Effect of flock age and dietary fat on production and reproduction performance in Japanese quail

R.E. Rizk[1*], H.S. Zeweil[2], M.A. El-Zayat[3], and Salma A. H. Abou Hafsa[1]

[1]Animal Prod. Res. Inst., Agric. Res. Cent., Giza, Egypt; [2]Animal and Fish Prod. Dept., Fac. Of Agric., (Saba Basha), Alex. Univ., Egypt; [3]Zoology Dept., Fac. Of Sci., Alex. Univ., Egypt;
***Corresponding author:** raouferizk@yahoo.com

Abstract

An experiment was conducted to study the effect of Japanese quail and different dietary fat sources such as animal tallow fat (AT) and corn oil (CO) on some productive and reproductive traits. Ninety females and forty five males of Japanese quail were used in this experiment up to 32 weeks of age. Three experimental diets were formulated, the first diet had been free of fat or oil as control, while the second diet contained 3% CO and the third one contained 3% tallow fat. The dietary treatments were examined in two periods of age. The first period was from 16 to 24 weeks of age as the younger ones to be studied and the second group from 24 to 32 weeks of age being the elder age. The birds were randomly assigned in batteries for different dietary treatments with fifteen replicates per treatment. Elder age of quail represented a higher significant ($P<0.01$) egg weight compared to those produced from the younger ones. Whereas, there were no significant differences between younger and elder stages of maternal flock age with respect to egg production percentage, egg number and total egg mass. Total egg mass of birds fed AT was significantly ($P<0.01$) higher than those fed CO or control diets. There were no apparent significant effect attribute to flock age or dietary treatment on fertility and hatchability and tended to diminish numerically in younger age compared to elder ones. Time of hatch for chicks from elder flock age was delayed significantly compared to that for chicks from younger ones. Absolute and relative chick weight loss of elder age were significantly greater than those of younger ones. Regardless of maternal flock age, adding AT to the diet had lengthened the hatch time for the chick by about 1.85 hrs compared to those of CO group and by about 2.38 hrs compared with control one. Moreover, AT supplementation had decreased the chick weight loss percentage in the incubator compared to CO or control diet groups. The last chicks produced from birds fed AT and control diet groups had hatched by about 2 hrs later than those produced from birds fed CO diet.

Keywords: Quail age; animal tallow fat; corn oil; egg production; hatchability traits.

Introduction

Japanese quail has become an important laboratory bird because of its small body size, high rate of reproduction. Fat and oils are included in poultry diets. Japanese quail is capable of maintaining a rather high rate of egg production under optimum condition, but that production is very sensitive to dietary change (Wilson, *et al.*, 1961). Vilchez *et al.*, (1990) found that feeding corn oil significantly improved egg production. Also, Peebles *et al.*, (2000) found that addition of oil or fat to laying hen diets had no adverse effect on egg production. In older hens, egg production decrease due to physiological changes (Ledur *et al.*, 2000).

Egg fertility and hatchability have depended upon different items and mainly by flock age (Tona *et al.*, 2001). Moreover, Suarez *et al.*, (1997) found that hatch weight was significantly affected by age, whereas Hashim *et al.*, (2002) reported that age of breeder had no significant effect on hatched chick weight. Vilchez *el al.*, (1991) found that quail weight at hatch from birds fed diet containing linoleic acid was heavier than those from diet containing oleic acid. Lowe and Carwood (1977) showed that eggs from elder flock hatch earlier than those from younger ones, while Vick (1992) suggested that incubation time can be shortened for younger flock. The purpose of the present study was to study the effect of Japanese quail age and different added sources of dietary fat such as tallow fat or corn oil on some productive and reproductive traits of Japanese quail.

Materials and methods

The present experimental was conducted at Faculty of Agriculture (Saba Bacha), Alexandria University, Egypt utilizing a total number of niety females and forty-five males of Japanese quail. Pre-experimental dietary treatments were used for four weeks and started at the 16th week of age and commenced up to the 32 weeks of age. The birds were randomly assigned in locally made batteries for different dietary treatments with fifteen replicates per treatment. Each replicate comprised two females and one male. Three experimental diets were formulated according to NRC (1994). The first diet without fat or oil addition as control, while the second diet contained 3% corn oil (CO) and the third one contained 3% animal tallow fat (AT). The compositions of the experimental diets are presented in Table 1. The dietary treatments were examined in two periods of age. The first period from 16 to 24 weeks of age as the younger one (YN) and the second group from 24 to 32 weeks of age as elder age (ED).

Table 1 Ingredient percentages and calculated analysis of quail diets

Ingredient (%)	Diet		
	Control	Corn oil	Tallow fat
Yellow corn	60.55	50.13	52.38
Wheat bran	1.25	10.0	6.95
Soybean meal (48%)	25.55	23.75	24.65
Fish meal (60%)	5.00	5.70	5.50
Limestone	6.02	6.07	5.99
Bone meal	0.95	0.67	0.85
Premix[1]	0.25	0.25	0.25
Salt	0.25	0.25	0.25
Corn oil	-	3.0	-
Animal tallow	-	-	3.0
Methionine	0.08	0.08	0.08
Ethoxyquin	0.10	0.10	0.10
Total	100.00	100.00	100.00
Calculated analysis:			
Crude protein (%)	20.10	20.08	20.12
ME (Kcal/kg diet)	2866	2874	2868
Fat (%)	3.02	6.01	5.97
Lysine (%)	1.15	1.15	1.15
Methionine (%)	0.45	0.45	0.45
Cystine (%)	0.35	0.35	0.35
Methionine + Cystine (%)	0.80	0.80	0.80
Calcium (%)	2.52	2.50	2.51
Available phosphorus (%)	0.35	0.35	0.36
Linoleic acid (%)	1.46	1.40	1.40

[1]vitamins and minerals premix provides per kilogram of diet: 5.500 IU vitamin A, 11.0 IU vitamin E, 1.1 mg menadione (as menadione sodium bisulfite), 1.100 ICU vitamin D_3, 4.4 mg riboflavin, 12 mg Ca pantothenate, 44 mg nicotinic acid, 191 mg choline chloride, 12.1 µg vitamin B_{12}, 2.2 mg vitamin B_6, 2.2 mg thiamin (as thiamin mononitrate), 0.55 mg folic acid, 0.11 mg d-biotin. Trace mineral (mg per kilogram of diet). 60 mg Mn, 50 mg Zn, 30 mg Fe, 5 mg Cu, 3 mg Se.

Eggs were individually weighed daily and egg percentage was recorded, also egg mass was calculated. Two thousands and four hundreds and sixty-two hatching quail eggs were numbered consequently and weighed before setting in the incubator. The time of egg setting in the incubator was recorded to obtain the hatch time exactly. Chicks that had fully emerged from eggs were removed, wing-banded, weighed to the nearest 0.1 gm and recorded as chick body weight at hatch then placed again to the incubator after recording the time of hatch. Hatching time and body weight at hatch were monitored every six hours after the hatch of first chicks. All chicks were weighed again at the time of removal from the hatcher (444 hrs). chick body weight loss during incubation expressed on absolute and percentage bases was calculated. All percentages data of fertility and hatchability were estimated after transformation to arcsin square root percentage.

Data were analyzed using SAS program (SAS, 1996) with factorial design (2x3) under general linear model. Duncan new multiple range test was used to interpert the differences among treatments (Duncan, 1955).

Results and discussion

Elder age of Japanese quail represents a higher significant egg weight compared to those produced from the younger ones. Besides there were no significant differences between younger and elder stages of maternal flock age with respect to egg production percentages, egg number per birds and egg mass (Table 2). In addition to that and irrespective of flock age, egg production percentage for birds fed diets containing AT was significantly higher than for those fed diet containing CO, whereas, it was not different significantly from those fed control diet. The same trend of effect was noticed with respect to egg number per bird during the eight experimental weeks. On the other hand, total egg mass for birds fed AT was significantly ($P<0.07$) higher than those fed CO or control diets. Interaction data in the same table represent the highest significant ($P<0.01$) records for average egg weight and total egg mass/bird/period and significant ($P<0.05$) records for egg production percentage and egg number/bird/period for interaction of elder flock age X AT dietary treatment. Moreover the results indicated that egg weight increased by about 7.17% with an increase of flock age from 16-24 wk to 24-32 wk. This result supports the finding of Yannakopoulos and Tserevni-Gousi (1987) who reported that egg weight has been found to increase with age of quail. Similar to our results, regarding the increase of egg weight with the dietary treatment containing AT, Jensen (1983) reported that incorportaiton of 1-2% feed ATF to the laying diet increased the percentage of extra large eggs. Parsons *et al.*, (1993) showed that egg weight during the early stage of egg production cycle was increased by adding 2% CO. Also, results herein regarding the effect of adding AT and CO on egg production are keeping with the data of Hill *et al.*, (1956).

Table 2 Effect of flock age and dietary treatment on egg production traits of Japanese quail.

Traits / Main effect	Average egg weight (g) $\bar{X}\pm$S.D	Egg production (%) $\bar{X}\pm$S.D	Egg.no/ bird/period $\bar{X}\pm$S.D	Egg mass/ bird/period (g) $\bar{X}\pm$S.D
Flock age:				
Younger age (16-24 wk)	11.29±0.158^{b}	59.37±2.292	33.24±1.284	379.81±17.958
Elder age (24-32 wk)	12.11±0.101^{a}	61.57±2.569	34.48±1.439	420.39±19.799
Significant	**	N.S	N.S	N.S
Dietary treatment:				
Animal tallow	12.05±0.175^{a}	66.63±2.738^{a}	37.31±1.533^{a}	452.74±22.489^{a}
Corn oil	11.62±0.163^{b}	54.81±2.313^{b}	30.69±1.295^{b}	357.51±17.185^{b}
Control	11.39±0.186^{b}	59.85±3.404^{ab}	33.52±1.906^{ab}	387.94±26.299^{b}
Significant	**	**	**	**
Interaction				
Significant	**	*	*	**

a and b. Means within each column for each item with different superscripts are significantly different (P≤0.05)

* Significant at P≤ 0.05 ** Significant at P≤0.01 N.S. non significant

It could be noticed from Table 3 that there was no apparent significant effect attributable to flock age on fertility and hatchability of fertile and total eggs set. Results demonstrate that hatchability of fertile and total eggs set tended to be diminish numerically in younger and compared to elder ones. Regardless of flock age, quail fed AT diet insignificantly increased fertility percentage (89.83%) than those fed CO (85.67%) and control diet (86.0%), while the fertility percentage had not been different between those fed CO and those fed control diet. Moreover, adding AT or CO to the diets had no apparent significant effect on hatchability of fertile and total eggs set, whereas the hatchability of fertile eggs had increased numerically for those fed AT by 2.5% compared to those fed CO and by 4.7% compared to those fed control diet. Also, hatchability of total eggs set had increased numerically for those fed AT compared to those fed CO or control diet. It is concluded from the interaction data in this table that addition of AT or CO to the diets for elder age flock could improve the hatchability of fertile and total eggs set rather than for younger age.

Table 3 Effect of flock age and dietary treatment on hatchability traits of Japanese quail.

Traits / Main effect	Fertility	Hatchability of fertile eggs (%)	Hatchability of total eggs (%)
	$\bar{X}$±S.D	$\bar{X}$±S.D	$\bar{X}$±S.D
Flock age:			
Younger age (16-24 wk)	86.89±1.23	75.44±2.35	65.56±2.69
Elder age (24-32 wk)	87.44±1.90	80.78±2.07	70.56±2.73
Significant	N.S	N.S	N.S
Dietary treatment:			
Animal tallow	89.83±1.92	80.50±3.14	72.33±4.45
Corn oil	85.67±1.15	78.00±2.91	66.38±3.06
Control	86.00±2.34	75.83±1.92	65.00±2.02
Significant	N.S	N.S	N.S.
Interaction			
Significant	**	N.S	*

* Significant at P≤ 0.05 ** Significant at P≤0.01 N.S. non significant

Average records of hatchability in the current study were somewhat similar to that reported by Yannakopoulos and Tserveni-Gousi (1987) which indicated that hatchability of all eggs in Japanese quail depressed in younger quail hens, while, Al-Murrani (1978) reported that it is not clear in coutrnix quail that age has a greater effect on hatchability.

Results in current study regarding the effect of dietary fat source on egg fertility is somewhat different than that reported in Japanese quail by Vilchez *et al.,* (1991) who found that fertility was not significantly affected by dietary fat treatment. Moreover, results of hatchability are in general agreement with the results of the same authors who mentioned that feeding corn oil significantly improved hatchability.

Time of hatch for chicks from elder flock age was delayed significantly (P<0.01) compared to that for chicks from younger ones (Table 4). Absolute and relative chick weight loss from elder age (1.34 gm and 15.21%) were greater significantly (P< 0.01) than those from younger ones (11.4 gm and 13.33%), respectively. Regardless of maternal flock age, adding AT to the diet had lengthened the hatch time by about 1.85 hrs compared with those for CO and by about 2.38 hrs compared with those for control group. Also, weight loss percentage had increased significantly (P<0.01) for chicks produced from bird fed control diet (15.06%) and CO (15.16%) compared to those produced from birds fed AT diet (13.29%).

Results of interaction revealed that the higher significant (P<0.01) record for interaction between younger age X AT diet with respect to hatch time compared to other records of interactions. Also, higher values for chick weight loss percentage were recorded for interactions between elder age X CO and elder age X control.

Results obtained in the present study were inconsistent with those reported by Suarez *et al.,* (1997) who mentioned that egg from elder flock hatch earlier than eggs from younger ones. Moreover, results herein regarding the increase of chick weight loss with the increase of parental flock age support the finding of Ries *et al.,* (1997) who reported that chicks from elder flock had higher chick weight loss. Therefore, the significant increase of chick weight loss and decrease of hatch time for control and CO diets groups compared to the decrease of chick weight loss percentage and increase of hatch time for those produced from flock fed AT could be explained through notion of Wyatt *et al.,* (1985) who reported that chicks which held in the incubator for a long period after hatch become dehydrated significantly than chicks removed soon after hatch.

Table 4 Effect of maternal flock age and dietary treatment on hatching time and chick weight loss during incubation

Traits / Main effect	Hatch time (hr)	Chick weight loss[#] (g)	Chick weight loss[#] (%)
	$\bar{X}$±S.D	$\bar{X}$±S.D	$\bar{X}$±S.D
Maternal flock age:			
Younger age (16-24 wk)	420.01±0.521[b]	1.14±0.025[b]	13.33±0.271[b]
Elder age (24-32 wk)	421.70±0.360[a]	1.34±0.027[a]	15.21±0.289[a]
Significant	**	**	**
Dietary treatment:			
Animal tallow	421.97±0.434[a]	1.19±0.027[b]	13.29±0.277[b]
Corn oil	420.12±0.718[b]	1.27±0.040[ab]	15.16±0.453[a]
Control	419.59±0.588[b]	1.29±0.033[a]	15.06±0.355[a]
Significant	**	*	**
Interaction			
Significant	**	**	**

[#] Chick weight loss from hatch time to pull time for those chicks that hatched prior to pull time.
a and b. Means within each column for each item with different superscripts are significantly different (P≤0.05)

* Significant at P≤ 0.05   ** Significant at P≤0.01

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