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EFFECT OF DIETARY OMEGA-3 PUFA RICH SOURCES ON GROWTH PERFORMANCE OF JAPANESE QUAIL

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Abstract: A study was conducted to assess the growth performance in Japanese quail upon enrichment of quail diets with Omega-3 PUFA rich sources like fish oil and linseed oil, independently and simultaneously at 2 and 4 per cent levels. The biological experiment was carried out by using, five hundred and twenty five day old straight-run Japanese quail chicks up to 5 weeks of age for growth performance studies. Individual body weight and total feed consumption in each replicate group were recorded at weekly intervals to calculate the weight gain and feed efficiency. . The mean body weight gain at the end of fifth week ranged between 201.23 and 221.89 g and birds fed basal diet with 4 per cent fish oil (T_4) had significantly higher body weight gain (221.89 g) as compared to Japanese quail fed basal diet alone (T_1) (205.75 g).

It is concluded that inclusion of n-3 PUFA rich fish oil and linseed oil sources at graded levels independently and simultaneously in Japanese quail feed revealed that birds fed diets enriched with fish oil at four and two per cent levels had significant ($P<0.01$) effect on body weight gain with non-significant variation observed in cumulative feed consumption, feed efficiency.

Keywords: Japanese quail-Omega-3 Polyunsaturated fatty acids – Growth performance.

Introduction

Commercial Japanese quail farming has created a huge impact in recent years and many farms have been established throughout the country both for meat and egg production. Its distinct characteristics include fast growth, shorter generation interval, simple rearing procedure, its ability to withstand wider range of climatic and farm conditions. Small size and rapid growth in Japanese quail has enabled enterprises to be established with low capital outlay, and to start generating income early. Keeping this in view, the present study was carried out to study the effect of Omega-3 Polyunsaturated fatty acid (PUFA) rich oil sources on growth performance of Japanese quail.

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Materials and Methods

The biological experiment was carried out by using five hundred and twenty five day old straight-run Japanese quail chicks reared up to 5 weeks of age for growth performance studies. The birds were wing banded, weighed individually and randomly allotted into seven treatment groups as T_1 (Control : without oils), T_2 (2% Fish oil), T_3 (2% Linseed oil), T_4 (4% Fish oil), T_5 (4% Linseed oil), T_6 : 2% oil (1% Fish oil + 1% Linseed oil) and T_7 : 4% oil (2% Fish oil + 2% Linseed oil) with three replicates having 25 chicks in each replicate. Seven experimental Japanese quail basal diets were formulated as per the standards prescribed by Shrivastav and Panda (1999) on isocaloric and isonitrogenous basis. The birds were reared under cage system of management with standard management practices throughout the experimental period. The birds were fed with experimental diet *ad libitum* and had free access to wholesome water throughout the experimental period except for the variation of polyunsaturated fatty acid (PUFA) rich sources used in ration.

Individual body weight and total feed consumption in each replicate group were recorded at weekly intervals to calculate the weight gain and feed efficiency. The mortality of chicks was recorded on its occurrence during the experimental period and the livability percentage was worked out. The data collected were subjected to statistical analyses as per Snedecor and Cochran (1989).

Results and Discussion

Body weight gain

The mean body weight gain of Japanese quail from first to fifth week of age as influenced by supplementing PUFA rich oil sources independently and simultaneously in feed is presented in Table 1. The mean body weight gain at the end of fifth week ranged between 201.23 and 221.89 g and birds fed basal diet with 4 per cent fish oil (T_4) had significantly higher body weight gain (221.89 g) as compared to Japanese quail fed basal diet alone (T_1) (205.75 g). The values in 2 per cent fish oil fed group were also comparable with that of 4 per cent fish oil group. However, the Japanese quail fed 4 per cent linseed oil had the lowest body weight gain (201.23 g) at fifth week of age between the treatment groups. Statistical analysis revealed highly significant ($P<0.01$) differences in mean body weight gain of Japanese quail and similar trend was observed throughout the experimental period. The above findings are in accordance with the earlier reports of Lopez-Ferrer *et al.* (2001) who reported that weight increase in grams per bird per day was significantly higher ($P<0.05$) in broilers fed with the highest content of fish oil at 4 per cent than in those fed the control diet at 38 days of age.

Contrary to the above findings, Chanmugham *et al.* (1992), An *et al.* (1995) and Saricicek *et al.* (1997) failed to observe significant influence on body weight of broilers. However birds fed with 4 per cent linseed oil had the lowest body weight gain when compared to control.

Cumulative feed consumption

The mean cumulative feed consumption of Japanese quail from first to fifth week of age is presented in Table 2. The mean cumulative feed consumption at the end of fifth week of age ranged between 568.28 and 587.21 g. Japanese quail fed basal diet with 4 per cent fish oil (T_4) consumed cumulatively more feed (587.21g) when compared to control group alone. However, Japanese quail birds fed with combination of fish and linseed oils at 4 per cent level had consumed less feed (568.28g) followed in ascending order by the Japanese quail birds grouped under 2 per cent (fish oil and linseed oil) (T_6) (569.52g), 2 per cent linseed oil (T_3) (569.59 g) and 4 per cent linseed oil (T_5) (577.42 g) when compared to Japanese quail birds consumed the basal diet alone (control). The analysis of variance of data on feed consumption revealed that even though there was a numerical difference in feed consumption noticed among the treatment groups, no significant differences were observed throughout the experimental period. The present study revealed that the inclusion of n-3 PUFA rich oil sources in Japanese quail diet had no significant influence on cumulative feed consumption which is in agreement with the earlier reports of Olomu and Baracos (1991), Chanmugham *et al*. (1992) , An *et al.* (1995), Saricicek *et al*. (1997), Newman *et al.* (2002) and Liu *et al.* (2003).

The research findings demonstrated that Japanese quail fed basal diet with 4 per cent fish oil consumed cumulatively more feed which coincides with the earlier report of Aranibar *et al.* (2001). Contrary to the above findings, Lopez-Ferrer *et al.* (1999) observed decreased feed consumption in broilers fed with 8.2 per cent fish oil than those fed with vegetable oils at 5 weeks of age. Similarly, Crespo and Esteve-Garcia (2001) stated that feed intake of broilers decreased significantly as dietary fat (linseed oil) increased which is in partial agreement with the results obtained in this study.

Feed efficiency

The mean cumulative feed efficiency of Japanese quail up to fifth week of age as influenced by supplementing PUFA rich oil sources independently and simultaneously in feed is presented in Table 3. The results of this study revealed that Japanese quail birds grouped under 4 per cent fish oil had better feed efficiency (2.65) when compared to control group alone. Meanwhile, the birds grouped under 4 per cent linseed oil recorded poorer feed

efficiency (2.88) between the treatment groups. Statistical analysis revealed highly significant (P<0.01) difference during first and third week, significant (P<0.05) difference observed at second week and no significant differences at fourth and fifth weeks of age. The analysis revealed no significant difference in feed efficiency at 4th and 5th week of age, which is in accordance with the earlier reports of Chanmugam *et al*. (1992), Saricicek et al. (1997), Lopez-Ferrer *et al*. (1999) and Crespo and Esteve-Garcia, (2002). However, Japanese quail fed diet supplemented with n-3 PUFA rich oil sources showed highly significant (P<0.01) difference during first and third week of age. The later findings did not support with the earlier report of Olomu and Baracos (1991) who reported that supplementation of 0.0, 1.5, 3.0 and 4.5 per cent flaxseed oil to the diets of broilers for feeding periods of 7 or 21 days revealed no significant difference in feed efficiency among treatment groups. According to Crespo and Esteve-Garcia (2001), feed efficiency was better in birds fed diets with 10 per cent linseed oil because of the higher metabolizable energy content. The results of the present study indicated that the total livability percentages of Japanese quail in all groups were 100 due to supplementation of various n-3 PUFA rich sources independently and simultaneously in feed. In general, the present study suggested that supplementation of various n-3 PUFA rich sources independently and simultaneously in Japanese quail feed had no deleterious effect on health of the birds and the livability was uniformly superior in all the treatment groups.

Table 1: Mean Body weight gain (± S.E.) (g) of Japanese quail as influenced by feeding Omega-3 fatty acid rich oil sources from 1 to 5 weeks of age

Treatment groups	I - Week	II – Week	III - Week	IV - Week	V - Week
T_1- Control	23.81^{BC}±0.49	62.66^{C}±1.04	111.70^{A}±1.74	170.64^{AB}±2.29	205.75^{AB}±2.54
T_2- 2% Fish oil (FO)	25.63^{CD}±0.45	69.21^{D}±1.02	120.93^{B}±2.29	173.01^{B}±2.34	214.65^{BC}±2.59
T_3- 2% Linseed oil (LO)	22.22^{B}±0.60	60.51^{BC}±1.17	111.03^{A}±2.05	167.80^{AB}±2.31	207.33^{AB}±2.80
T_4- 4% Fish oil	26.29^{D}±0.56	71.37^{D}±1.08	123.53^{B}±2.07	182.49^{C}±2.45	221.89^{C}±3.06
T_5- 4% Linseed oil	23.95^{BC}±0.52	61.53^{C}±0.84	110.25^{A}±1.69	163.77^{A}±1.72	201.23^{A}±2.12
T_6-2 %(1%FO+1%LO)	19.88^{A}±0.47	56.81^{AB}±1.16	110.65^{A}±2.06	170.26^{AB}±2.28	207.53^{AB}±2.92
T_7- 4 %(2%FO +2%LO)	23.46^{B}±0.60	56.49^{A}±1.05	109.48^{A}±1.86	164.41^{A}±2.22	206.51^{AB}±2.59

Value within each cell is a mean of 75 observations $^{A-D}$Mean values not sharing a common superscript columnwise differ significantly. (P< 0.01)

Table 2. Mean cumulative feed consumption (± S.E.) (g) of Japanese quail as influenced by feeding Omega-3 fatty acid rich oil sources from 1 to 5 weeks of age

Treatment groups	I - Week	II - Week	III - Week	IV - Week	V - Week
T_1-Control	39.00±0.12	132.00±0.23	273.52±0.30	423.35±4.51	579.19±13.03
T_2-2% Fish oil (FO)	38.77±0.10	131.55±0.19	278.21±3.35	429.39±4.91	585.67±07.24
T_3-2% Linseed oil (LO)	38.64±0.20	131.28±0.39	275.11±4.44	423.36±3.34	569.59±05.71
T_4-4%Fish oil	38.89±0.09	131.79±0.17	278.46±3.82	428.32±1.16	587.21±07.56
T_5-4%Linseed oil	38.71±0.15	131.41±0.29	274.75±5.88	429.28±5.28	577.42±01.30
T_6-2 % (1%FO+1%LO)	39.09±0.07	132.19±0.15	278.75±2.77	432.60±3.92	569.52±10.00
T_7- 4 % (2%FO +2%LO)	38.96±0.08	131.92±0.17	271.27±2.06	415.72±3.37	568.28±10.86

Value within each cell is a mean of three observations

Table 3: Mean cumulative feed efficiency (±S.E.) of Japanese quail as influenced by feeding Omega-3 fatty acid rich oil sources from 1 to 5 weeks of age

Treatment groups	I - Week	II - Week	III - Week	IV - Week	V - Week
T_1- Control	1.64^{ABC}±0.05	2.12^{abc}±0.15	2.45^{BC}±0.02	2.48±0.03	2.82±0.08
T_2- 2% Fish oil (FO)	1.51^{AB}±0.02	1.90^{ab}±0.03	2.30^{AB}±0.05	2.48±0.04	2.73±0.05
T_3- 2% Linseed oil (LO)	1.74^{C}±0.04	2.17^{bc}±0.06	2.48^{C}±0.03	2.53±0.08	2.75±0.10
T_4- 4% Fish oil	1.48^{A}±0.03	1.85^{a}±0.02	2.26^{A}±0.05	2.35±0.02	2.65±0.05
T_5- 4% Linseed oil	1.62^{ABC}±0.03	2.14^{bc}±0.04	2.49^{C}±0.04	2.62±0.04	2.88±0.11
T_6-2 % (1%FO+1%LO)	1.97^{D}±0.08	2.35^{c}±0.18	2.52^{C}±0.00	2.54±0.04	2.75±0.07
T_7- 4 % (2%FO +2%LO)	1.66^{BC}±0.05	2.35^{c}±0.12	2.48^{C}±0.07	2.54±0.10	2.76±0.14

Value within each cell is a mean of three observations $^{A-D}$ Mean values not sharing a common superscript columnwise differ significantly. (P< 0.01)

[abc] Mean values not sharing a common superscript columnwise differ significantly. (P< 0.05)

Summary

Inclusion of n-3 PUFA rich fish oil and linseed oil sources at graded levels independently and simultaneously in Japanese quail feed revealed that birds fed diets enriched with fish oil at four and two per cent levels had significant (P<0.01) effect on body weight gain (221.89 g), with non-significant variation observed in cumulative feed consumption, feed efficiency.

References

[1] An, B.K., Tanaka, K. and Ohtani, S.1995. Effects of various n-3/n-6 fatty acid ratios in diet on lipid metabolism in growing chicks. *Anim. Sci. Technol.,* 66(10): 830-840, (*Poult.Abstr.*,1996, **22**(5): 1235).

[2] Aranibar, M.J., Gracia, M. I. and Mateos, G.G. 2001. Effects of post-hatching fasting and type and level of initial dietary fat on production traits in broilers. In: IX Jornadassobre Produccion Animal, 25-27 April 2001, Zaragoza, Spain, (*Poult. Abstr*., 2002, **28**(9): 2882).

[3] Chanmugam, P., Boudreau, M., Boutte, T., Park, R.S., Hebert, J., Berrio, L. and Hwang, D.H. 1992. Incorporation of different types of n-3 fatty acids into tissue lipids of poultry. *Poult. Sci*., **71**: 516-521.

[4] Crespo, N and Esteve-Garcia, E. 2001. Dietary fatty acid profile modifies abdominal fat deposition in broiler chickens. *Poult. Sci*., **80**: 71-78.

[5] Crespo, N. and Esteve-Garcia, E. 2002. Dietary polyunsaturated fatty acids decrease fat deposition in separable fat depots but not in the remainder carcass. *Poult. Sci*., **81** : 512-518.

[6] Liu, D., Veit, H.P., Wilson, J.H. and Denbow, D.M. 2003. Long-term supplementation of various dietary lipids alters bone mineral content, mechanical properties and histological characteristics of Japanese quail. *Poult.Sci.*, **82:** 831-839.

[7] Lopez-Ferrer,S., Baucells, M.D., Barroeta, A.C. and Grashorn, M.A. 1999. n-3 enrichment of chicken meat using fish oil: Alternative substitution with rapeseed and linseed oils. *Poult.Sci.*, **78:** 356 - 365.

[8] Lopez-Ferrer,S., Baucells, M.D., Barroeta, A.C., Galobart, J. and Grashorn, M.A. 2001. n-3 enrichment of chicken meat. 2. Use of precursors of long-chain polyunsaturated fatty acids: Linseed oil. *Poult.Sci.*, **80**: 753 - 761.

[9] Newman R.E., Bryden, W.L., Fleck, E., Ashes, J.R., Buttemer, W.A., Storlien, L.H. and Downing, J.A. 2002. Dietary n-3 and n-6 fatty acids alter avian

metabolism: Metabolism and abdominal fat deposition. *Br. J. Nutr*., **88**(1): 11-18, (*Poult.Abstr*., 2002, **28**(10) :3196).

[10] Olomu, J.M. and Baracos, V.E. 1991. Influence of dietary flaxseed oil on the performance, muscle protein deposition, and fatty acid composition of broiler chicks. *Poult. Sci*., **70** : 1403 – 1411.

[11] Saricicek, B.Z., Ocak, N. and Garipoglu, A.V. 1997. A study on utilizing fish oil in broiler diets. *Ziraat Fakultesi Dergisi,* **12**(1):33-42 (*Poult. Abstr*.,1998, **24**(7): 2068).

[12] Shrivastav, A.K. and Panda, B. 1999. A review of quail nutrition research in India. *World's Poult. Sci. J.,* **55** : 73-81.

[13] Snedecor,G.W. and Cochran, W.G. 1989. Statistical methods. 8th ed. Iowa State University Press / Ames, Iowa - 50010.