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***Research Article***

# EFFECT OF SUNFLOWER CAKE INCLUSION ON PRODUCTION PERFORMANCE OF QUAIL BREEDERS

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## ABSTRACT
The biological trial of twenty-four weeks duration was carried out with 400 adult Japanese quails equally and randomly distributed into ten treatment groups of two replicates. All the quails were housed in multi-tier breeder cages up to thirty weeks of age. The quails in control group were fed corn-soya based diet with no multi-enzyme supplementation. Treatment groups were fed on diets containing 25, 50, 75 and 100 per cent levels of sunflower cake replacing the protein mix consisting of 60% groundnut cake and 40% DORB on an isolysine, isomethionine, isocalric and isonitrogenous with no multi-enzyme supplementation and, similar treatment groups were fed with multi-enzyme supplementation. The means hen-housed egg production in different treatments showed significant variation ($P<0.05$ and $P<0.01$) except for 19-22 and 27-30 weeks age intervals. But, the means hen-day egg production in different treatments showed significant variation ($P<0.05$ and $P<0.01$) except for 15-18 and 19-22 weeks age intervals. The means for feed efficiency per dozen eggs was significantly ($P<0.05$ and $P<0.01$) influenced by the treatments during 11-14, 23-26 and 27-30 weeks age intervals. Similarly, the means for feed efficiency per kg eggs was significantly by the different treatments during 15-18, 23-26 and 27-30 weeks age intervals The enzyme supplementation did not influence the hen-hosed hen-day egg production and feed efficiency (per dozen eggs and per kg egg mass).

***Key Words****: Japanese Quails, Sunflower Cake, Multi-Enzyme, Egg production Traits*

## INTRODUCTION
Quail farming has shown increasing importance in India because quails show early sexual maturity and have small body size, which results in lower necessity of housing space and feed. It is important to determine more precisely the cost effective nutritional requirement of quails. Protein of high quality with adequate amino acids balance is one of the most important nutrients for quails and is also one of the most expensive nutrients. Sunflower oil cake is the cheaper source of vegetable protein than groundnut oil cake and soya and, is also rich in fiber which limits its utilization but could be enhanced through enzyme supplementation. Hence, the present study was undertaken to analyze the effect of Sunflower oil cake on egg production performance of Japanese quails at different levels of its inclusion replacing the groundnut oil cake.

## MATERIALS AND METHODS
The biological trial of twenty-four weeks duration (7-30 weeks) was carried out with 230 adult Japanese quails were equally and randomly distributed in to ten different treatment groups (T0, T1, T2, T3, T4, T5, T6, T7, T8 and T9) of two replicates belonging to the same age. All the quails were housed in multi-tier Japanese quail breeder cages and standard feeding and other management practices were followed. The per cent ingredient and nutrient composition of the diet for treatment groups are formulated as per NRC standards (1977) and are furnished (Table 1). A protein mixture consisting of 60% groundnut oil cake and 40% de-oiled rice bran was prepared and used as major protein source (31.4%) in the control diet (T0) which was replaced by sunflower oil cake at graded levels on isolysine (1.3%) and isomethionine (0.5 %) basis according to NRC standards (1977). The dietary treatments were control – T0 corn GNC based diet T1, T2, T3, T4 were 25, 50, 75 and 100 per cent replacement of GNC by SFOC T5 corn GNC based diet with multi enzyme, T6, T7, T8, T9 were 25, 50, 75 and 100 per cent levels replacement of GNC by SFOC with multi enzyme supplementation. Feeding was carried out up to thirty weeks of age. Data on hen-

housed and, hen-day egg production and feed efficiency (per dozen eggs and per kg egg mass) at four week intervals up to thirty weeks of age were recorded and subjected to analysis of variance as per Snedcor and Cochran (1989).

**Table 1: Composition of the ration**

| Sr. No. | Ingredients | Control | 25% | 50% | 75% | 100% |
|---|---|---|---|---|---|---|
| 1 | Maize | 47 | 47 | 47 | 47 | 47 |
| 2 | Protein mix | 34 | 25.5 | 17 | 8.5 | 0 |
| 3 | SFOC | 0 | 8.5 | 17 | 25.5 | 34 |
| 4 | Soya bean meal | 5 | 5 | 5 | 5 | 5 |
| 5 | Fishmeal | 8 | 8 | 8 | 8 | 8 |
| 6 | Shell grit | 4 | 4 | 4 | 4 | 4 |
| 7 | Mineral mixture | 2 | 2 | 2 | 2 | 2 |
| 8 | Vitamin mixture | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 9 | Total | 100 | 100 | 100 | 100 | 100 |
| 10 | CP (%) | 20.51 | 20.56 | 20.61 | 20.66 | 20.72 |
| 11 | ME (Kcal/kg) | 2612 | 2611 | 2611 | 2610 | 2609 |
| 12 | Calcium (%) | 2.62 | 2.64 | 2.65 | 2.67 | 2.69 |
| 13 | Phosphorus (%) | 0.37 | 0.38 | 0.40 | 0.42 | 0.44 |

*The composition of T5 to T9 diets were similar to T0 to T4 respectively except for the addition of 500 gm of enzyme mix per ton of feed the enzyme contained cellulose 2000, hemicelluloses 2500,glucosidase 245, pectinase 850 protease 48000 and amylase 11000 IU per gram*

## RESULTS AND DISCUSSION

The means hen-housed egg production from 7-30 weeks of age (Table 2) in different treatments showed significant variation ($P<0.05$ and $P<0.01$) except for 19-22 and 27-30 weeks age intervals. But, the means hen-day egg production from 7-30 weeks of age (Table 3) in different treatments showed significant variation ($P<0.05$ and $P<0.01$) except for 15-18 and 19-22 weeks age intervals. Enzyme supplementation showed a non-significant effect on hen-housed and hen-day egg production at all age intervals except the hen-day egg production of 23-26 weeks age interval. It was also observed that quails can perform better even on complete replacement levels of sunflower cake with groundnut oil cake. These results are in accordance with the findings of Singh and Prasad (1978), Elangovan *et al.,* (2000) and Shrivastav and Johri (2005).

The means for feed efficiency per dozen eggs was significantly ($P<0.05$ and $P<0.01$) influenced by the treatments during 11-14, 23-26 and 27-30 weeks age intervals (Table 4). Similarly, the means for feed efficiency per kg eggs was significantly by the different treatments during 15-18, 23-26 and 27-30 weeks age intervals (Table 5). Supplementation was found to be significant only for 15-18 weeks age interval feed efficiency per dozen eggs and per kg egg mass. The results are in accordance with the findings of Shrivatsava (1977) and Elangovan *et al.,* (2000) who obtained better feed efficiency in sunflower meal fed groups. It is to conclude that feed conversion in Japanese quails did not show any definite pattern based on feeding of graded levels of sunflower oil cake and enzyme supplementation, it needs further studies for consistent results and valid conclusion.

**Table 2: Hen-Housed egg production performance of breeder quails**

| age intervals (weeks) | T0 | T5 | Pooled | T1 | T6 | Pooled | T2 | T7 | Pooled | T3 | T8 | Pooled | T4 | T9 | Pooled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7-10 | 49.76 ± 1.66 | 52.01± 1.78 | 50.88 ± 1.72 a | 50.83 ± 3.45 | 53.09 ± 3.33 | 51.96 ± 3.39 abc | 50.95 ± 0.95 | 52.37 ± 3.09 | 51.66 ± 2.02 ab | 58.57 ± 0.30 | 53.56 ± 5.23 | 56.21 ± 2.76 d | 54.17 ± 0.83 | 54.75 ± 6.66 | 54.46 ± 3.74 abcd |
| 11-14 | 71.07 ± 1.31 | 70.70 ± 1.69 | 70.88 ± 9.10 a | 79.63 ± 2.02 | 79.28 ± 6.19 | 79.45 ± 4.10 abc | 70.59 ± 3.93 | 78.09 ± 3.09 | 74.34 ± 3.51 ab | 89.16 ± 1.07 | 80.47 ± 2.86 | 84.81± 1.96 c | 82.26 ± 0.12 | 89.87 ± 9.64 | 86.06 ± 4.88 c |
| 15-18 | 71.07 ± 1.31 | 84.87 ± 2.73 | 77.97 ± 2.02 ab | 79.63 ± 2.02 | 79.28 ± 6.19 | 79.45 ± 4.10 ab | 70.59 ± 3.93 | 78.09 ± 3.09 | 74.34 ± 3.51 ab | 89.16 ± 1.07 | 80.47 ± 2.86 | 84.81 ± 1.96 ab | 82.14 ± 0.30 | 89.87 ± 9.64 | 86.00 ± 4.97 b |
| 19-22 | 64.04 ± 0.24 | 75.59 ± 2.74 | 69.81 ± 1.49 a | 71.42 ± 2.85 | 68.21 ± 1.31 | 69.81 ± 2.08 a | 67.37 ± 1.02 | 67.85 ± 2.62 | 67.61 ± 6.42 a | 76.06 ± 2.26 | 69.75 ± 0.71 | 72.90 ± 1.48 a | 69.04 ± 1.90 | 76.42 ± 1.04 | 72.73 ± 6.18 a |
| 23-26 | 58.44 ± 0.83 | 57.02± 2.04 | 57.73 ± 1.43 cd | 52.73 ± 1.31 | 51.30 ± 0.11 | 52.01 ± 0.71 ab | 59.52 ± 0.24 | 59.99 ± 0.71 | 59.75 ± 0.47 d | 51.19 ± 0.95 | 56.42 ± 0.47 | 53.80 ± 0.71 abc | 54.26 ± 1.17 | 47.73 ± 0.83 | 50.99 ± 1.00 a |
| 27-30 | 56.18 ± 0.23 | 67.85 ± 0.24 | 62.02 ± 0.24 a | 58.92 ± 1.07 | 55.59 ± 1.31 | 57.26 ± 1.19 a | 57.25 ± 7.02 | 66.07± 1.07 | 61.66 ± 4.05 a | 51.54 ± 1.54 | 54.51 ± 4.28 | 53.03 ± 2.91 a | 63.56 ± 3.30 | 54.75 ± 2.85 | 59.16 ± 3.08 a |

*Means bearing the same superscript within classes do not differ significantly.*
** (P<0.05),** (P<0.01).*

**Table: 3 Hen-Day egg production performances of breeder quails**

| Age intervals (weeks) | T0 | T5 | Pooled | T1 | T6 | Pooled | T2 | T7 | Pooled | T3 | T8 | Pooled | T4 | T9 | Pooled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7-10 | 49.76 ± 1.66 | 52.02 ± 1.78 | 50.89 ± 1.72 [a] | 53.59 ± 3.84 | 53.09 ± 3.33 | 53.34 ± 3.59 [abc] | 50.95 ± 0.95 | 52.38 ± 3.09 | 51.67 ± 2.02 [ab] | 59.66 ± 1.08 | 53.66 ± 5.23 | 56.61 ± 3.16 [c] | 57.52 ± 0.82 | 54.76 ± 6.66 | 56.14 ± 3.74 [abc] |
| 11-14 | 71.07 ± 1.31 | 72.52 ± 7.67 | 71.79 ± 9.49[a] | 85.33 ± 2.17 | 79.28 ± 6.19 | 82.31 ± 4.18 [abc] | 74.39 ± 0.12 | 78.09 ± 3.09 | 76.24 ± 1.61 [ab] | 94.45 ± 0.07 | 80.47 ± 2.86 | 87.46 ± 1.47 [bc] | 88.14 ± 0.12 | 89.88 ± 9.64 | 89.01 ± 4.88 [c] |
| 15-18 | 71.16 ± 1.39 | 90.94 ± 2.93 | 81.05 ± 2.16[a] | 85.33 ±2.17 | 83.38 ± 6.82 | 84.36 ± 4.49[a] | 78.70 ± 7.28 | 79.45 ± 3.92 | 79.08 ± 5.60 [a] | 95.53 ± 1.15 | 83.35 ± 3.06 | 89.44 ± 2.11 [a] | 88.01 ± 0.13 | 92.98 ± 7.02 | 90.49 ± 3.57 [a] |
| 19-22 | 69.69 ± 0.82 | 80.99 ± 2.93 | 75.34 ± 1.88[a] | 81.03 ± 5.63 | 73.08 ± 1.40 | 77.06 ±3.52 [a] | 77.83 ± 1.72 | 72.68 ± 2.82 | 75.26 ± 2.56 [a] | 82.56 ± 2.67 | 74.74 ± 0.77 | 78.65 ± 1.72 [a] | 74.66 ± 0.54 | 81.88 ± 1.22 | 78.27 ± 5.88 [a] |
| 23-26 | 65.25 ± 1.24 | 67.35 ± 5.59 | 66.30 ± 3.42[abcd] | 66.78 ± 0.77 | 56.41 ± 0.43 | 61.59 ± 0.60[abc] | 77.53 ± 3.43 | 64.69 ± 0.85 | 71.11 ± 2.14 [bcd] | 59.06 ± 1.10 | 61.47 ± 0.28 | 60.27 ± 1.38 [ab] | 60.35 ± 0.91 | 52.55 ± 0.71 | 56.45 ± 0.81 [a] |
| 27-30 | 73.03 ± 3.91 | 86.03 ± 2.51 | 79.53 ± 3.21[b] | 75.32 ± 4.68 | 66.75 ± 1.10 | 71.04 ± 2.89 [ab] | 78.88 ± 1.29 | 76.24 ± 1.23 | 77.56 ± 7.09 [ab] | 64.45 ± 3.45 | 65.73 ± 7.77 | 65.01 ± 5.61 [a] | 75.36 ± 6.80 | 64.41 ± 3.18 | 69.89± 4.99 [ab] |

*Means bearing the same superscript within classes do not differ significantly. * (P<0.05),** (P<0.01).*

**Table: 4 feed efficiency (kg of feed per dozen eggs) of breeder quails**

| age intervals (weeks) | T0 | T5 | Pooled | T1 | T6 | Pooled | T2 | T7 | Pooled | T3 | T8 | Pooled | T4 | T9 | Pooled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7-10 | 0.34 ± 0.01 | 0.31 ± 0.05 | 0.33 ± 0.03 [a] | 0.32 ± 0.01 | 0.31 ± 0.01 | 0.32 ± 0.01 [a] | 0.33 ± 0.01 | 0.31 ± 0.02 | 0.32 ± 0.03 [a] | 0.28 ± 0.01 | 0.31 ± 0.03 | 0.30 ± 0.02 [a] | 0.31 ± 0.01 | 0.31 ± 0.04 | 0.31 ± 0.03 [a] |
| 11-14 | 0.33 ± 0.01 | 0.25 ± 0.01 | 0.29 ± 0.01 [b] | 0.26 ± 0.01 | 0.28 ± 0.02 | 0.27 ± 0.02 [a] | 0.29 ± 0.02 | 0.29 ± 0.02 | 0.29 ± 0.02 [b] | 0.25 ± 0.01 | 0.27 ± 0.01 | 0.26 ± 0.01 [ab] | 0.25 ± 0.01 | 0.25 ± 0.03 | 0.25 ± 0.02 [ab] |
| 15-18 | 0.36 ± 0.01 | 0.30 ± 0.01 | 0.33 ± 0.01 [a] | 0.34 ± 0.01 | 0.31 ± 0.01 | 0.33 ± 0.01 [a] | 0.32 ± 0.01 | 0.33 ± 0.01 | 0.33 ± 0.01 [a] | 0.30 ± 0.01 | 0.33 ± 0.01 | 0.32 ± 0.01 [a] | 0.31 ± 0.01 | 0.28 ± 0.02 | 0.29 ± 0.02 [a] |
| 19-22 | 0.40 ± 0.01 | 0.34 ± 0.02 | 0.37 ± 0.02 [a] | 0.32 ± 0.02 | 0.39 ± 0.01 | 0.36 ± 0.02 [a] | 0.35 ± 0.04 | 0.38 ± 0.01 | 0.37 ± 0.03 [a] | 0.35 ± 0.03 | 0.38 ± 0.01 | 0.37 ± 0.02 [a] | 0.37 ± 0.01 | 0.34 ± 0.04 | 0.36 ± 0.03 [a] |
| 23-26 | 0.40 ± 0.04 | 0.42 ± 0.03 | 0.41 ± 0.04 [ab] | 0.46 ± 0.03 | 0.48 ± 0.02 | 0.47 ± 0.03 [c] | 0.37 ± 0.02 | 0.42 ± 0.01 | 0.40 ± 0.01 [a] | 0.49 ± 0.01 | 0.43 ± 0.01 | 0.46 ± 0.01 [c] | 0.48 ± 0.01 | 0.53 ± 0.01 | 0.51 ± 0.01 [c] |
| 27-30 | 0.40 ± 0.02 | 0.31 ± 0.05 | 0.36 ± 0.02 [a] | 0.38 ± 0.02 | 0.43 ± 0.01 | 0.40 ± 0.01 [abc] | 0.36 ± 0.06 | 0.38 ± 0.01 | 0.37 ± 0.04 [ab] | 0.43 ± 0.03 | 0.45 ± 0.06 | 0.44 ± 0.05 [c] | 0.38 ± 0.04 | 0.41 ± 0.02 | 0.39 ± 0.03 [abc] |

*Means bearing the same superscript within classes do not differ significantly.*
** (P<0.05),** (P<0.01).*

**Table 5: feed efficiency (kg of feed per kg of eggs) of breeder quails**

| age intervals (weeks) | T0 | T5 | Pooled | T1 | T6 | Pooled | T2 | T7 | Pooled | T3 | T8 | Pooled | T4 | T9 | Pooled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7-10 | 2.86 ± 0.04 | 2.71 ± 0.06 | 2.79 ± 0.05 [a] | 2.74 ± 0.16 | 2.57 ± 0.07 | 2.66 ± 0.12 [a] | 2.80 ± 0.05 | 2.52 ± 0.19 | 2.66 ± 0.12 [a] | 2.25 ± 0.01 | 2.64 ± 0.37 | 2.45 ± 0.19 [a] | 2.47 ± 0.04 | 2.65 ± 0.43 | 2.56 ± 0.24 [a] |
| 11-14 | 3.14 ± 0.14 | 2.27 ± 0.07 | 2.71 ± 0.11 [a] | 2.62 ± 0.04 | 2.68 ± 0.40 | 2.65 ± 0.22 [a] | 2.75 ± 0.30 | 2.93 ± 0.14 | 2.84 ± 0.22 [a] | 2.24 ± 0.02 | 2.64 ± 0.24 | 2.44 ± 0.13 [a] | 2.31 ± 0.01 | 2.43 ± 0.36 | 2.37 ± 0.19 [a] |
| 15-18 | 3.96 ± 0.38 | 3.21 ± 0.20 | 3.59 ± 0.29 [b] | 3.42 ± 0.29 | 3.13 ± 0.04 | 3.28 ± 0.17 [ab] | 3.31 ± 0.18 | 3.16 ± 0.22 | 3.24 ± 0.20 [ab] | 3.29 ± 0.16 | 2.88 ± 0.12 | 3.09 ± 0.14 [a] | 3.42 ± 0.12 | 3.01 ± 0.34 | 3.22 ± 0.23 [ab] |
| 19-22 | 3.60 ± 0.18 | 3.21 ± 0.36 | 3.41 ± 0.27 [a] | 2.84 ± 0.20 | 3.26 ± 0.19 | 3.05 ± 0.20 [a] | 3.53 ± 0.08 | 3.43 ± 0.01 | 3.48 ± 0.05 [a] | 2.84 ± 0.02 | 3.32 ± 0.09 | 3.08 ± 0.06 [a] | 3.33 ± 0.01 | 3.18 ± 0.32 | 3.26 ± 0.17 [a] |
| 23-26 | 3.75 ± 0.34 | 3.73 ± 0.42 | 3.74 ± 0.38 [ab] | 4.69 ± 0.43 | 3.96 ± 0.19 | 4.33 ± 0.31 [abc] | 3.22 ± 0.02 | 4.15 ± 0.09 | 3.69 ± 0.06 [a] | 4.77 ± 0.01 | 4.09 ± 0.40 | 4.43 ± 0.21 [abc] | 4.72 ± 0.22 | 4.68 ± 0.18 | 4.70 ± 0.20 [c] |
| 27-30 | 3.99 ± 0.04 | 3.20 ± 0.09 | 3.59 ± 0.07 [a] | 4.04 ± 0.47 | 4.73 ± 0.06 | 4.39 ± 0.27 [bc] | 3.88 ± 0.57 | 3.87 ± 0.33 | 3.88 ± 0.45 [ab] | 4.55 ± 0.36 | 4.99 ± 0.62 | 4.77 ± 0.49 [c] | 3.77 ± 0.48 | 4.34 ± 0.18 | 4.06 ± 0.33 [abc] |

*Means bearing the same superscript within classes do not differ significantly.*
** (P<0.05),** (P<0.01).*

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