

EFFECT OF DIETARY OMEGA-3 FATTY ACID RICH OIL SOURCES ON FERTILITY AND HATCHABILITY PERFORMANCE OF JAPANESE QUAIL EGGS

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Abstract: A study was conducted to assess the fertility and hatchability of Japanese quail eggs upon enrichment with polyunsaturated fatty acid (PUFA) rich sources like fish oil and linseed oil, independently and simultaneously at 2 and 4 per cent levels in ration. The results revealed that the birds fed with 2 per cent fish oil supplementation showed significantly higher fertility and hatchability on total eggs set ($P < 0.01$) and hatchability on fertile eggs set ($P < 0.05$). However, break-open study on unhatched eggs indicated no significant differences in early and late embryonic mortality due to supplementation.

Keywords: n-3 / Omega-3 fatty acids, fertility, hatchability and Japanese quail

INTRODUCTION

Japanese quail (*Coturnix coturnix japonica*) is the smallest domesticated avian species grown for meat and egg production. Commercial quail farming is becoming more popular and is being gaining momentum in Asian countries, especially in India. The Japanese quail production is practiced at all levels ranging from subsistence to large scale commercial operations. The commercial operations depend on the hatcheries for the supply of day old chicks (King'ori, 2011). The uninterrupted supply of quality day-old chicks is necessary for the success of production chain.

Fertility and hatchability are two major parameters that highly influence the supply of day-old chicks. Fertility refers to the percentage of incubated eggs that are fertile, while hatchability is the percentage of fertile eggs that hatch. It is therefore important to understand the factors that influence fertility and hatchability of eggs. There are many reasons for poor fertility and hatchability of eggs.

Polyunsaturated fatty acids (PUFAs) are known to have health promoting effects. They retain the functional, nutritional and sensory qualities of meat and egg (designer food) but alter the lipid composition. Considering the above facts, an attempt has been made to assess the

fertility and hatchability of Japanese quail eggs by way of supplementing PUFAs enriched lipid sources like fish oil and linseed oil, independently and simultaneously in Japanese quail ration.

MATERIALS AND METHODS

A biological experiment was conducted with Japanese quail chicks from day-old to 26 weeks of age; with sexes together up to 5 weeks and separately thereafter up to 26 weeks of age. Seven experimental diets were formulated by incorporating known quantities of PUFA rich fish and linseed oils into Japanese quail basal diet at graded levels either independently or simultaneously as follows:

T₁ - Control (without oils)

T₂ - 2% Fish oil

T₃ - 2% Linseed oil

T₄ - 4% Fish oil

T₅ - 4% Linseed oil

T₆ - 2% (Fish oil + Linseed oil)

T₇ - 4% (Fish oil + Linseed oil)

All the experimental diets were formulated as per the standards prescribed by Shrivastav and Panda (1999) on isocaloric and isonitrogenous basis. Samples of fish and linseed oils as well as different feed samples used in the biological study were subjected to extract lipids and transmethylation process as described by Sukhija and Palmquist (1988). The breeding males were reared separately and fed with male Japanese quail diets. After 26 weeks of age, males were introduced in the ratio of one male to 2.7 females to obtain fertile eggs and were artificially incubated to study the reproduction parameters viz. fertility, hatchability on both total and fertile eggs set, early embryonic mortality and late embryonic mortality. The data collected in the experiment of this study were subjected to statistical analyses as per Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

The mean fertility and hatchability (%) of Japanese quail eggs as influenced by PUFA rich oil sources are presented in Table. It indicated that fertility per cent ranged between 82.39 and 95.14. Higher ($P < 0.01$) fertility was observed in T₂ (2% fish oil) (95.14) and T₆ (2% fish oil + linseed oil) (93.85) groups when compared to control group (T₁) (82.39).

The results on per cent hatchability on total eggs set and fertile eggs set ranged from 53.99 to 67.47 and 65.55 to 70.95 per cent, respectively. From the table, it was observed that

hatchability (%) on both total eggs set and fertile eggs set was higher in T₂ group (2% fish oil) (67.47,70.95) followed by T₆ group (2% fish oil + linseed oil) (66.38,70.77) as compared to control group (T₁) (53.99, 65.55), respectively. Statistical analysis revealed significant influence on hatchability on fertile eggs set (P<0.05) and on total eggs set (P<0.01).

Hazim Al-Daraji *et al.* (2010) studied the effect of dietary supplementation with different oils on reproductive performance of Japanese quail and concluded that addition of dietary fish oil recorded the best results on fertility and hatchability of eggs set, hatchability of fertile eggs which is in agreement with the results of this study. The above research findings coincide with the earlier reports of Zanini *et al.* (2003) who stated that the addition of fish oil based diets to the 30 week old White Leghorn cockerels resulted in a linear increase in fertility rate. Contrary to the above findings, Herstad *et al.* (2000) reported that supplementation of fish oil to the diets of broiler breeders resulted in negative effects with reduced fertility of eggs and reduced hatchability of fertile eggs.

Meanwhile, researches on Japanese quail fed diets with flaxseed oil at two per cent level showed an increased hatchability per cent and higher fertility rate as compared with soyabean and olive oil and tallow supplemented groups which are in partial agreement with the results of this study.

Further, statistical analysis failed to reveal significant difference on early and late embryonic mortalities of Japanese quail eggs due to PUFA rich oil supplementation.

Table: Mean fertility, hatchability and embryonic mortalities (\pm S.E.) (%) of Japanese quail eggs as influenced by Omega-3 fatty acid rich oil sources

Treatment groups	Fertility	Hatchability on total eggs set	Hatchability on fertile eggs set	Early embryonic mortality (<7d)	Late embryonic mortality (>7d)
T ₁ - Control	82.39 ^A \pm 1.86	53.99 ^A \pm 0.92	65.55 ^a \pm 0.56	8.47 \pm 0.90	10.72 \pm 0.66
T ₂ - 2% Fish oil (FO)	95.14 ^D \pm 0.82	67.47 ^C \pm 1.79	70.95 ^b \pm 2.23	9.94 \pm 2.13	9.31 \pm 0.63
T ₃ - 2% Linseed oil (LO)	89.43 ^{BC} \pm 0.97	60.20 ^B \pm 1.06	67.32 ^{ab} \pm 1.03	9.95 \pm 0.88	8.76 \pm 1.13
T ₄ - 4% Fish oil	87.55 ^{AB} \pm 1.04	57.40 ^{AB} \pm 1.40	65.55 ^a \pm 0.92	11.91 \pm 0.50	9.55 \pm 1.04
T ₅ - 4% Linseed oil	86.03 ^{AB} \pm 0.74	55.74 ^{AB} \pm 1.14	64.82 ^b \pm 1.85	9.44 \pm 0.69	11.40 \pm 2.06
T ₆ - 2 % (FO +LO)	93.85 ^{CD} \pm 2.12	66.38 ^C \pm 0.89	70.77 ^a \pm 1.00	7.97 \pm 0.09	9.31 \pm 0.87
T ₇ . 4 % (FO +LO)	88.77 ^{AB} \pm 1.11	58.41 ^{AB} \pm 0.91	65.80 ^a \pm 0.44	12.78 \pm 0.80	9.88 \pm 0.53

Value within each cell is a mean of three observations

^{A-D} Mean values not sharing a common superscript column wise differ significantly (P< 0.01)

^{a & b} - Mean values not sharing a common superscript column wise differ significantly (P< 0.05)

Based on the results of this study, it is concluded that Japanese quail fed diets with two per cent fish oil had increased fertility and hatchability (both total and fertile eggs set) followed by birds fed with combination of fish and linseed oils at two per cent level when compared to control groups.

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