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UTILIZATION OF DATE STONE MEAL IN LAYING JAPANESE QUAIL DIETS

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A total number of 120 Japanese quail (80 females and 40 males) at 4 weeks of age were used in an experiment lasted for 22 weeks. The experiment aimed to study the utilization of date stone meal (DSM) in laying Japanese quail diets. Quail were classified into 4 equal experimental groups of 20 females each. The DSM was used at a percentage of 0,10,15 or 20 % in the diets. The experimental diets were isonitrogenous (20% crude protein) and isocaloric (2900 kcal ME/kg). At 15 weeks of age, males were transferred to female cages (one male per two female) for twenty minutes for five days, the eggs were then collected and incubated.

The final live body weight and body weight change during the productive performance period were decreased significantly ($P<0.05$) with increasing DSM level in the diet, the DSM level of 20 % recorded the lowest one.

Age at sexual maturity recorded a non-significant difference among groups, while first egg weight, egg number and egg mass during the whole experimental period recorded a significant difference ($P<0.05$) among groups.

It is worthy noting that feed intake (g/day) decreased significantly ($P<0.05$) with increasing DSM levels, however 20 % DSM recorded the lowest one.

Feed conversion ratio (g feed /g egg mass) revealed significantly ($P<0.05$) decreased with increasing of DSM level in diet.

Hatchability percentage recorded a non-significant difference among groups.

Egg weight (g), yolk, yolk index and egg shape percentage showed significant ($P<0.05$) decrease among the experimental groups, while albumen % and shell thickness (mm) showed a non-significant decrease between groups.

Digestibility coefficients of OM, CP, CF, NFE % and the nutritive values expressed as DCP, TDN % and ME

(kcal/kg) were significantly varied among experimental groups.

The 10 % DSM group showed the best net return as well as the highest value of economic efficiency among experimental groups.

Keywords: Quail, date stone meal, productive performance, egg quality, digestibility and economical efficiency.

In Egypt, the production of quail in the desert and newly reclaimed areas is very limited. This may be due to the high costs of feedstuffs in these regions, since the feed alone accounts about 65-70 % of the total cost of poultry production. Many available agro-industrial by-products such as date stone meal are prevailing in the desert and recently the newly reclaimed areas can be used in feeding laying quail as cheap untraditional feedstuffs.

Date stone meal content is rich in various nutrients. Nwokolo *et al.* (1976) found that date stone meal can be successfully utilized as protein source in poultry diet. Kholif and Abo El-Nor (1993) reported that the protien of date stone consists of seven amino acids namely aspartic, glutamic, arginine, proline, threonine, methionine and lysine. Abd El-Nabey (1999) found that the major amino acids in date stone were glutamic, aspartic and arginine being 17.79, 10.93 and 8.68 g/100g protein, respectively. Lysine and methionine, which are well known as limiting amino acids in diets based on cereals and legumes were slightly higher in date stone being 6.87and 2.69 g/100 g protein, respectively, while indicated that the minerals in date stone K, P, Ca, Mg and Na were the major minerals and microelements such as Fe, Mn, Zn and Cu were found in low concentrations. Date stone meal can be used to replace yellow corn partially as an energy source in poultry diets (Kamel *et al.*, 1981 and Nour *et al.*, 1986).

There are many researches on the used date stone meal in poultry diets. In broiler diets (Jumah *et al.*, 1973; Kamel *et al.*, 1981 and Abd El-Mageed, 1993). in laying hen diets (Radwan *et al.*, 1997 and Abd El-Rahman *et al.*, 1999) and in quail diets (El-Bogdady, 1995 and El-Bogdady *et al.*, 1995). There is little information in literature concerning the use of date stone meal particularly in feeding laying quail.

The main objective of the present work was the utilization of date stone meal as agro-industrial by-product and its effect on productive performance of laying Japanese quail.

MATERIALS AND METHODS

The present experiment was carried out at Maryiout Experimental Research Station (South West of Alexandria), which belongs to the Desert Research Center. A total number of 120 Japanese quail (80 females and 40 males) at 4 weeks of age were used in an experiment lasted 22 weeks. Experimental Japanese quail (*Coturnix coturnix japonica*). Were kept under similar managerial, hygienic and environmental conditions and were divided randomly into four equal experimental groups (20 females in each group). Quail were kept in batteries, which were divided into separate cages, where two females were housed in each cage.

The first group was fed the basal diet as a control (0 % DSM), while the other three groups were fed diets containing either 10,15 or 20 % DSM. The quail were housed in cages at 4 weeks till 22 weeks of age.

The experimental diets (Table 1) were formulated according to N.R.C. (1994) and were isonitrogenous (20% CP) and isocaloric (2900 kcal ME/kg). Feed was offered ad *libitum* and fresh water was available all time. Chemical analysis of DSM, the experimental diets and dried excreta were assayed using methods of A.O.A.C (1990).

Proximate chemical analysis of DSM indicate that crude protein (CP) content was 7.65%, while crude fiber (CF), ether extract (EE), nitrogen free extract (NFE) and ash were 10.57, 7.91, 62.10 and 2.15 %, respectively.

During the experimental period, individual live body weight and feed intake were determined biweekly. Feed conversion ratio (g feed intake / g egg mass) was calculated and the mortality was recorded every day.

Age at sexual maturity was determined at the first egg laying. Eggs were collected daily and weighed for each group, so egg number, egg mass were calculated during the experimental period. At 15 weeks of age, 20 eggs were randomly taken from each group and were used to evaluate egg quality; yolk weight and shell weight were recorded. Shell thickness (without membrane) was measured by micrometer, while albumen weight was calculated by subtracting yolk and shell weight from egg weight. Yolk, shell and albumen percentage were calculated as a percentage of egg weight.

Males were housed individually in cages (one quail per cage) and fed the same diets for females. At 15 weeks of age, males (40 males) were transferred to female cages (one male per two female) for twenty minutes for five days, the eggs were then collected and incubated. Hatchability percentage was calculated for each group.

At the end of the experimental feeding period, digestion trials were conducted using 20 adult quail males (five from each treatment) to determine the digestibility coefficients of the experimental diets as affected by DSM levels. Males were housed individually in metabolic cages. The digestibility trials extended for 9 days of them 5 days as a preliminary period followed by 4

days as collection period. The individual live body weights were recorded during the main collection period to determine any loss or gain in the live body weights. During the main period, excreta were collected daily and weighed dried at 60 °C bulked, finally ground and stored for chemical analysis. The faecal nitrogen was determined according to Jakobsen *et al.*(1960). Urinary organic matter was calculated according to Abou-Raya and Galal (1971).

The digestion coefficients % of dry matter, organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and nitrogen free extract (NFE) of the experimental diets were estimated. The nutritive values expressed as digestible crude protein (DCP), total digestible nutrients (TDN) were calculated. Metabolizable energy (ME) was calculated as 4.2 kcal per gram TDN as suggested by Titus (1961).

The economical efficiency of feed was calculated from the input-output analysis based upon the differences in feed conversion ratio and feeding cost/kg egg.

Statistical analysis was carried out using General Linear Model (GLM) procedures by SAS program (1996) using simple one-way analysis of variance according to this model:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:

Y_{ij} = Represented observation in j^{th} DSM level.

μ = Overall mean.

T_i = Effect of j^{th} DSM level (j = 0,10,15, 20%).

e_{ij} = Random error.

Duncan's New Multiple Range Test (Duncan, 1955) separated differences among treatment means.

Regression equations analysis of egg weight, egg number, egg mass, feed intake and feed conversion ratio were undertaken to clarify the relation between these parameters and DSM content in the experimental diets.

RESULTS AND DISCUSSION

Live Body Weight and Body Weight Change

Effects of feeding different levels of date stone meal on productive performance of quail females are summarized in table (2). The final live body weight and body weight change during the whole experimental period varied significantly ($P<0.05$) between the experimental groups.

It is worthy noted that live body weight decreased with increasing the DSM level in the diet. The DSM level at 10 % resulted in 2.03 % lower body weight than that of the control group, while 15 % or 20 % DSM recorded 3.66 % and 8.03 % lower values than that of the control group, respectively.

TABLE (1). Composition and proximate chemical analysis of the experimental diets.

Ingredients,%	Levels of date stone meal			
	Control (0)	10%	15%	20%
Date stone meal	0.00	10.00	15.00	20.00
Yellow corn	59.84	53.10	50.70	46.30
Soybean meal (44% CP)	6.30	8.37	12.00	9.00
Protein concentrate*	10.00	10.00	10.00	10.00
Corn gluten meal (60%CP)	9.70	9.00	6.80	8.56
Wheat bran	8.44	4.00	0.00	0.00
Limestone ground	4.30	4.30	4.30	4.30
Dicalcium phosphate	0.50	0.50	0.45	0.65
Vit. and min. premix**	0.30	0.30	0.30	0.30
L-lysine	0.20	0.22	0.18	0.25
Dl- methionine	0.22	0.21	0.27	0.26
Total	100	100	100	100
Proximate chemical analysis %				
Crude protein	20.21	20.14	25.16	20.25
Crude fiber	3.35	3.48	5.83	4.05
Ether extract	3.98	3.91	4.99	4.22
Calculated values				
Metabolizable energy (kcal/kg)***	2900	2900	2900	2900
Calcium %	2.91	2.93	2.91	2.93
Available phosphorus %	0.30	0.35	0.30	0.30
Methionine %	0.46	0.45	0.45	0.45
Lysine %	1.00	1.00	1.00	1.00
Methionine + Cystin %	0.70	0.70	0.70	0.70
Price /kg diet (L.E.)****	1.38	1.36	1.34	1.30

* Protein concentrate contained, 52 % Crude protein, 2.03% Crude fiber, 6.17% Ether extract, ME 2800 (kcal/kg),1.50 % Methionine,2.0% Methionine & Cystin, 3.0 %Lysine 7.00% Calcium, 2.93 % Available Phosphorus and 2.20 % Nacl.

** Each 3 kg Vitamins and minerals premix contains (per ton of feed), Vit. A 10000000 IU. Vit. D_3 2000000 IU. Vit.E 10g. Vit.K_3 1000 mg. Vit. B_1 1000 mg. Vit. B_2 5000mg. Vit. B_6 1.5g. Vit. B_{12} 10 mg. Pantothenic acid 10g. Niacin 30g. Folic acid 1g. Biotin 50 mg. Iron 30g. Manganese 70g. Choline chloride 10g. Iodine 300 mg. Copper 4g. Zinc 50g and Selenium 100 mg.

*** Calculated according to NRC of poultry (1994) and metabolizable energy of DSM 2675 kcal /kg according to Abd El-Galil *et al.* (2005).

****Calculated according to price of feed ingredients at the time of the experiment.

Price of one-ton date stone meal 420 LE.

It is worthy noting that feeding quail on 10 % DSM resulted in 1.46 % lower in body weight change than that of the control group, while increasing the DSM level to 15 or 20 % resulted in 9.29 % and 15.39 % lower values than that of the control group, respectively.

The reduction in live body weight apparently being related to a significant decline in feed intake. The inclusion of progressively higher quantities of DSM in the diets may have reduced the energetic value of diet and decrease in digestibility of nutrients in diets contained DSM at any level from 10 to 20 %, also may be the presence of tannins, which decrease palatability and depressing of body weight gain. Baehum and Peterson (1964)

found that the added tannin diet had a pronounced depressing effect on the body weight gain of the chicks by about 6%.

These results agreed with those of Jumah et al. (1993) who found that the body weight gain of broiler fed diets with 5, 10 or 15% DSM were lower than the control group. Similarly, Soliman (1996) noticed a decrease in chicks fed 5, 10 or 15% DSM and this decrease in body weight gain was significant at 10 and 15% levels. El-Bogdady (1995) and Abd El-Gabl et al.(2005) recorded that live body weight and body weight gain decreased with the inclusion of DSM at any levels in growing quail diets.

Age at Sexual Maturity

Age at sexual maturity ranged from 40.20 to 47.55 day, showing that DSM levels in laying quail diets did not affect this trait as shown in table (2). Level of 20% DSM was recorded early sexual maturity in comparison to the other groups.

The early sexual maturity in level of 20% DSM may be due to the effect of steroid hormone. Rizk (1986) reported that date seeds contained estrone hormone (estrone has estrogenic activates) at the rate of 1.9 mg/kg. Jacoby et al.(1992) indicated that estradiol hormone (estradiol has estrogenic activates) could early sexual maturity when given to White Leghorn pullets.

TABLE (2). Effect of feeding different levels of date stone meal on the productive performance (mean ± SE) of laying quail.

Items	Levels of date stone meal				Sig
	Control (0)	10 %	15 %	20 %	
Initial live body weight (g)	115.49±0.53	112.38±0.91	118.88±0.22	116.19±0.40	ns
Final live body weight (g)	250.81±0.56[a]	241.35±5.90[ab]	241.65±6.58[ab]	230.7±08.12[b]	*
live body weight change (g)	135.34±0.55[a]	129.59±5.61[a]	122.77±5.28[ab]	114.51±0.35[b]	*
Age at sexual maturity/ bird/day	48.20±0.11	48.15±0.13	47.55±0.14	40.55±0.16	ns
First egg weight (g)	11.40±0.09[a]	11.26±0.01[a]	10.61±0.01[ab]	10.03±0.04[b]	*
Egg weight (g)	11.35±0.11[a]	11.03±0.18[a]	10.98±0.15[b]	9.03±0.13[b]	*
Egg number/bird/ day	0.63±0.02[a]	0.63±0.01[a]	0.61±0.04[ab]	0.58±0.06[b]	*
Egg mass (g)/ bird/day	7.15±0.05[a]	6.91±0.06[a]	6.18±0.09[b]	5.36±0.17[b]	*
Feed intake (g)/ bird/day	29.23±0.11[a]	28.84±0.12[a]	26.48±0.11[b]	24.66±0.15[b]	*
Feed conversion ratio	4.09±0.05[b]	4.12±0.07[b]	4.29±0.06[ab]	4.62±0.08[a]	*
Mortality rate %	0.00	0.00	0.00	0.00	
Hatchability %	80.12±5.82	80.41±5.37	78.51±6.01	77.80±10.27	ns

[a,b] Means within the same row showing different letters are significantly different Sig =Significance, *=(P<0.05), ns=not significant.

Weight of First Egg

Results on first egg weight recorded a decrease ($P<0.05$) among groups. It was noticed that there was a decrease in weight of first egg with the increase of DSM % in the diets. It is worthy noting that feeding quail on 20 % DSM recorded lower values that may be attributed to early sexual maturity compared to other experimental groups (Table 2).

Egg Weight

Egg weight during the whole experimental period of laying quail showed linear decrease ($P<0.05$) with increasing DSM levels. It is worth noting that substitution of diet by 20 % DSM decreased ($P<0.05$) egg weight by 17.95 % and 20.26% compared to that of the 10 % DSM and the control group, respectively, while this decrease by 2.82 % between 10 % DSM and the control group one (Table 2). The reduction in egg weight may be attributed to the decrease in feed intake and digestibility of dietary nutrient

This relationship between egg weight (EW) and dietary DSM levels could be defined by the following regression equation:

$$EW = 11.64\text{-}0.11\ X$$
$$r^2 = 0.85, (P<0.05).$$

Where: X = level of date stone meal.

This result agreed with those of Vandepopuliere *et al.* (1995) who found a decrease in egg production and egg weight of laying quail fed diets containing 10 % and 15 % DSM. Abd El-Rahman *et al.* (1999) noticed a large drop in egg production of laying hens with 13% DSM.

Moreover, Hermes and Al-Homidan (2004) reported that laying hen fed 10 % DSM recorded lower reduction in egg weight as compared with those fed 15 % DSM. El-Bogdady (1995) reported that incorporation of DSM up to 12 % in the diet of laying quail had no effect in reducing egg weight.

Egg Number and Egg Mass

Results in table (2) indicate that egg number and egg mass during the whole experimental period significantly varied ($P<0.05$) among experimental groups. It is worthy noting that egg number decreased with increasing levels of DSM in diet, this may be due to the differences in sexual maturity. It is clear that substitution of diet by 15 or 20 % DSM decreased egg number by 3.17 or 6.35 than that of the control group, respectively, while the egg number was similar in quail receiving 10 % and the control group.

Regression equation were obtained for egg number (En) as affected by DSM level as in the following equation:

$$En = 0.63\text{-}0.001\ X$$
$$r^2 = 0.75, (P<0.05).$$

Where: X = level of date stone meal

Egg mass has a gradual decrease in quail fed diets containing DSM level as compared with the control. It is clear that substitution of diet by 20 % DSM decreased egg mass by 23.17 % or 25.31% lower than that of 10 % DSM or the control group, respectively, while the decreased was only 2.80 % between 10% DSM and the control group.

The relationship between egg mass (Em) and DSM levels could be defined by the following regression equation:

$$Em = 7.39 - 0.09\ X$$
$$r^2 = 0.83,\ (P<0.05).$$

Where: X = level of date stone meal

A large drop that was noticed in egg number and egg mass of 20 % DSM level may be due to decreased in feed intake and the effect of steroid hormone. Hamza (1978) and Rizk (1986) reported that date seeds contained estrone hormone at the rate of 1.9 mg/kg. Moreover, EL-brady (1987) reported that estrone has estrogenic activates, synthesis and release of hormones are creating ways of negative or positive feed back mechanism when increase of estrone hormone in large doses, it resulted an action to inhibition of synthesis and reduced FSH and LH, respectively, leading to atrophy of the ovary and inhibition of ovulation.

This result agrees with the finding of Abd El-Rahman *et al*.(1990) who reported that the DSM up to 10 % in laying hen diets had no significant effect on egg number and egg weight. El-Bogdady (1995) noticed no significant difference in egg number and egg weight up to 12 % DSM in laying. Vandepopuliere *et al*.(1995) obtained a non significant decrease in egg number of laying quail after incorporation of DSM in quail diets up to 15 % level.

Feed Intake

Feed intake (g/day) during the whole experimental period was decreased significantly (P<0.05) among the experimental groups. It is worthy noting that feed intake decreased with increasing DSM level in the diet from 0 to 20%. The DSM level of 20 % recorded the lowest one (Table 2).

It is clear that substitution of diet by 20 % DSM decreased feed intake by 13.90 % or 15.63% than that of 10 % DSM or the control group, respectively, while this decrease by 2.02 % between 10% and the control group.

The relationship between feed intake (FI) and DSM levels could be defined by the following regression equation:

$$FI = 29.80 - 0.23\ X$$
$$r^2 = 0.89,\ (P<0.05).$$

Where: X = level of date stone meal.

The decrease in FI may be due to the presence of tannins, which may decrease palatability of feed. It may also be concluded that the 10% level

had a better palatability than other treatments of DSM. Attalla and Harraz (1996) recorded that date seeds contained from 1.59-3.48 % tannins. Makkar (1995) indicated that tannin could decrease palatability through precipitation of salivary glycoproteins.. Moreover, Distle and Provenza (1991) reported that phenols in blood may stimulate emetic receptors in mid brain and brain stem, causing a conditioned food aversion and reduced FI.

In accordance with the present data, El- Bogdady *et al.* (1995) found that chicks of quail fed 10 and 15% DSM consumed less feed than the control group. El-Kerdawy *et al.*(1998) recorded a non significant decrease in FI in rabbits fed 5,10 and 15% DSM. Abd El-Fattah (1990) indicated that average FI of ducklings receiving DSM was lower than that of the control group.

In this study, it may also be concluded that the 10% level has a better palatability than other levels of DSM.

Feed Conversion Ratio

Feed conversion ratio (g feed /g egg mass) revealed significantly ($P<0.05$) decreased with increasing of DSM level in diet (Table 2).

It is clear that substitution of diet by increasing DSM level tend to get worst of feed conversion ratio, the 10% DSM level was better than in 15% or 20% DSM. The improvement in feed conversion ratio of 10 % DSM level may be due to its highest egg mass as compared to that of DSM levels till 20%.

The relationship between feed conversion ratio (FCR) and DSM levels were defined by the following regression equation:

$$FCR = 4.01 + 0.02\,X$$

$$r^2 = 0.74, (P<0.05)$$

Where: X = level of date stone meal

Similarly, Hermes and Al-Homidan (2004) found no negative effect on daily FI of laying hens fed 5,10 or 15 % DSM and the best FCR was detected with 10% DSM, while the worst FCR was found in birds fed higher levels of DSM. However, Abd El-Rhman *et.al.*,(1999) have found that incorporation of 13 % DSM in feeding laying hen decreased FI and FCR significantly. El-Bogdady (1995) found that FCR was not affected after using DSM till 12 % DSM in laying quail diet.

Hatchability

Results on hatchability percentage in the present study recorded a non-significant difference among groups (Table 2). Similar results on laying quail were recorded by El-Bogdady (1995) who observed no significant effect of DSM levels till 12%.

Egg Quality Traits

The relationship between diets containing different levels of DSM and egg quality in comparison with the control diet is shown in table (3).

Data on egg weight, yolk, Yolk index and egg shape percentage were significantly decreased by increasing DSM, while eggshell percentage increased (P<0.05) by increasing DSM. On the other hand, albumen % and shell thickness (mm) showed a non significant decrease among groups.

In agreement with the previous results, Hermes and Al-Homidan (2004) found that the best egg components of laying hens were seen when 10% DSM was incorporated in diets. Radwan *et al.*(1997) also found no significant effect of DSM on egg quality measurements up to 30 % DSM in diets of laying hen. Moreover, Abd El-Rahman *et al.*(1999) recorded no significant effect on egg quality of laying hens after using different levels of DSM till 13%.

Digestibility and Nutritive Values of The Experimental Diets

Digestion coefficients of nutrients content as affected by the different levels of DSM are illustrated in table (4) and fig (1). Results indicate a highly significant (P<0.01) decrease in digestibility coefficients of CP and CF% by the increasing of DSM in the experimental diets. On the other hand, significant differences (P<0.05) were noticed in digestibility of OM, EE and NFE among the experimental diets.

TABLE (3). Egg quality (mean±SE) as affected by date stone meal level in laying quail diets.

Items	Levels of date stone meal %				Sig
	Control (0)	10	15	20	
Egg weight (g).	11.56±0.04^{a}	11.23±0.06^{a}	10.75±0.09^{b}	9.50±0.08^{b}	*
Yolk %	31.15±0.02^{a}	31.11±0.07^{a}	30.97±0.06^{ab}	30.81±0.11^{b}	*
Albumen %	55.46±0.05	55.24±0.10	55.15±0.07	54.07±0.05	n.s.
Egg shell %	13.39±0.07^{b}	13.65±0.07^{ab}	13.88±0.04^{a}	14.12±0.03^{a}	*
Yolk index %	48.74±0.03^{a}	48.01±0.05^{a}	47.12±0.06^{ab}	44.35±0.07^{b}	*
Egg shape %	78.98±0.01^{a}	77.59±0.04^{a}	75.13±0.07^{ab}	74.60±0.05^{b}	*
Shell thickness (mm)	0.241±0.03	0.238±0.02	0.236±0.04	0.232±0.03	n.s

^{a,b}:Means within the same row showing different letters are significantly different. .Sig.=Significance. *= (P<0.05).), ns=not significant.

TABLE (4). Digestibility coefficients and nutritive values (mean±SE) of experimental diets as affected by date stone meal level.

Items	Levels of date stone meal %				Sig
	Control (0)	10	15	20	
Apparent digestion coefficients %					
OM	80.50±1.22^{a}	79.82±1.28^{a}	76.83±1.67^{ab}	73.58±2.04^{b}	*
CP	81.98±1.20^{a}	78.15±1.49^{a}	75.20±2.51^{ab}	70.12±3.63^{b}	**
CF	24.86±1.04^{a}	19.52±1.06^{ab}	15.66±1.07^{b}	13.21±1.10^{b}	**
EE	86.63±1.82^{b}	87.94±0.90^{ab}	88.24±0.85^{a}	89.11±0.79^{a}	*
NFE	87.89±1.10^{a}	85.97±0.60^{a}	84.01±0.51^{ab}	81.32±1.20^{b}	*
Nutritive values					
DCP%	16.57±0.30^{a}	15.74± 0.42^{a}	15.16 ±0.30^{ab}	14.99±0.90^{ab}	**
TDN%	64.86 ±1.20^{a}	62.06 ±2.01^{a}	60.86±1.75^{ab}	58.82±1.95^{b}	*
ME (kcal/kg)	2724±12.20^{a}	2607±13.50^{ab}	2556±16.57^{b}	2470±20.80^{b}	*

^{a,b}: Means within the same row showing different letters are significantly different. .Sig.=Significance.*=(P<0.05).**=(P<0.01).

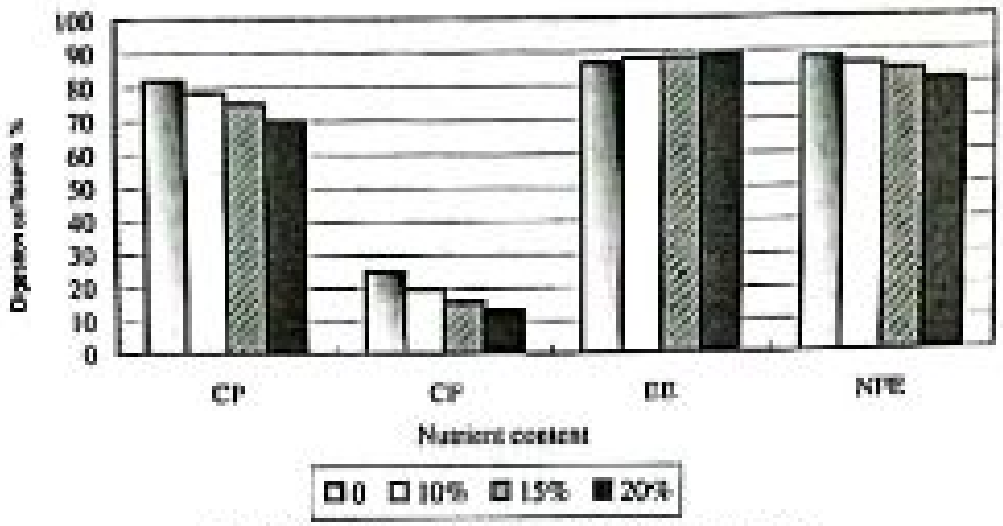

Fig.(1): Digestion coefficients of experimental diets of quail fed diets containing different levels of DSM

Regarding the nutritive values, it is clear that DCP, TDN % and ME (kcal/kg) of the experimental diets were significantly decreased with increasing DSM up to 20%. It is of great importance to note that the results of the digestion trial were coincided generally with the negative response in productive performance of quail fed DSM.

The reduction in digestibility and nutritive values of the experimental diets may be attributed to lignin and tannin content of DSM, Ibrahim (1998) estimated fiber fractions in DSM as 42.30, 60.97,18.67, 29.31 and 12.99% for acid detergent fibers, neutral detergent fibers, hemicellulose, cellulose and lignin, respectively.

The decrease in nutrients digestibility may also caused by the presence of tannins, which may adversely affect the nutrition of herbivores through inhibition of digestion as suggested by Reed *et al.*(1990) who reported that tannins may reduce cell wall digestibility by forming indigestible complexes with cell wall carbohydrate. Awad (2005) recorded that DSM contained 5.1% tannins. Such tannins are naturally occurring as polyphenolic compounds and from complexes with macromolecules (proteins, cellulose, hemicellulose, starch), minerals and vitamins, which affect their availability in man and animals (Makkar, 1993). Also, tannins reduce the amino acid (Armstrong *et al.*, 1974) and metabolizable energy of diet (Cous *et al.*,1982).

Economic Efficiency of Feed

Results of economic efficiency for laying quail diets containing DSM are presented in table (5) and fig (2).

Data indicate that increasing DSM levels in diets of quail decreased cost of kg feed where 20% DSM recorded the lowest price followed by 15 and 10% DSM.

TABLE (5). Economic efficiency as affected by date stone meal level in laying quail diets.

Traits	Levels of date stone meal			
	Control (0)	10%	15%	20%
Feed conversion ratio	4.09	4.12	4.29	4.62
Cost of kg feed (L.E.)	1.38	1.36	1.34	1.30
Feed cost of kg egg (L.E.)	5.64	5.60	5.75	6.01
Market price of one kg egg (L.E.)	10.00	10.00	10.00	10.00
Net return (L.E.)	4.36	4.40	4.25	3.99
Economic efficiency of feed	77.30	78.57	73.91	66.39
Relative economic efficiency	100	101.64	95.61	85.89

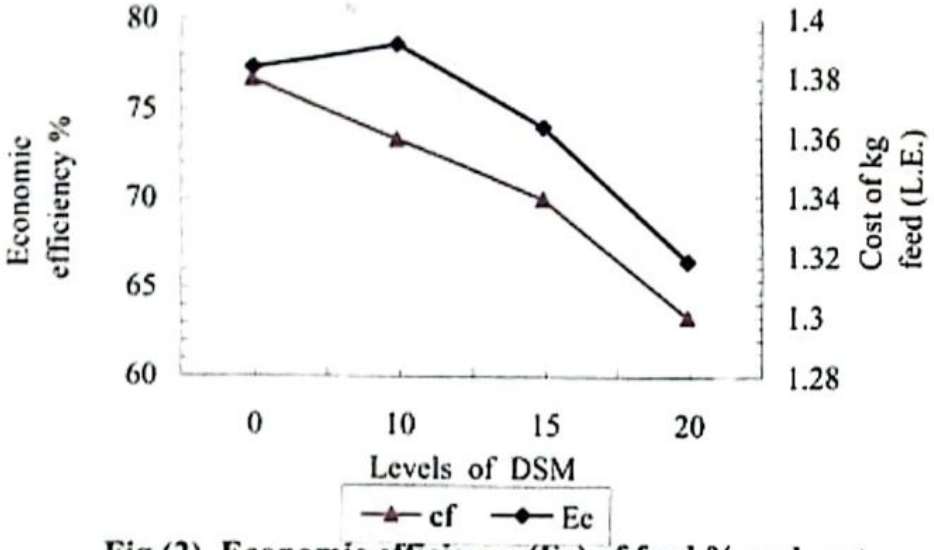

Fig.(2). Economic efficiency (Ee) of feed % and cost of kg feed (cf) of different levels of DSM by laying quail

It was noticed that 10 % DSM group showed the best net return as well as the highest value of economic efficiency among experimental groups. It recorded the highest economic efficiency, this is due to decrease in feed cost of kg egg and because of its feed conversion ratio was the best, while 20% DSM recorded the lowest net return and economic efficiency.

CONCLUSION

From the nutritional and economic efficiency points of view, the use of 10% level of DSM as feed resource for laying quail was superior and did not cause any adverse effect on their productive performance.

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الاستفادة من مسحوق نوى البلح في علائق السمان الياباني البياض

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استخدم في هذا البحث عدد ١٢٠ طائر سمان ياباني عمر ١ أسابيع و حتى عمر ٢٢ أسبوع. استهدفت التجربة تقييم الاستفادة من مسحوق نوى البلح في علائق السمان الياباني البياض بحيث قسمت الإناث (٨٠ أنثى) إلى أربع مجموعات تجريبية متساوية. اشتملت كل مجموعة على ٢٠ أنثى سمان، بينما قسمت الذكور (٤٠ ذكر) إلى أربع مجاميع متساوية (١٠ ذكر لكل مجموعة). غذيت الطيور حتى عمر ٢٢ أسبوع على نسب متدرجة من مسحوق نوى البلح ٠ ، ١٠ ، ١٥ و ٢٠ % من مكونات العليقة. وكانت العلائق المستخدمة متشابهة في نسبة البروتين الخام ٢٠ % والطاقة الممثلة ٢٩٠٠ كيلو كالوري /كيلوجرام. عند عمر ١٥ أسبوعا تلقت الذكور للإناث بنسبة ثلاثية ٩ أنثى:١ ذكر لمدة ٢٠ دقيقة يوميا لمدة خمسة أيام لتقدير نسبة الخصب.يمكن إيجاز أهم النتائج في النقاط التالية:

١- سجل كل من وزن الجسم الحي والتغير في وزن الجسم انخفاضا معنويا(عند مستوى ٥%) مع زيادة نسبة إضافة مسحوق نوى البلح ، وقد سجلت المجموعة ٢٠ % أكثر القيم انخفاضا مقارنة بباقي نسب إضافة مسحوق نوى البلح.

٢- لم يسجل العمر عند النضج الجنسي فروقا معنوية ، بينما سجل وزن البيضة الأولي ووزن وعدد وكتلة البيض اختلافا معنويا (عند مستوى ٥%) بين المجموعات أثناء الفترة التجريبية.

٣- لوحظ انخفاض معدل استهلاك الغذاء انخفاضا معنويا (عند مستوى ٥%) وذلك بزيادة نسبة إضافة مسحوق نوى البلح في العليقة.وقد سجلت المعاملة المغذاة على ٢٠ % أكبر ذلك القيم انخفاضا لاستهلاك الغذاء.

٤- سجل معدل تحويل الغذاء(جم غذاء مستهلك / جم كتلة البيض) انخفاضا معنويا(عند مستوى ٥%) وذلك بزيادة نسبة إضافة مسحوق نوى البلح.

٥- سجلت النسبة المئوية للفقس انخفاض غير معنوي بزيادة نسبة إضافة مسحوق نوى البلح.

٦- سجلت النسبة المئوية للصغار وقليل الصغار انخفاضا معنويا (عند مستوى ٥ %) بينما سجلت النسبة المئوية للبياض وسمك قشرة البيضة انخفاض غير معنوي بزيادة مستويات إضافة مسحوق نوى البلح في العليقة.

٧- حدث انخفاض معنوي (عند مستوى ٥ %) في شكل البيضة وذلك بزيادة نسبة مسحوق نوى البلح في العليقة.

٨- أظهرت معاملات الهضم الظاهرية لكل من البروتين والإيثر الخام انخفاضا معنويا (عند مستوى ١ %) و كان الانخفاض معنويا (عند مستوى ٥ %) لمعاملات هضم المادة العضوية والمستخلص الخالي من النتروجين، بينما ارتفع معامل هضم مستخلص الإثير ارتفاعا معنويا (عند مستوى ٥ %) بزيادة مستويات الإضافة لمسحوق نوى البلح في العليقة.

٩- تم استنتاج معادلات خط الانحدار التي تمثل العلاقة بين نسبة إضافة مسحوق نوى البلح وزن البيضة وعدد وكتلة البيض ومعدل استهلاك الغذاء ومعدل التحويل الغذائي.

١٠- حققت المجموعة المغذاة على ١٠ % مسحوق نوى البلح أفضل عائد مالي للتنبية بالإضافة إلى أفضل كفاءة اقتصادية مقارنة بباقي المعاملات.

من الوجهة الغذائية والاقتصادية توصي الدراسة بإمكانية استخدام مسحوق نوى البلح في علائق السمان البياض حتى مستوى ١٠ % دون تأثير سلبي على معدلات أداء الإنتاج والعائد الاقتصادي.