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Egg Size of Saudi Local Layers as Affected by Line of the Bird (Body Weight at Sexual Maturity) and Dietary Fat Level

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Abstract: Egg size is an important economic factor that determines the profitability of the producer. Most of the eggs produced by the local birds are small and do not command market price. Nutrition and Management may play an important role in altering the size of the egg. This study was conducted to evaluate the use of different weight groups at sexual maturity (line of the bird) and different levels of supplemental fat on performance and egg size of the Saudi local birds. To achieve that a 2 x 3 factorial arrangement was used on 120 local hens. These hens were assigned to 6 treatments namely 2 weight groups and 3 levels of added fat 0, 2 and 4% corn oil at the age of 22 weeks. Data obtained from week 22 to 28 were not included in the average performance of the birds due to the large number of missing data. Performance criteria and egg characteristics were used to test the hypothesis of the study. Result of the study showed a significant effect of linoleic acid (corn oil) on the average egg weight. There was a clear indication that as level of corn oil increased from 0 to 4%, size of the eggs increased accordingly. The effect of interaction between level of fat and line (weight) of the bird on egg weight was highly significant ($p<0.001$). Brown birds (medium in weight) responded better to the higher level of linoleic acid in the diet with 51 g of egg weight compared to the lower level of dietary linoleic acid and the control in the same group, 48.11 and 47.29 g, respectively and also to the treatments of the other group (black, small in weight). Egg production, egg mass and feed efficiency were highly affected by the two lines and the interaction with fat level favoring the 4% corn oil (when fed to the larger line (Brown birds). Effect of added fat corn oil (linoleic acid) on egg characteristics was significant ($p<0.01$) for yolk color and Haugh unit. Better Albumen quality was found with the higher level of fat (4% corn oil) but with less yellowish yolk color as measured by La-Rroche fan. In conclusion and based upon the results of this study, it is suggested that linoleic acid play an important role in maximizing the egg size of the local birds and adding 4% corn oil without jeopardizing the energy content of the ration may be a good way of improving the egg size of the Saudi local brown birds during the onset and first part of the laying year.

Key words: Egg size, Saudi local chicken, linoleic acid (fat), body weight, line, performance

INTRODUCTION

Egg size is an important economic factor that influences the profitability of egg production. In most Middle East market, a premium is paid for larger egg size. Unfortunately, eggs produced from local breeds are so small and cannot command market price. Some people in the area may purchase these egg believing have better taste than commercial eggs.

Many factors may affect egg size, one of the most influenced one on local chicken is body weight. Local breeds especially those originated in areas like Al-Hassa, Riyadh and Al-Qasim have small body size and they most likely black in color (Al-Yousef *et al*., 1995). Early in Festing and Nordskog (1967) and Sorensen *et al*. (1980) stated that Body weight and egg weight are two relevant productive traits in poultry. Similarly, Robinson and Sheridan (1982) and Summers and Leeson (1983) reveled that one of the most important factors determining egg weight is body weight of hen at the age of sexual maturity.

More recent, Najib and Al-Dosary (1992) studied the effect of grouping layers at 38 weeks of age in to 3 groups by weight (<1500, 1520-1700 and >1720 g) and fed two levels of protein on layer performance. They found small birds significantly produced smaller eggs and there was no significant interaction between protein level and weight groups. In the same line Lacin *et al*. (2008) provided evidence that eggs produced by light birds (1400-11500 g) were smaller than eggs produced by either medium (1500-1600 g) and heavy (>1600 g). In Najib and Khattab (1989) studied the productivities and profitability of caged layers with different stocking densities and weights. They found that heavy birds (15% initially heavier than light birds produced 4.4% larger eggs than light birds. The biological and economic information indicated that housing 6 light birds/cage (48 X 44 cm) was the most probable profit followed by housing 6 heavy birds/cage, they further added.

Nutrition plays an important role in manipulating the egg size of the bird. Certain components of the laying ration

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may affect egg size. Early in, Najib and Sullivan (1986) conducted a study of 16 weeks in duration to determine the effect of increasing dietary levels of linoleic acid (from corn oil) and metabolizable energy on egg size and other production parameters of Single Comb White Leghorn. Their data revealed no significant differences among the treatments pertaining to egg weight, hen-day production, feed consumption, ME intake and feed efficiency. Birds receiving 4% corn oil (2.08% linoleic acid) with higher energy level tended to produce numerically (none significantly) larger eggs, consume less feed exhibit the best feed efficiency and gain slightly more body weight as compared to birds receiving 0% corn oil and the lower energy level. They concluded that lack of obtaining significant response to linoleic acid supplementation was due to the fact that birds were not depleted from this fatty acid during the growing period.

More recent studies have shown that increasing dietary energy or dietary fat significantly increases early egg weight (Keshavarz, 1995; Keshavarz and Nakajima, 1995; Grobas *et al*., 1999; Harms *et al*., 2000; Bohnsack *et al*., 2002; Sohail *et al*., 2003, Wu *et al*., 2005). The increased egg weight with increased dietary energy or fat is mostly due to increased yolk weight (Sell *et al*., 1987; Wu *et al*., 2005). However, as dietary energy increases to a certain level, further increases of dietary energy do not increase egg weight more (Wu *et al*., 2005). This could be due to the fact that higher intake of energy will decrease other nutrients intake such as (protein, TSAA and Lys). This will result in to decreases albumen weight or percentage of albumen (Prochaska *et al*., 1996; Shafer *et al*., 1998; Novak *et al*., 2004). Increasing the intensity of the local layer feed may solve this problem. This may not be a burden on the producer since the requirements of the baladi chicken well below the foreign layer. Increasing both dietary energy and other nutrients (amino acids, Ca and available P) may have a significant effect on egg mass because of similar nutrient (protein or amino acids) intakes of hens fed different energy levels.

This study is a 2 x 3 factorial arrangement of weight groups (small and medium) and 3 levels of added corn oil, 0, 2 and 4%. Ingredients and nutrient composition of the experimental diets are depicted in Table 1. Because feed intake normally decreases with increasing dietary energy, percentage of protein, amino acids, Ca, Na and available P were increased as dietary energy increased to achieve a similar nutrient (protein, amino acids, Ca, Na and P) intake so that these factors could not interfere with the effect of dietary energy.

Table 1: Dietary treatments of local Saudi layers of different weights and fed different levels of corn oil

Ingredients	Medium weight			Light weight		
Levels of corn oil	0%	2%	4%	0%	2%	4%
Yellow corn (%)	65.35	57.92	50.52	65.35	57.92	50.52
SBM, 44 (%)	19.9	21.4	21.1	19.9	21.4	21.1
Wheat bran (%)	0.00	4.20	9.00	0.00	4.20	9.00
Fish meal (%)	6.15	5.00	5.00	6.15	5.00	5.00
Lime stone (%)	7.86	8.00	8.00	7.86	8.00	8.00
MVMIX[1]	0.10	0.10	0.10	0.10	0.10	0.10
DL. Methionine	0.10	0.20	0.20	0.10	0.20	0.20
DIC. Phosphate	0.00	0.49	0.49	0.00	0.49	0.49
Choline-CL	0.29	0.29	0.29	0.29	0.29	0.29
Salt (%)	0.25	0.25	0.25	0.25	0.25	0.25
Corn oil (%)	0.00	2.00	4.00	0.00	2.00	4.00
Antioxidant (%)	0.00	0.15	0.15	0.00	0.15	0.15
Sand	0.00	0.00	0.90	0.00	0.00	0.90
Total	100	100	100	100	100	100
Calculated composition						
Protein (%)	18	18	18	18	18	18
ME (Kcal/kg)	2800	2800	2800	2800	2800	2800
Calcium (%)	3.46	3.56	3.56	3.46	3.56	3.56
Av-phos (%)	0.32	0.38	0.38	0.32	0.38	0.38
Riboflavin (mg/kg)	1.76	1.79	1.83	1.76	1.79	1.83
Niacin (mg/kg)	24.84	30.67	37.74	24.84	30.67	37.74
PA (mg/kg)	6.29	7.44	8.59	6.29	7.44	8.59
Choline (mg/kg)	1311	1326	1331	1311	1326	1331
Methionine (%)	0.43	0.50	0.50	0.43	0.50	0.50
Met+Cys (%)	0.73	0.80	0.80	0.73	0.80	0.80
Lysine (%)	1.05	1.04	1.05	1.05	1.04	1.05
Tryptophan (%)	0.22	0.23	0.24	0.22	0.23	0.24
Threonine (%)	1.43	1.35	1.29	1.43	1.35	1.29
Linoleic acid (%)	1.47	2.59	3.71	1.47	2.59	3.71

[1]Multi vitamin-minerals premix provide the following per ton of diet: 7000000 IU, vit A; 1500000 ICU, vit D3; 30000 IU, vit E; 50000 mg, vit C; 2300 mg, vit K; 1400 mg, vit B1; 5520 mg, vit B2; 2300 mg, vit B6; 12 mg, vit B12; 27600, mg Niacin; 920 mg, Folic acid; 6900 mg, PA; 92 mg, Biotin; 50000 mg, Antioxidant (BHT); 220 mg, Cobalt; 4400 mg, copper; 800 mg, Iodine; 26400 mg, Iron; 44000 mg, Manganese; 180 mg, Selenium; 44000 mg, Zinc

This experiment was conducted to study the effect of line of the bird (body weight) on egg size and other performance criteria of the local Saudi birds, fed different levels of corn oil (linoleic acid).

MATERIALS AND METHODS

Two hundred brown Saudi female chicks were raised to maturity in a house prepared for that purpose. These chicks were exposed to all management practices similar to that applied on the white leghorn. Commercial starter and grower feed were given to the birds from day 1 to 20 weeks of age. Lighting hours were held constant at 10-11 h daily till the end of the period. Photo-stimulation was not done till the birds at the onset of the lay. At this time (sexual maturity) all the birds were weighed to the nearest gram. From this population, 120 birds were selected and divided into 2 groups based on color, black, light (700-900 gm) and Brown, medium (900-1080 gm). Origin of these birds is not the same. Ancestors of the Brown birds came from the western province of Saudi Arabia which have most probably been exposed to some kind of out breeding while those colored with complete black came from the eastern province which were originated and bred there. The selected birds were placed in cages at a rate of 5 per cage. This arrangement resulted in to 24 cages. Three different levels of corn oil, 0, 2 and 4%) were assigned to each of the 2 weight groups forming 4 replications per treatment with a total 20 pullets per treatment. Total amount of linoleic acid in the diet was estimated to be 2.59% in the 2% corn oil treatment and 3.71% linoleic acid in the 4% corn oil diet.

The trial lasted 24 weeks. Replicates were equally distributed into upper and lower cages to minimize cage level effect. All hens were housed in an environmentally controlled house with temperature maintained at comfortable range. Egg production was recorded daily; egg weight and feed consumption were recorded weekly; and egg-specific gravity was recorded on a monthly basis. Egg weight and egg-specific gravity were measured using all eggs produced during 2 consecutive days. Feed intake was determined by subtracting the left over feed weight of each trough (each replicate) from the initial feed weight, weekly. Egg-specific gravity was determined using 9 gradient saline solutions varying in specific gravity from 1.060 to 1.100 incremented with 0.005-unit increments (Holder and Bradford, 1979). Mortality was recorded daily. Body weight was obtained by weighing each hen individually at the beginning and at the end of the experiment. Egg mass and feed conversion (Kg of feed/Kg of egg) were calculated from egg production, egg weight and feed consumption.

Haugh unit was calculated from the values of albumen height and egg weight using the following formula:

$$HU = 100 \log10 (H-1.7 W0.37+7.56)$$

where, HU = Haugh unit, H = height of the albumen and W = egg weight. Yolk color was determined according to the scale of *Hoffman-La Roche* fan colors.

Statistical analysis: The experiment was arranged as a 2 X 3 factorial in a complete randomized design using the GLM procedure. Differences among groups were evaluated by Duncan's multiple range test (SAS Institute, 2000). The linear model was to test the effects of treatment groups on laying performance. The model was as follows:

$$Yijk = \mu + G_i + F_j + (G \times F)_{ij} + eijk$$

where:

Yijk = Response variable

μ = Population mean

G_i = is the effect of ith line (group weights) 1, 2

F_j = is the effect of ith fat level 1,2 and 3

$(G \times F)_{ij}$ is interaction effect of the ith level of line and jth level of fat eijk = experimental error

RESULTS AND DISCUSSION

Egg weight is an important economic factor in poultry production. During the laying period, Leghorn strain usually start their laying cycle with relatively small eggs which are not very profitable however, they get larger as the bird advances in age. Local birds are not much different from that except that their eggs are much smaller than the leghorn (Al-Yousef *et al.*, 1995).

Response of the local birds in terms of egg weight to different levels of linoleic acid was highly significant ($p<0.01$) (Table 2). There was a clear indication that as level of corn oil increased from 0 to 4%, size of the eggs increased accordingly. Figure 1 depicted this result clearly. As local birds starts laying, at the 22 week of age with very few eggs, linoleic acid did not have much of an effect on the size of the egg, not until 28 weeks of age when 2 and 4% corn oil starts showing the effect with the superiority of 4% till the end of the study (Fig. 1). Since the experimental diets were formulated to be iso caloric therefore, it is assumed that the effect on egg weight was due to the linoleic acid and not the energy effect. This is in contrast with the study of Grobas *et al.* (2001) who indicated that increased egg weight was associated with the total dietary fat contents of the diet rather than the linoleic acid content over 1%. However, Balevi and Coskun (2000) suggested that corn oil has significantly increased egg weight when compared with poultry fat. Likewise, Keshavarz and Nakajima (1995) found that supplemented fat effect on egg size was independent of energy level. In a field trial, using 3600 pullets, Schaublin *et al.* (2005) found that increased linoleic acid content did not have a significant effect on the number of eggs > 70 g but had a positive effect in

Table 2: Effect of feeding different levels of corn oil (linoleic acid) to two lines of local birds, a medium with brown color and a lighter with black color[1] on Production parameters

Source of variation	GBD	FC	HD	EM	EW
Levels	NS	*	NS	NS	**
0	72.27^{a}	3.849^{a}	48.26^{a}	22.52^{a}	46.47^{a}
2	74.98^{a}	3.553^{ab}	48.02^{a}	22.82^{a}	47.29^{b}
4	71.04^{a}	3.252^{b}	49.77^{a}	24.68^{a}	48.92^{c}
p =	0.2635	0.0119	0.7535	0.1734	<0.0001
Line	NS	**	**	**	**
Medium (M)	70.90^{a}	2.931^{a}	52.30^{a}	25.50^{a}	48.80^{a}
Light (L)	74.63^{a}	4.178^{b}	45.06^{b}	21.16^{b}	46.30^{b}
P =	0.0648	<0.0001	0.0005	<0.0001	<0.0001
Interaction	**	**	**	**	**
0 * M	75.17±7.78	2.829±0.59	58.44±12.29	27.73±6.36	47.29±2.03
2 * M	70.22±7.14	3.211±0.83	48.24±12.47	23.21±6.10	48.11±2.62
4 * M	67.31±11.22	2.753±0.66	50.23±12.56	25.54±6.34	51.01±3.00
0 * L	69.37±21.04	4.870±2.13	38.08±22.57	17.32±10.38	45.65±2.70
2 * L	79.75±28.23	3.895±1.27	47.79±20.35	22.43±10.42	46.46±2.81
4 * L	74.77±16.46	3.761±1.88	49.30±20.92	23.80±10.33	46.78±2.70
p =	0.0038	0.0018	<0.0001	0.0001	0.0007

[1]Means Within columns carrying different superscripts are significantly different, $p<0.05$. NS = Not significant, $p>0.05$. **Significant at 1% level of probability or less; GBD = gram per bird per day, daily feed intake; FC = Kg feed per Kg eggs, feed conversion; EW = gram, egg weight; HD = percent hen-day production; EM = gram per hen-day egg mass (% HD*EW), Levels = 0, 2 and 4% of corn oil; Line = M, Medium (900-1000 gm Brown colored line), L, light (800-900 gm, Black colored line)

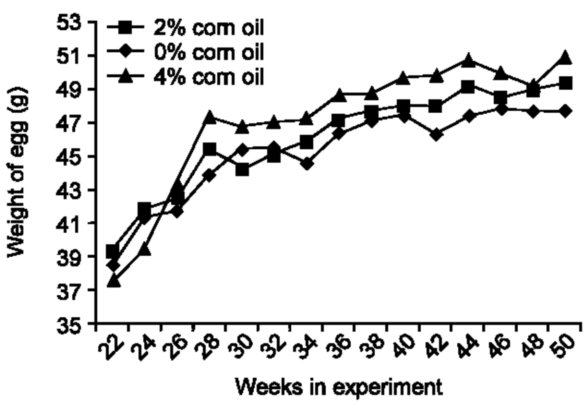

Fig. 1: Effect of corn oil on egg weight of Saudi local the initiation of lay and during the experimental

minimizing the number of eggs <53 g. It is known from sometimes that unsaturated fatty acids are more easily absorbed in the layer gut and can be a good source of lipids in the egg yolk which increases the size of the egg (Freeman, 1984). Line of the bird had a significant effect ($p<0.001$) on egg weight. Average egg weight for the entire experimental period was 48.80 gm for the brown birds (medium in size) and 46.30 gm for the black birds (smaller in size) (Table 2). Summers and Leeson (1983) stated that body weight at sexual maturity is one of the most important factors determining egg weight. Report from ISA (2009) genetic company indicated that strain of the bird has the potential range of egg weights, which can vary by about 3.5 gm.

Effect of line (weight) started early in lay (Fig. 1). Although very few eggs laid in weeks from 22 to 28, but they were enough to illustrate the significant differences between the two lines at the commencement of lay and later during the experimental period (Table 3, Fig. 1). Al-Yousef *et al.* (1995) found Large variation in body weight among parent stocks, originated from different locations in Saudi Arabia where by birds of the western part of Saudi Arabia (namely: Makkah, Jedda and Madina), mostly brown in color, showed higher body weight than those originated from Al-Hofuf area (Eastern province), mostly black feather and shank. The authors attributed this phenomenon to the presence of foreign genes in chickens or eggs, introduced by the pilgrimages visiting the western area (mostly came from South Asia). These birds were the ancestors of the birds used in this study. The effect of interaction between level of fat and line (weight) of the bird on egg weight was highly significant ($p<0.001$). Table 2 shows that Brown birds (medium in weight) responded better to the higher level of linoleic acid in the diet with 51 gm of egg weight compabrown to the lower level of dietary linoleic acid and the control in the same group, 48.11 and 47.29 gm, respectively and also to the treatments of the other group (black, small in weight) (Table 2). This result was in agreement with Leary *et al.* (1998) who stated that "early in lay, the effect of linoleic acid on egg weight was strain dependent, with Hy-Line CB Black, Tegel SB2 and Hi-Sex Brown hens responding to varying dietary concentrations of Linoleic. Whether, genetics has played a role in responding of the local lines to the added fat is open for speculation. These birds are also known for their resistance to heat. Al-Aqil (1998) showed many of the bird physiological characteristics including resistance to heat.

Effect of added oil level on feed intake, egg production and egg mass was not significant ($p>0.05$) (Table 2)

Table 3: Effect of feeding different levels of corn oil (linoleic acid) to two lines of local birds, a medium with brown color and a lighter with black color on egg characteristics and mortality

Source of variation	SPG	YC	HU	LIV
Levels	NS	**	**	NS
0	1.092[a]	5.85[a]	73.84[b]	98.53[a]
2	1.092[a]	5.73[a]	73.52[b]	98.91[a]
4	1.092[a]	5.30[b]	75.31[a]	98.92[a]
p =	0.9583	0.001	0.0236	0.8554
Line	**	**	NS	**
Medium (M)	1.092[a]	5.83[a]	74.70[a]	99.78[a]
Light (L)	1.091[b]	5.42[b]	73.74[a]	97.78[b]
p =	0.0239	0.0015	0.0908	0.0023
Interaction	NS	NS	**	NS
0 * M	1.091±0.003	6.17±0.94	75.53±4.00	99.55±2.29
2 * M	1.091±0.003	5.93±1.00	73.80±4.67	99.85±1.03
4 * M	1.092±0.003	5.38±0.70	74.78±4.83	99.94±0.41
0 * L	1.092±0.004	5.54±1.53	72.14±5.42	97.50±9.74
2 * L	1.092±0.004	5.53±0.91	73.24±4.97	97.96±7.11
4 * L	1.092±0.004	5.21±1.20	75.84±4.75	97.89±5.50
p =	0.2026	0.3366	0.0055	0.993

[1]Means Within columns carrying different superscripts are significantly different, $p<0.05$

S = Not significant, $p>0.05$. ** Significant at 1% level of probability

SPG = Specific gravity of the egg

YC = Yolk color

HU = Haugh Unit

LIV = percent Livability

Levels = 0, 2 and 4% of corn oil

Line = M, medium (900-1000 gm, Brown line), L, light (800-900 gm, Black line)

however, there was an indication of higher production and egg mass with higher level of fat. Grobas *et al.* (1999) found that increasing dietary level of linoleic acid from 1.15 to 1.65% in brown layers did not have any positive effect on egg production and other production parameters. These levels are much lower than the ones used in this study (total linoleic acid was 2.59 for the 2% corn oil diet and 3.79 for the 4% corn oil diet).

Between the two lines and the interaction with fat level, it was found a highly significant differences ($p<0.001$) in egg production and egg mass favoring the 4% corn oil (when fed to the larger line (brown birds) (Table 2). This line has also the best egg weight as mentioned before and naturally had the best feed conversion since feed consumption was low. It was some how surprising that smaller line (black) ate more feed than the larger one (brown) (Table 2) and gained less weight when fed higher level of fat (Fig. 2). The opposite is usually true with the foreign breeds. Leeson and Sumers (1987) and Harms *et al.* (1982) found as body weight increased, feed consumption of hens increased accordingly. Lacin *et al.* (2008) also reported that feed consumption found to be higher in medium and heavy groups than the light group. Of course their definition of groups weight differ from the birds weights of this study. Recent study at King Faisal University (unpublished) provided evidence that mitochondrial activity of the black bird (small in size) is different from that of the Brown one (medium in size) based on MIT assay, which probably means that energy utilization of the Brown birds is more efficient than the one of the black birds. The positive response of the brown line to a higher energy was elucidated by Abugreen (2013) who reported that Saudi local birds (Hajar 2, Brown line) responded much better to the higher energy level (2850 Kcal/Kg) than to the lower ones (2750 and 2650 Kcal/Kg) in terms of egg production and feed conversion. These birds are sisters to the birds of this study. Recently, Ahmad and Al Abbad (2014) characterized and designated the Saudi local chickens lines in to "Hajar 1, dominantly black in color and Hajar 2 with brown feathers". Studies by Lacin *et al.* (2008), Harms *et al.* (2000) and Kirikci *et al.* (2004) showed no effect of body weight on egg production which agreed with the result of this experiment.

Effect of added fat corn oil (linoleic acid) on egg characteristics was significant ($p<0.01$) for yolk color and Haugh unit (Table 4). Again a better Albumen quality was found with the higher level of fat (4% corn oil) but with less yellowish yolk color as measured by *La-Rroche* fan. According to this result, it is assumed that most of the increase in egg weight caused by the higher level of added fat was due to the albumen content. Whitehead (1995) suggested that dietary fatty acids may increase egg weight by stimulating the synthesis of oviductal proteins. This process is stimulated mainly by estrogen, a hormone where fat is an important part of it is formation pathway (Nimpf and Schneider, 1991). Whitehead *et al.* (1993) reported that improvement in egg weight was mainly due to an increase in albumen. The pale color found in egg yolk of birds fed the 4% corn oil can probably be attributed to the higher replacement of corn with oil compared to the control (Table 1). Mortality was significantly ($p<0.01$) lower in the brown bids (medium size birds).

Table 4: Egg weight as affected by corn oil (linoleic acid level) and weight of the birds on Saudi local birds during the weeks of the experiment[1]

	Line of the bird (weight)[2]			---------- Level of corn oil (Linoleic acid)% ---------			
Weeks in experiment	Medium (Brown)	Light (Black)	p =	0	2	4	p =
28	47.28^{a}	43.91^{b}	0.0307*	43.95^{b}	45.40^{ab}	47.94^{a}	0.1361
30	46.52^{a}	44.39^{a}	0.1020	45.44^{a}	44.16^{a}	46.78^{a}	0.2495
32	47.30^{a}	44.47^{b}	0.0091	45.48^{a}	45.07^{a}	47.11^{a}	0.2171
34	47.33^{a}	44.46^{b}	0.0136	44.61^{a}	45.88^{a}	47.20^{a}	0.1614
36	49.20^{a}	45.66^{b}	0.0009**	46.37^{a}	47.24^{a}	48.68^{a}	0.1301
38	49.59^{a}	46.15^{b}	0.0001**	47.11^{a}	47.74^{a}	48.76^{a}	0.1796
40	49.51^{a}	47.28^{b}	0.0132*	47.45^{b}	48.01^{ab}	49.72^{a}	0.0853
42	48.91^{a}	47.12^{a}	0.0956	46.30^{b}	47.88^{ab}	49.86^{a}	0.0346*
44	50.50^{a}	47.76^{b}	0.0027	47.44^{b}	49.20^{ab}	50.74^{a}	0.0110*
46	49.81^{a}	47.71^{a}	0.0518	47.84^{a}	48.50^{a}	49.94^{a}	0.2487
48	49.17^{a}	48.09^{a}	0.3657	47.70^{a}	48.10^{a}	49.20^{a}	0.5352
50	50.52^{a}	48.35^{b}	0.0215*	47.70^{b}	49.36^{ab}	50.96^{a}	0.0356*

[1]Means within each raw carrying different superscript are significantly different ($p<0.05$); p = Probability level

[2]Birds weights ranged from, 800-900 gm for light birds (Black) and 900-1000 gm for heavier birds (Brown)

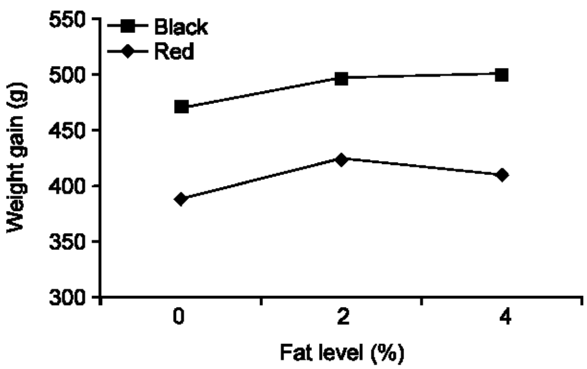

Fig. 2: Effect of corn oil on body weight gain of Saudi local birds

Conclusion: In conclusion, based upon the results of this study, it is suggested that linoleic acid play an important role in maximizing the egg size of the local birds and adding 4% corn oil without jeopardizing the energy content of the ration may be a good way of improving the egg size of the Saudi local brown birds during the onset and first part of the laying year.

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