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

G. Raj Manohar* and S.C. Edwin
*Assistant Professor, Department of Poultry Science, Madras Veterinary College, Chennai-600 007 Tamil Nadu Veterinary and Animal Sciences University
E-mail: rajmanovet@gmail.com (*Corresponding Author)

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 (T4) had significantly higher body weight gain (221.89 g) as compared to Japanese quail fed basal diet alone (T1) (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<sub>1</sub> (Control : without oils), T<sub>2</sub> (2% Fish oil), T<sub>3</sub> (2% Linseed oil), T<sub>4</sub> (4% Fish oil), T<sub>5</sub> (4% Linseed oil), T<sub>6</sub> : 2% oil (1% Fish oil + 1% Linseed oil) and T<sub>7</sub> : 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<sub>4</sub>) had significantly higher body weight gain (221.89 g) as compared to Japanese quail fed basal diet alone (T<sub>1</sub>) (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 (T₄) 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) (T₆) (569.52g), 2 per cent linseed oil (T₃) (569.59 g) and 4 per cent linseed oil (T₅) (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

<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>I - Week</th>
<th>II - Week</th>
<th>III - Week</th>
<th>IV - Week</th>
<th>V - Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁- Control</td>
<td>23.81BC±0.49</td>
<td>62.66C±1.04</td>
<td>111.70A±1.74</td>
<td>170.64AB±2.29</td>
<td>205.75AB±2.54</td>
</tr>
<tr>
<td>T₂- 2% Fish oil (FO)</td>
<td>25.63CD±0.45</td>
<td>69.21D±1.02</td>
<td>120.93B±2.29</td>
<td>173.01B±2.34</td>
<td>214.65BC±2.59</td>
</tr>
<tr>
<td>T₃- 2% Linseed oil (LO)</td>
<td>22.22B±0.60</td>
<td>60.51BC±1.17</td>
<td>111.03A±2.05</td>
<td>167.80AB±2.31</td>
<td>207.33AB±2.80</td>
</tr>
<tr>
<td>T₄- 4% Fish oil</td>
<td>26.29D±0.56</td>
<td>71.37D±1.08</td>
<td>123.53B±2.07</td>
<td>182.49C±2.45</td>
<td>221.89C±3.06</td>
</tr>
<tr>
<td>T₅- 4% Linseed oil</td>
<td>23.95BC±0.52</td>
<td>61.53C±0.84</td>
<td>110.25A±1.69</td>
<td>163.77A±1.72</td>
<td>201.23A±2.12</td>
</tr>
<tr>
<td>T₆-2% (1%FO+1%LO)</td>
<td>19.88A±0.47</td>
<td>56.81AB±1.16</td>
<td>110.65A±2.06</td>
<td>170.26AB±2.28</td>
<td>207.53AB±2.92</td>
</tr>
<tr>
<td>T₇-4% (2%FO+2%LO)</td>
<td>23.46B±0.60</td>
<td>56.49A±1.05</td>
<td>109.48A±1.86</td>
<td>164.41A±2.22</td>
<td>206.51AB±2.59</td>
</tr>
</tbody>
</table>
Value within each cell is a mean of 75 observations. 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

<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>I - Week</th>
<th>II - Week</th>
<th>III - Week</th>
<th>IV - Week</th>
<th>V - Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 - Control</td>
<td>39.00±0.12</td>
<td>132.00±0.23</td>
<td>273.52±0.30</td>
<td>423.35±4.51</td>
<td>579.19±13.03</td>
</tr>
<tr>
<td>T2 - 2% Fish oil (FO)</td>
<td>38.77±0.10</td>
<td>131.55±0.19</td>
<td>278.21±3.35</td>
<td>429.39±4.91</td>
<td>585.67±07.24</td>
</tr>
<tr>
<td>T3 - 2% Linseed oil (LO)</td>
<td>38.64±0.20</td>
<td>131.28±0.39</td>
<td>275.11±4.44</td>
<td>423.36±3.34</td>
<td>569.59±05.71</td>
</tr>
<tr>
<td>T4 - 4% Fish oil</td>
<td>38.89±0.09</td>
<td>131.79±0.17</td>
<td>278.46±3.82</td>
<td>428.32±1.16</td>
<td>587.21±07.56</td>
</tr>
<tr>
<td>T5 - 4% Linseed oil</td>
<td>38.71±0.15</td>
<td>131.41±0.29</td>
<td>274.75±5.88</td>
<td>429.28±5.28</td>
<td>577.42±01.30</td>
</tr>
<tr>
<td>T6 - 2% (1% FO+1% LO)</td>
<td>39.09±0.07</td>
<td>132.19±0.15</td>
<td>278.75±2.77</td>
<td>432.60±3.92</td>
<td>569.52±10.00</td>
</tr>
<tr>
<td>T7 - 4% (2% FO+2% LO)</td>
<td>38.96±0.08</td>
<td>131.92±0.17</td>
<td>271.27±2.06</td>
<td>415.72±3.37</td>
<td>568.28±10.86</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>I - Week</th>
<th>II - Week</th>
<th>III - Week</th>
<th>IV - Week</th>
<th>V - Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 - Control</td>
<td>1.64^ABC±0.05</td>
<td>2.12^abc±0.15</td>
<td>2.43^BC±0.02</td>
<td>2.48±0.03</td>
<td>2.82±0.08</td>
</tr>
<tr>
<td>T2 - 2% Fish oil (FO)</td>
<td>1.51^AB±0.02</td>
<td>1.90^ab±0.03</td>
<td>2.30^AB±0.05</td>
<td>2.48±0.04</td>
<td>2.73±0.05</td>
</tr>
<tr>
<td>T3 - 2% Linseed oil (LO)</td>
<td>1.74^C±0.04</td>
<td>2.17^bc±0.06</td>
<td>2.48^C±0.03</td>
<td>2.53±0.08</td>
<td>2.75±0.10</td>
</tr>
<tr>
<td>T4 - 4% Fish oil</td>
<td>1.48^A±0.03</td>
<td>1.85^a±0.02</td>
<td>2.26^A±0.05</td>
<td>2.35±0.02</td>
<td>2.65±0.05</td>
</tr>
<tr>
<td>T5 - 4% Linseed oil</td>
<td>1.62^ABC±0.03</td>
<td>2.14^bc±0.04</td>
<td>2.49^C±0.04</td>
<td>2.62±0.04</td>
<td>2.88±0.11</td>
</tr>
<tr>
<td>T6 - 2% (1% FO+1% LO)</td>
<td>1.97^D±0.08</td>
<td>2.35^c±0.18</td>
<td>2.52^C±0.00</td>
<td>2.54±0.04</td>
<td>2.75±0.07</td>
</tr>
<tr>
<td>T7 - 4% (2% FO+2% LO)</td>
<td>1.66^BC±0.05</td>
<td>2.35^c±0.12</td>
<td>2.48^C±0.07</td>
<td>2.54±0.10</td>
<td>2.76±0.14</td>
</tr>
</tbody>
</table>

Value within each cell is a mean of three observations. 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**


