimental diets

During the experimental period, which lasted 12 weeks (30/1/2002 to 24/4/2002)) hens were fed the experimental diets. As shown in Table (2), the experimental diets were based on corn-soybean diets and were adjusted to be iso-caloric (11.9 MJ ME/kg) and iso-nitrogenous (17.0% crude protein). The main nutrient requirements, energy (MJ ME/kg), crude protein (%), and calcium (%) were based on the recommendation of NRC (1994) for white egg layers.

Seven experimental starter diets (Table 2) were formulated in which the first one (T1) was corn-soybean diet and served as a control. In the other diets, yellow corn was replaced by either DWM at three levels of 8, 16 and 24% (T2, T3 and T4, respectively) or DPM at three levels of 5,10 and 15% (T5, T6 and T7, respectively). The composition and calculated analysis of the seven experimental diets (T1-7) are shown in Table (2).

To evaluate the commercial production, layer diet usually used in the local market was compared to our experimental diets. It was designed to use this diet as commercial diet (T8). The commercial layer diet was based on typical corn-soybean meal and was formulated to supply 11.51 MJ ME/kg diet, 17.0% CP, and 3.6 Ca %, and was brought from a local mill.

Layer hens and management

Layer hens used in this study were either of White Leghorn (WL) or crossbred, Baladi Saudi X White Leghorn (SL). They were taken from Experimental Poultry and Livestock Farm of the Agricultural Research Experimental Station, College of Agriculture & Veterinary Medicine, King Saud University, Saudi Arabia.

Two hundred and eight hens around 30-weeks old (2 Breeds X 8 Treat. X 13 hens/Treat. = 208 hens) were leg-banded and were individually housed in individual pens in two-tier batteries equipped with feeding hoppers and drinking nipples. Birds were subjected to standard management practices and were reared in closed houses and temperature was controlled using separate electric heaters and air-conditioners using electric extractor fans. Lighting program was (16L+8D) during the experimental period. Both breeds were reared under the same environmental and hygienic conditions. Body weight was recorded at the start as initial weight (at 8 wks of laying period) and at the end of the experiment (at 20 wks of laying period or at 42 wks old). Hens were fed *ad-Libitum* and water was available at all times. Feed was added to individual cages as necessary. Every week, feed left was measured to determine feed consumption (FC) .The eggs from each individual hen were collected every week and were individually weighed and egg mass (EM) was calculated for determination of feed conversion ratio (FCR).

Every 2 weeks, 2 eggs from each hen of each experimental treatment were used for determination of egg components. The eggs from each individual hen were collected and were stored overnight at 10-11^{0}C. The next day, the eggs were individually weighed to the nearest 0.1 g, broken, the yolk separated from the albumen, and the albumen discarded. The yolk was then rolled on a damp paper towel to remove any adhering albumen and yolk was weighed. The shell was washed carefully to remove albumen, and

Table (2): Composition of experimental layer diets.

Ingredients (%)	Experimental diets (%)							
	1	2	3	4	5	6	7	8[(a)]
Yellow corn	59.70	50.00	42.00	30.00	55.00	50.00	40.00	
Date waste meal	------	8.00	16.00	24.00	-------	------	-----	
Date pits meal	------	-------	-------	-------	5.00	10.00	15.00	
Soy. Meal (48%)	24.22	25.50	26.48	28.17	24.49	24.82	26.05	
Stabilized fat	3.00	4.43	4.90	7.21	4.40	4.56	8.33	
Di-cal- phosphate	1.60	1.60	1.60	1.60	1.60	1.60	1.60	
Limestone	8.36	8.36	8.36	8.36	8.36	8.36	8.36	
Salt	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
Vitamin-premix[(b)]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Mineral-premix[(b)]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
DL-Methionine	0.10	0.15	0.15	0.15	0.15	0.15	0.15	
DL-Lysine	0.01	-----	-----	------	-----	-----	-----	
Choline chloride	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Sand	2.50	1.45	-----	-----	0.49	-----	-----	
Total	100	100	100	100	100	100	100	
Calculated values:								
ME (MJ/ kg)	11.93	11.93	11.93	11.93	11.93	11.81	11.85	
Crude protein	17.00	17.00	17.00	17.00	17.00	17.00	17.00	
Ether extract	5.36	6.62	6.86	9.35	6.77	7.88	11.35	
Crude fiber	2.26	3.38	4.52	5.60	4.27	5.87	6.20	
Methionine	0.43	0.48	0.48	0.47	0.48	0.48	0.47	
Meth. + Cystine	0.65	0.69	0.68	0.67	0.69	0.69	0.67	
Lysine	0.88	0.89	0.90	0.92	0.88	0.89	0.92	
Calcium	3.60	3.61	3.62	3.63	3.61	3.61	3.61	
Non-Phytate-P	0.40	0.40	0.40	0.40	0.40	0.40	0.40	

(a)Layer birds were fed on typical corn/soybean commercial diet containing 17% crude protein and 11.93 ME MJ/kg diet. The main ingredients were: Yellow corn, soybean meal, alfalfa meal, vegetable fat, limestone, di-cal- phosphate, salt, vitamin-premix, choline chloride, ascorbic acid, mineral-premix, methionine and ethoxyquin.

(b)Vitamin and mineral premixes provided / kg of the final diet:

Vit. A, 10000 IU; vit. D_3, 5500ICU; vit. E, (91% –tocopherol acetate) 15 IU; vit K 1mg; vit. B_1, 1.5 mg; vit. B_2, 4 mg; vit B_6, 3 mg; vit. B_{12} 4 ug; Pantothenic acid, 7.5 mg; Folic acid, 0.7 mg; Biotin, 32 mg; Niacin 32 ug; Choline, 100 mg; vit. C 80 mg; Ethoxyquin 56 mg.

Trace minerals: Fe, 40 mg; Cu, 7 mg; Zn, 50 mg; Mn, 100 mg; I, 300 ug; Se, 150 ug; Co, 300ug.

dried at 20-25^{0}C for 24h prior to weighing. Subtracting yolk weight and dry shell weight from the initial whole egg weight then calculated the albumen weight. Shell, albumen and yolk weights percentages were calculated. Routine chemical analysis (protein, fat and ash) for inner egg components (yolk+albumen) was determined according to AOAC (1990).

For egg quality characteristics, similar number of eggs were collected and stored overnight at 10-11^{0}C. The next day, the eggs (EW) were individually weighed to the nearest 0.1g, broken-out and the presence of blood (BS) and meat (MS) spots visually determined. Haugh unit values (HU) were directly estimated using micrometer *(Ames, 131 Lexington St., Waltham, MA 02452, USA)* adjustable to egg weight and directly gives Haugh unit value according to Haugh, (1937) and USDA, (1977). The shell was washed carefully to remove albumen, and dried at 25^{0}C for 24h and individually weighed (SW) to the nearest 0.1 g.

Eggshell quality were evaluated using the following parameters

1-Shell thickness (ST), expressed in millimeter X 100 was obtained at 3 locations, middle and both side of each egg without membrane using dial touch micrometer *(Ames, 131 Lexington St., Waltham, MA 02452, USA).*

2-Shell surface area (SA) in cm^2 was calculated for each egg using the following equation suggested by Nordstrom and Qusterhout (1982):

$$\textbf{SA (cm}^2\textbf{)} = \textbf{3.9782 X EW}^{0.7056}$$

Where: 3.9782= Constant factor, EW= Fresh egg weight (g)$^{0.7056}$

3-Shell weight per unit surface area (SWUSA) was calculated for each egg using the following equation suggested by Nordstrom and Qusterhout (1982):

SWUSA (mg/ cm) = SW (mg) / SA (cm^2)

4-Shell density (SD) in g/cm^2 was estimated for each egg using the following equation suggested by Curtis *et al.*, (1985):

SD = SW (g) / SA (cm^2) X ST (cm).

Statistical analysis

Data were subjected to a two-way analysis of variance concerning breed and treatment (date waste sources, DWM and DPM and its levels) as main effects and their interaction by using the General Linear Models (GLM) procedure of SAS User's Guide, (1996) according to the following linear model:

$$Y_{ijk} = \mu + B_i + T_j + BT_{ij} + e_{ijk}$$

Where:

Y_{ijk} = Observation of ijkth hen

μ = Common mean

B_i =Effect of ith bred group (1-White Leghorn, WL and 2-crossbred, SL)

T_j =Effect of jth Treatment (1-8), date waste source (DWM and DPM) and its level effects

BT_{ij} = Two order interaction of bred group by treatment

e_{ijk} = Random error

When significant breed and treatment effects were detected, means were separated using Duncan, s new multiple range test *(Duncan, 1955)*

RESULTS AND DISCUSSION

Chemical analysis and nutritive values of date waste meal (DWM) and date pits meal (DPM)

Results of proximate analysis (on dry weight basis) of Sukarry date waste (DWM and DPM) used in this research in comparison with yellow corn was summarized in Table (1). The experimental data showed that yellow corn was the highest in crude protein (8.50%), while DWM was the lowest (2.90%) and DPM was in the middle (5.64%). The crude protein content of

DPM is comparable to that found in some grains commonly used in poultry diets (Salem and Hegazi 1971. Ether extract was relatively higher in DPM (5.10%) and DWM (3.95%) than those found in corn (3.80%). While, nitrogen–free extract (NFE) was higher in corn (84.35%) than those found in DWM (74.57%) and DPM (65.67%). Ether extract and NFE contents of DPM indicate a possibility of using it to replace corn partially as an energy source in poultry diet (Kamel *et al.,* 1981 and Radwan *et al.,* 1997). On the other hand, DPM contained the highest value in crude fiber (22.0%) followed by DWM (16.0%) and corn had the lowest (2.20%). This high fiber percentage may limit the diet inclusion level of date waste, especially date pits to 10-15% in poultry diets (Jumah *et al.,* 1973, Yeong *et al.,* 1981, Sawaya *et al.,* 1984, El-Boushy and Van der Poel 1994).

As shown in Table (1), the calculated critical sulfuric essential amino acids, especially (Methionine+cystine) content in yellow corn are much higher than those in date waste. Contrary to that, lysine in DPM showed nearly the same value (0.26%) as in yellow corn, of 0.27%. These observations, are in agreement with those reported by Nwokolo, *et al.,* (1976) and Onwudikee *et al.,* (1986a and 1986b). Macro elements such as calcium and total-phosphorus were shown to be much higher than those in yellow corn.

The Metabolizable energy (ME) was calculated to be 2512 and 1126 Kcal/kg in DWM and DPM on the basis of its chemical composition according to Carpenter and Clegg (1956) respectively. These figures for ME were much lower than yellow corn (3350 Kcal/kg according to NRC 1994). Similarly, AL-Yousef (1985) reported that ME of Khudri date was estimated to be 2409 Kcal/kg. On the other hand, the calculated value of ME in DPM (1126 Kcal/kg) was relatively lower than those obtained by Radwan *et al.,* (1997) who calculated the ME of date stone meal on the basis of its chemical composition and found it to be 1746 Kcal ME/kg.

Effect of nutritional treatments on productive performance

The effect of feeding date waste on productive performance of layers can be shown as follows:

Live body weight

It is worth to note that layer hens fed commercial diet (T8) during experimental period (12 wks) reflected the lowest significant body weight gain (BWG) compared with those fed control diet (T1) and the corresponding values were 119.4 and 190.0g, respectively. Similar results were reported by AL-Homidan (2003) in broiler chicks. Layers fed diets containing date waste (DWM and DPM) showed the lowest BWG (except T6) compared with those fed controls diets and in most cases differences were significant. In addition, birds fed 24% DWM gave the lowest BWG (149.2g) compared to those fed diets containing lower levels of 8 or 16% being 179.4 and 171.9g, respectively, however, differences failed to be significant. A possible explanation of that may be due to the fact that the highest level of DWM (24%) may affect the structure of the diet and cause granularity and stickiness owing to the high total sugar contents, mostly glucose and fructose (Kamel *et al.,* 1981). Feeding diets containing 10% DPM showed the highest (195.1g) BWG followed by those fed 5% DPM, while layers fed 15% had the lowest BWG. The explanation for this reduction may be due to its highest fiber content (6.2%) as shown in Table (2), which in consequence may reduce digestibility and availability of nutrients. These findings are in contrast with the results obtained by Radwan *et al.*, (1997), who concluded that feeding Egyptian local layer strain (Golden Montazah) date stone meal up to 30% in diets had no adverse effect on body weight, and birds can tolerate dietary fiber content up to 6% with no adverse effect on their productive performance.

Egg production and egg weight

Productive performance of layers for both breeds (WL and SL) as effected by experimental treatments is illustrated in Table (4). The obtained data showed that there were significant differences in egg production and egg weight among treatments during the studied period (1-12 wks). Birds fed commercial diet (T8) reflected the lowest egg production and egg weight, compared with other treatments (T1-7). However, egg production decreased by 7% (63.0% versus 58.9%) compared with that fed control diets (T1) and egg weight showed similar trend (55.4g versus 51.7 g). Besides, the differences between the two treatments were significant. The explanation of that could be related to the fact that, T1 was formulated to meet the optimum nutrient requirements for layers based on the recommendation of NRC (1994).

Moreover, feeding diets containing 16 % DWM (T4) gave the best egg production (63.7%) compared the diets containing other levels 8 or 24%, (being the same figure 60.2%, respectively), however, the differences failed to be significant. The response of egg weight to DWM levels was not significant and the corresponding values were 54.9, 53.7 and 53.8 g when birds were fed diets containing 8, 16 and 24% DWM, respectively. Similar observations were reported by other investigators, AL-Hiti (1971) in turkeys and layers, Al-Yousef (1985), Vandepopuliere *et al.*, (1995) and EL-Bogdady *et al.*, (1995) in Quail breeders. They concluded that egg production, egg weight, fertility and hatchability on all date and date part diets were equal to those of the control. On the other hand, these findings are in contrast with the results obtained by Huthail *et al.*, (1993), who showed that inclusion of whole dates (20, 24 and 28%) in the layer rations reflected a negative effect on the layer performance (egg production, egg weight) of the White Leghorn layers.

Birds fed diets containing 10% DPM (T6) showed the highest egg production (63.0%) while, bird's fed 5% or 15% DPM had the lowest figures being 61.9 and 60.0%, respectively. The differences among treatments were not significant. In the same order, birds fed 15% DPM showed the lowest reduction in egg weight (52.3g) compared with those fed other levels 5 or 10% DPM. The reduction in egg weight increased slightly as the level of DPM increased. Differences among treatments in egg weight were highly significant. This reduction may be due to its highest fiber content (6.2 %), which may reduce digestibility and availability of nutrients. These results are in agreement with those reported by many investigators (Jumah *et al.*, 1973, Yeong *et al.*, 1981, Sawaya *et al.*, 1984, El-Boushy and Van der Poel 1994). They concluded that high crude fiber percentage would limit the diet inclusion level of date waste, especially date pits to 10-15% in poultry diets. On the other hand, the obtained data are in disagreement with those reported by Radwan *et al.*, (1997), who found that date stone meal can be used in laying diets up to 30% with no adverse effect on egg production and egg weight. Egg mass, an another way of measuring performance of layer, was highly affected

Table (3) : Effect of Sukarry date waste (DWM and DPM) on live body weight gain, BWG (g) of layer hens during experimental period (12wks).

Traits		White Leghorn (WL)			Crossbred (SL)		
Treat.	BWG	Initial	Final	Gain	Initial	Final	Gain
1	190.0^{a}	1361.5	1580.6	219.1	1396.8	1557.7	160.9
2	179.4^{a}	1437.7	1614.2	176.5	1357.7	1539.9	182.2
3	171.9^{ab}	1294.5	1471.8	177.3	1286.0	1452.6	166.6
4	149.2^{ab}	1433.0	1582.6	149.6	1214.2	1363.0	148.8
5	165.4^{ab}	1391.6	1545.5	153.9	1348.0	1524.9	176.9
6	195.1^{a}	1480.5	1634.0	153.5	1375.3	1611.9	236.6
7	160.1^{ab}	1392.3	1550.2	157.9	1343.7	1505.9	162.2
8	119.4^{b}	1408.2	1537.9	129.7	1266.4	1375.5	109.1
± SE	17.2	56.2	100.4	24.3	56.2	100.4	24.3
Overall Mean	164.7 ±8.6	1399.9 ±19.9	1564.6 ±35.5	164.7 ±8.6	1323.5 ±19.9	1491.4 ±35.5	167.9 ±8.6

	Initial weight	Final weight	Weight gain
SOV:	------------	Probability	------------
Treat.(T)	NS	0.0253	0.0572
Breeds (B)	0.0090	NS	NS
(TxB)	NS	NS	NS

$^{a-b}$Values in a column not followed by a common letter are significantly different at (P<0.05).
NS = Non significant

Table (4) : Effect of Sukarry date waste (DWM and DPM) on productive performance of layers during experimental period (12 wks).

Traits	EP (H.D%)	EW (g)	FC (g/d)	EM (g/d)	FCR (FC/EM)
Treatments(T):					
1	63.0^{a}±1.7	55.4^{a}±0.6	108.7±8.6	31.6±7.7	3.142^{c}±0.073
2	60.2^{ab}±1.7	54.9^{ab}±0.7	110.1±8.5	32.9±7.8	3.347^{ab}±0.073
3	63.7^{a}±1.8	53.7^{abc}±0.7	107.6±8.7	34.1±8.8	3. 155^{c}±0.075
4	60.2^{ab} ±1.8	53.8^{abc}±0.6	108.5±8.7	32.4±8.8	3.348^{ab}±0.075
5	61.9^{ab}±1.7	54.4^{ab}±0.6	109.6±8.6	33.6±7.6	3.262^{ab}±0.073
6	63.0^{a}±1.8	53.5^{bc}±0.6	108.3±8.8	34.2±7.9	3.167^{c}±0.074
7	60.0^{ab}±1.8	52.3^{c}±0.6	107.3±8.9	32.1±8.8	3.343^{ab}±0.075
8	58.9^{b}±1.8	51.7^{c}±0.6	112.2±8.9	32.3±8.0	3.474^{a}±0.075
Significance	*	***	NS	NS	*
Breeds(B):					
WL	64.8^{a}±0.9	56.8^{a}±0.3	109.6±4.4	36.9^{a}±3.9	2.970^{b}±0.037
SL	58.0^{b}±0.9	50.6^{b}±0. 3	108.5±4.3	29.4^{b}±3.4	3.690^{a}±0.037
Significance	***	***	NS	***	***
Interaction: (TxB)					
Significance	*	*	**	*	*

EP (H.D%): Egg production; EW (g): Egg weight
FC (g/d): Daily feed consumption; EM (g/d): Daily egg mass
FCR: Feed conversion ratio = FC / EM.
$^{a-b}$Values in a column not followed by a common letter are significantly different at (P<0.05).
NS = Non significant ** =P<0.01; ***=P<0.001

by level of date waste. Again, best egg mass was achieved when 16% DWM or 10% DPM were incorporated in the layer diets (Table4). Best production and best egg weight were the reasons for best egg mass.

Feed consumption and feed conversion ratio

Data in Table (4) indicate that daily feed consumption per hen (g/d) increased by feeding commercial diet (T8) compared with those fed control diets, (T1). The corresponding figures were 112.2 versus 108.7 (g/h/d), without any significant differences. This might be due to the fact that layer commercial diet contained lower energy and increasing daily feed consumption to 112.2 (g/d) could be related to the fact that birds met their energy requirements by increasing feed consumption. According to Scott and Nesheim (1982) and Lesson and summers (1991) birds have the ability to meet their energy requirements to certain extent by increasing feed consumption. Increasing DWM and DPM till 24% and 15% in experimental diets respectively showed no negative effect on daily feed consumption and the differences between treatments failed to be significant (Table 4). On the contrary, Huthail *et al.*, (1993), found that inclusion of whole dates (20, 24 and 28%) in the layer rations reflected a significant reduction in the feed consumption compared with their control group. Feed conversion ratio (FCR) showed the same trend since birds fed control diet (T1) were more efficient in converting their food into egg compared with those fed commercial diet (T8). The corresponding figures were 3.142 versus 3.474 with significant differences between the two treatments. In the same order, the figures of FCR indicted significant differences between birds fed diets containing date waste (T2-7) compared with those fed controls diet (T1). The best FCR was detected for the birds fed diets incorporated with 16.0% DWM (3.155) or 10.0% DPM (3.167). On the other hand, the worst FCR were found in birds fed higher levels of date waste (24% DWM or 15% DPM), which could be due to the lowest egg production, egg weight and egg mass (Table 4). This reduction in FCR may be due to the high fiber content (6.2%). Jumah *et al.*, (1973) showed that high level of fiber in poultry diets will increase the passage of ingesta in the intestines, resulting in an increase in feed consumption, a lower body weight and a poor feed conversion. In addition, Onwudikee (1986a, 1986b and 1988) reported that increasing dietary fiber content showed negative response on the availability of amino acids.

Egg components and chemical composition of egg

The results in Table (5) show the relationship between dietary date waste (DWM and DPM) and egg components and chemical composition. The percentages of egg yolk in relation to egg weight for layers fed control diets (T1) reflected significant differences than those fed commercial diets (T8). While chemical composition (protein and fat on dry matter basis) of inner egg components (yolk and albumen without shell) were almost the same when layers fed according to T1 or T8. Ash percentage for layers fed commercial diets showed the lower significant figures compared with that fed control diets (2.93 versus 3.52%). The response to feeding date waste (T2-7) on egg components showed a significant differences without clear trend in the relation to the kind of date waste (DWM and DPM). In general, the best figures of egg components were seen when 10%

Table (5) : Effect of Sukarry date waste (DWM and DPM) on egg components and chemical composition of egg (Yolk and albumen) during experimental period (12 wks).

Traits	Egg components				Chemical composition (In dry matter basis)		
	Egg weight (g)	Yolk(%)	Albumen (%)	Shell (%)	Protein(%)	Fat (%)	Ash(%)
Treatments(T):							
1	53.2 ± 0.7^{abc}	35.6 ± 0.3^{a}	54.9 ± 0.3^{b}	9.6 ± 0.1^{dc}	48.7 ± 0.2	38.91 ± 0.29	3.52 ± 0.08^{a}
2	54.0 ± 0.7^{ab}	35.5 ± 0.3^{ab}	54.6 ± 0.3^{ab}	9.9 ± 0.1^{abc}	48.1 ± 0.2	38.13 ± 0.29	3.42 ± 0.08^{ab}
3	55.0 ± 07^{abc}	34.2 ± 0.3^{bc}	56.4 ± 0.3^{a}	9.4 ± 0.1^{d}	48.1 ± 0.2	38.22 ± 0.30	3.34 ± 0.08^{ab}
4	51.5 ± 0.7^{c}	35.1 ± 0.3^{ab}	54.9 ± 0.3^{b}	10.0 ± 0.1^{ab}	48.1 ± 0.2	38.31 ± 0.30	3.26 ± 0.08^{b}
5	53.1 ± 0.7^{abc}	34.2 ± 0.3^{bc}	56.1 ± 0.3^{ab}	9.8 ± 0.1^{abcd}	48.1 ± 0.2	38.03 ± 0.29	3.24 ± 0.08^{b}
6	55.1 ± 0.7^{a}	35.2 ± 0.3^{a}	54.8 ± 0.3^{b}	10.0 ± 0.1^{a}	48.1 ± 0.2	38.41 ± 0.30	3.34 ± 0.08^{ab}
7	52.1 ± 0.7^{bc}	33.9 ± 0.3^{c}	56.4 ± 0.3^{ab}	9.7 ± 0.1^{abcd}	48.2 ± 0.2	38.53 ± 0.30	3.28 ± 0.08^{b}
8	51.4 ± 0.7^{c}	33.2 ± 0.3^{c}	57.2 ± 0.3^{a}	9.6 ± 0.1^{bcd}	48.01 ± 0.2	38.63 ± 0.30	2.93 ± 0.08^{c}
Significance	*	*	*	*	NS	NS	*
Breeds(B):							
WL	56.7 ± 0.4^{a}	35.1 ± 0.2^{a}	57.5 ± 0.2^{a}	9.8 ± 0.2^{a}	49.6 ± 0.1^{a}	39.49 ± 0.15^{a}	3.70 ± 0.04^{a}
SL	50.1 ± 0.4^{b}	33.1 ± 0.2^{b}	55.0 ± 0.2^{b}	9.4 ± 0.2^{b}	46.6 ± 0.1^{b}	37.29 ± 0.15^{b}	2.88 ± 0.04^{b}
Significance	***	***	***	*	***	***	***
Interaction:(TxB)							
Significance	**	**	***	***	NS	NS	***

a-d Values in a column not followed by a common letter are significantly different at ($P<0.05$).

NS = Non-significant; * = $P<0.05$; ** = $P<0.01$; *** = $P<0.001$

DPM (T6) was incorporated in diets and the corresponding values in relation to egg weights were 35.20% and 10.00% for Yolk and shell respectively. The obtained results are in disagreement with those reported by Radwan *et al.,* (1997), in which they concluded that using date stone meal (5-30%) in layer diets did not significantly affect egg composition. While by feeding diets containing DWM (8-24%) showed no clear trend on studied criteria. The contents of protein and fat percentages of egg were relatively similar in all treatments and the overall mean were 48.18% and 38.40 % in dry matter basis respectively. Contrary to that, the values of ash percentages of eggs (without eggshell) ranged between 3.24% (T5) and 3.42% (T2) when date waste (DWM and DPM) was incorporated in diets and the differences were significant.

Egg quality

Treatments and breeds had a significant effect upon most of egg quality traits included in the study as shown in Table (6). Shell thickness (ST) ranged between 40.10 and 38.22 (mmx100) and layers fed diets containing 10% DPM (T6) gave the highest figure while, bird's fed 16% DWM (T3) had the lowest figures and differences among treatments were significant. In the same order shell surface area (SA) and shell weight per unit surface area (SWUSA) figures showed the same trend, in which 10% DPM (T6) reflected the highest figures compared with other treatments and the corresponding figures being 67.83 (cm^2) and 79.37 mg/cm^2 respectively and in most cases differences between treatments were significant. However, these findings are in agreement with those reported by Huthail *et al.,* (1993), who reported that shell quality was improved as date was added to the ration and they explained that on the basis that sucrose was found to improve shell quality even if added at low level (5%) by improving the utilization of Ca of the bird. Contrary to that, Radwan et al., (1997) concluded that shell thickness values did not show change with using date stone meal (5-30%). No significant differences were observed on shell density (SD) g/cm^2, the percentages values of blood spots (BS), meat spots (MS) and Haugh unit values (HU) of eggs due to date waste (DWM and DPM) addition (T2-7) compared with control (T1). Unfortunately, there are no available published literature dealing with the effect of date waste ((DWM and DPM) on blood spots (BS), meat spots (MS) and Haugh unit values (HU) of table eggs. It is worth to note that in most cases, the layers fed commercial diet (T8) reflected the lowest significant figures concerning egg quality parameters compared with other treatments (T1-7).

Effect of breeds

The overall means of the initial live body weights for both breeds (WL and SL) were 1399.9 and 1323.5 g receptively, and showed higher significant difference, as shown in Table (3). The both breeds were in the same age (around 30 wks), but WL gave higher figures (5.5 %) than SL. These observations were in agreement with those reported by Khalil *et al.*, (1999). They reported that the WL breed had significant superior performance in body weights compared to the Baladi Saudi chicks. Generally, exotic breed (WL) reflected a significant higher production performance (Egg production, egg weight, egg mass, and feed conversion ratio) than crossbred (SL) as shown in Table (4). The corresponding values of productive performance were (64.8

Table (6): Effect of Sukarry date waste (DWM and DPM) on egg quality [Egg weight (EW), shell thickness (ST), shell surface area (SA), shell weight per unit of surface area (SWUSA), shell density (SD), blood spots (BS), meat spots (MS) and Haugh unit values (HU)] during experimental period (12 wks).

Traits	EW (g)	ST mmx100	SA cm^2	SWUSA (mg/cm^2)	SD (g/cm^2)	BS (%)	MS (%)	HU
Treatments(T)								
1	53.7±0.7^{abc}	39.2±0.5^{ab}	66.2±0.1 ^{ab}	75.7±0.3 ^{ab}	3.0±0.1	2.15±.01	7.43±0.05	76.90±0.77
2	54.6±0.7^{ab}	39.5±0.5^{ab}	66.9±0.1 ^{ab}	79.0±0.3 ^{a}	3.1±0.1	3.23±.01	7.39±0.05	76.31±0.77
3	54.5±07^{abc}	38.2±0.5^{bc}	66.8±0.1 ^{ab}	74.7±0. 3 ^{c}	2.9±0.1	2.30±.01	7.10±0.05	74.10±0.77
4	52.0±0.7^{c}	39.4±0.5^{ab}	66.6±0.1 ^{ab}	78.3±0.3 ^{a}	3.0±0.1	2.46±.01	6.25±0.05	75.25±0.77
5	53.7±0.7^{abc}	39.7±0.5^{a}	66.1±0.1 ^{ab}	77.3±0.3 ^{ab}	3.1±0.1	2.28±.01	7.14±0.05	75.90±0.77
6	55.7±0.7^{a}	40.1±0.5^{a}	67.8±0.1 ^{a}	79.4±0.3 ^{a}	3.2±0.1	3.19±.01	7.49±0.05	76.30±0.77
7	52.6±0.7^{bc}	38.8±0.5^{abc}	65.2±0.1 ^{abc}	76.7±0.3 ^{ab}	3.0±0.1	2.36±.01	8.30±0.05	75.47±0.77
8	51.9±0.7^{c}	37.8±0.5^{c}	64.6±0.1 ^{c}	73.2±0.3 ^{c}	2.8±0.1	2.10±.01	7.51±0.05	74.81±0.77
Significance	*	*	*	*	NS	NS	NS	NS
Breeds(B):								
WL	57.30±0.4^{a}	39.4±0.2	69.2±0.1 ^{a}	78.1±0..4	3.08±0.1	2.05±.01	6.50±0.09 ^{b}	78.25±0.92 ^{a}
SL	50.61±0.4^{b}	39.4±0.2	63.4±0.1 ^{b}	79.0±0..4	3.11±0.1	2.19±.01	8.13±0.09 ^{a}	71.57±0.92 ^{b}
Significance	***	NS	*	NS	NS	NS	*	*
Interaction:(TxB)								
Significance	**	NS	NS	*	NS	NS	NS	NS

a-c Values in a column not followed by a common letter are significantly different at ($P<0.05$).

NS = Non-significant; * =$P<0.05$; ** =$P<0.01$; ***=$P<0.001$

versus 58.0%), (56.8 versus 50.6g), (36.9 versus 28.6 g/h/d) and (2.970 versus 3.690) for egg production, egg weight, egg mass and feed conversion ratio respectively. The same trend was reported in egg components and chemical composition of egg and egg quality, as shown in Tables (5 and 6). This was not surprising since it is known that exotic breed, White leghorn has superiority and genitcal potency for productive performance and egg quality than Baladi Saudi as local breed. Several investigators reported similar genotypes differences with respect to productive performance and egg quality (Amer, 1961, Hassanin, 1990, Khalil *et al.*, 2002, Alsobayl *et al.*, 2003).

Interaction between treatments and breeds (T x B)

Generally, in most cases, the interaction between treatments and breeds (T x B) for studied criteria were significant (Tables 3, 4, 5 and 6)). To date, publications concerning the effect of feeding date waste (DWM and DPM) to different layer breeds on productive performance, egg components, chemical composition of egg and egg quality, are not available and therefore no comparisons were made with results of the present study.

Health condition and mortality rate

Because the calculated energy (ME-Kcal/kg) values of date waste (DWM or DPM) were much lower than yellow corn, it was necessary to increase the level of fat as the level of DWM or DPM increased, to keep all diets iso-caloric (Table 2). Using relatively high level of fat in relation to DPM addition (8.33% by T7), no negative response on health condition, fatty liver syndrome and mortality rate was found. These observations were in agreement with results obtained by Hermes *et al.*, (1996), who concluded that no adverse effect were observed on productive performance, health condition and mortality rate when Lohmann brown layers were fed 6% animal fat saving 15% yellow corn compared with those fed controls diets. Under the condition of the present study all birds appeared healthy and the total mortality rate was 3.85 % (8 birds) during the total experimental period (12 wks), without any clear differences among treatments (T), breeds (B) and interaction between (TxB). Hence, it seems that neither kind of date waste (DWM or DPM) nor inclusion rate influenced health conditions and mortality rate.

The variability and conflicting results in the literature with respect to responses of poultry to date waste addition might have been due to different reasons. Sawaya *et al.*, (1983) found that certain varieties of date from the central and western regions of Saudi Arabia may contain up to 42 gm/100 gm and 38 gm/100 gm sucrose respectively. However, date from the eastern region contain much less than that (0-3.6 gm/100 gm) sucrose. Date waste (DWM and DPM) contain relatively high fiber content (16 to 22%) and many investigators (Jumah *et al.*, 1973, Yeong *et al.*, 1981, Sawaya *et al.*, 1984, El-Boushy and Van der Poel 1994) reported that date waste are poorly digested by poultry and resulted in relatively poor productive performance. Moreover, the lower levels of critical essential amino acids such as lysine, methionine, leucine and isoleucine in date waste are not enough to meeting the requirements for birds (Nwokolo, *et al.*, 1976) and Onwudikee *et al.*, (1986a, 1986b and 1988). For these reasons an effective use of date waste can be achieved by combining it with other good protein sources (supplementary effect) to provide better amino acid balance (Onwudikee *et al.*, 1986a, 1986b and 1988). In addition, Yeong et al., (1981) confirmed this trend and concluded that birds fed proper well balanced diets could be able to tolerate high level of date waste.

CONCLUSION

This was clearly demonstrated in this study, the best performance was seen when 16% DWM or 10% DPM were incorporated in the layer diets. This would lead to conclude that date waste (DWM and DPM) could be replaced yellow corn without any adverse effect. Generally, exotic breed (WL) had significant superior performance compared to the crossbred (SL). More studies to improve (Genetically and environmental) Baladi Saudi chicks as local breed are needed.

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تأثير مخلفات التمور(التمور الكاملة ونوى التمور) على الأداء الإنتاجي ، مكونات وجودة البيض لكل من الدجاج البلدي السعودي والليجهورن البياض

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نظرا لارتفاع محتوى التمور من الكربوهيدرات ، يمكن استعمالها كمصدر للطاقة في علائق الدواجن. يهدف هذا البحث إلى معرفة مدى إمكانية استعمال مخلفات التمور (التمور الكاملة ونوى التمور) من خلال الإحلال الجزئي محل الازرة الصفراء في علائق الدجاج البياض. تمت التغذية على ٨ معاملات غذائية بكل منها ١٣ طائر بصورة فردية ، عليقة مقارنة (خالية من مخلفات التمور) ، ٣ مستويات من مسحوق التمور (٨،١٦،٢٤%)، ٣ مستويات من مسحوق نوى التمور(٥،١٠،١٥%). وكانت العلائق التجريبية (١-٧) متساوية في محتواها من الطاقة والبروتين، وتم تجربة عليقة تجارية لانتاج بيض المائدة (معاملة ٨). أجريت هذه التجربة على عدد ٢٠٨ دجاجة بياضة (٨ معاملات x ١٣ دجاجة/ معاملة x ٢ سلالة) من سلالتين (سلالة الليجهورن الأبيض وسلالة خليط - دجاج الليجهورن الأبيض x دجاج البلدي السعودي) ، وتم تسكين الطيور في بطاريات (أقفاص فردية) واستمرت التجربة لمدة ١٢ أسبوع وكان متوسط عمر الطيور في كلا السلالتين حوالي ٣٠ أسبوع. يمكن تلخيص أهم النتائج في الآتي:

١)-أظهرت نتائج التغذية على العليقة التجارية (المعاملة ٨) انخفاض معنوي للأداء الإنتاجي للطيور مقارنة بالمعاملات الغذائية الأخرى.

٢) التغذية على علائق تحتوى على ١٦ % مسحوق التمور (المعاملة ٣) أو ١٠%مسحوق نوى التمور (المعاملة ٦) أدى إلي تحسن في كل من: معدل إنتاج البيض (%) ، وزن البيضة (جم) ، كتلة البيض وكفاءة تحويل الغذاء (كجم غذاء/كجم بيض) مقارنة بالعليقة الكنترول أو المعاملات الغذائية الأخرى.

٣) مكونات البيضة من حيث النسب المئوية لكل من الصفار ، البياض ، القشرة كانت أفضل للطيور المغذاة على علائق تحتوى على ١٦ % مسحوق التمور أو ١٠%مسحوق نوى التمور مقارنة بالعليقة الكنترول أو المعاملات الغذائية الأخرى ، بينما لم يظهر التحليل الكيماوي للبيض (% البروتين ، % الدهن ، % الرماد) أي تأثير يذكر.

٤) اختبارات جودة البيض وتشمل: مواصفات قشرة البيضة (سمك القشرة ، كثافة القشرة ، مسطح القشرة ، وزن القشرة/ وحدة من مسطح القشرة) كانت أفضل للطيور المغذاة على علائق تحتوى على ١٦ % مسحوق التمور أو ١٠%مسحوق نوى التمور مقارنة بالعليقة الكنترول أو المعاملات الغذائية الأخرى ، بينما لا يوجد أي تأثير يذكر على كل من البقع الدموية واللحمية وكذلك وحدات هاوف للبيض المختبر.

٥) كانت الفروق بين المعاملات الغذائية (المعاملة ١-٨) معنوية لبعض هذه القياسات.

٦) سلالة الليجهورن الأبيض أظهرت تفوقا عالي المعنوية على السلالة الخليط لبعض القياسات (الأداء الإنتاجي ، مكونات البيضة ، التحليل الكيماوي للبيض واختبارات جودة البيض).

٧) كان تأثير التفاعل والتداخل بين (المعاملة x السلالة) معنويا لمعظم القياسات.

توصى نتائج هذه الدراسة بإحلال ١٦ % من مسحوق التمور أو ١٠% مسحوق نوى التمور محل الازرة الصفراء حيث كان التأثير مساويا أو متفوقا على عليقة الكنترول وبدون أدنى تأثير سلبي يذكر على كل من الأداء الإنتاجي ، مكونات البيضة ، التحليل الكيماوي للبيض واختبارات جودة البيض للدجاج البياض . يتطلب أداء الدجاج البلدي السعودي مزيد من الدراسة في مجالي التحسين الوراثي والبيئي.