INFLUENCE OF FISH OIL ON EGG PRODUCTION AND FEED INTAKE IN ATHULYA AND NATIVE CHICKENS

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ABSTRACT

An experiment was conducted in Department of Poultry Science, College of Veterinary and Animal Sciences, Mannuthy to evaluate the influence of sardine fish oil on production performance of Athulya and native chicken. Two breeds of hen (Athulya and native 60 each) with three dietary treatments *viz.,* 0, 1.5 and 3.0 per cent fish oil were tested in a randomized block design arrangements with four replicates of five birds each. The experiment was conducted from 29th-40th weeks of age comprising of three, 28 day periods. The breed effect and the interaction effect between fish oil level and breed were significant for overall mean hen day egg production per cent and for mean daily feed consumption. The egg production has remained optimal in Athulya hens on inclusion of fish oil at the two levels whereas a negative impact was noticed in native hens on inclusion of fish oil. Lower egg production rate in native hen could be due to a significant reduction in total feed intake. Significant difference in feed intake might be due to the difference in genetic makeup of these two breeds.

Keywords: Sardine fish oil, Athulya chicken, native chicken

INTRODUCTION

In present scenario consumers are extremely conscious on their wellbeing, as a result demands of beneficial foods inflates enormously. Designer eggs provide health benefits beyond its traditional nutritional value which can be produced by either modification of hen's diet or by manipulating immune system of hen. Efforts by the poultry industry to market value added eggs have stimulated research concerning the fatty acid modification of eggs. Omega-3 fatty acids have been proven to be one of the remedies to counteract cardiovascular diseases in addition to other health benefits. Dietary supplementation with preformed Docosahexaenoic Acid (DHA) and Eicosapentaenoic Acid (EPA) in the form of fish oil isconsidered to be more effective in enrichment of egg compared to enrichment with its precursor α-Linolenic acid through addition of flaxseed, linseed, canola, soyabean etc. The success of this strategy depends on developing ways to increase the omega-3 fatty acid content of eggs without affecting production performance of laying chicken.

The Athulya chicken is a single combed White Leghorn strain cross (IWN x IWP) developed by intense selection for egg production for 30 generations. The native chicken is a brown egg layer selected for egg production for four generations. The both breeds were improved by Osborn index method of selection in AICRP on Poultry for Eggs, Mannuthy. This study was conducted to determine the effects of fish oil on feed consumption and egg production in these two breeds of chicken.

MATERIALS AND METHODS

A total of one hundred and twenty hens, belonging to two breeds (Athulya-White Leghorn strain cross and native birds) were housed in individual cages (15× 18 cm) of two tier California cage system available at All India Co-ordinated Research Project (AICRP) on Poultry Improvement, Mannuthy. The birds were subjected to three dietary treatments *viz*., control diet without fish oil, a diet with 1.5 per cent fish oil and a diet with 3.0 per cent fish oil. Each of the six experimental treatments was having four replicates with five birds each. The three dietary treatments were tested in both breeds of hen in a randomized block design arrangements. The experiment was conducted from 29-40 weeks of age comprising three, 28-day periods (Period I, II and III). All the diets were isonitrogenous and isocaloric and formulated as per Bureau of Indian Standards Specification (2007). Sardine oil for dietary treatment was purchased from Central Marine Fisheries Research Institute (CMFRI), Cochin, at three weeks interval during the experimental period. Chemical composition of experimen-

tal diets are presented in Table 1. Individual egg production from 29 to 40 weeks of age was recorded and mean hen day egg production per cent was calculated. Feed intake was recorded replicate wise at the end of every 28-day period as the difference between total feed offered and the cumulative left over. From the above data, feed intake per bird per day was calculated. Data on egg production and feed intake were analysed statistically using SPSS version 24.0.

Table 1. Chemical composition of experimental diets

Composition	Control	1.5 % fish oil diet	3.0 % fish oil diet
ME (kcal/kg)	2600	2600	2600
Crude protein (per cent)	18.00	18.28	18.20
Dry matter (per cent)	89.2	89.0	89.3
Crude fibre (per cent)	3.41	3.89	4.32
Total ash (per cent)	14.50	13.99	13.82
Acid insoluble ash(per cent)	1.56	1.66	1.73
Calcium (per cent)	3.35	3.33	3.29
Ether extract (per cent)	2.94	3.25	4.85

RESULTS AND DISCUSSION

The effect of dietary fish oil level at the three levels was not significant for the mean per cent hen day egg production either during periods I and III or when pooled over the entire experimental period from 29 to 40 weeks of age as shown in Table 2(a). During period II, significantly ($p<0.05$) higher hen day egg production was observed in control group (80.06 per cent) when compared to 1.5 per cent oil fed group (66.95 per cent). However, hen day egg production in 3.0 per cent oil fed group (71.69 per cent) was statistically similar with 0 and 1.5 per cent oil fed groups.

The observation of similar egg production during different periods and overall period was in agreement with observations of Hargis *et al*. (1991) who reported no significant difference on egg production in Leghorn hens fed diet containing 3 per cent menha-

den oil for 18 weeks feeding trial compared to control birds. Similarly, Cachaldora *et al*. (2005) and Ceylan *et al*. (2011) also revealed no significant difference in egg production characteristics when laying hens were fed with different levels of fish oil.

On contrary, Herbert and Van Elswyk (1996) reported significantly higher egg production in menhaden oil added group (63.3 per cent) compared to control (53.3 per cent) after a four weeks feeding trial. Similarly, Scheideler and Froning(1996) noticed significantly ($p<0.05$) higher hen day egg production in the fish oil added group (93 per cent) compared to control (83.1 per cent) for a period of eight weeks.

The breed effect was significant ($p<0.01$) for mean per cent hen day egg production during the three periods and when pooled over the entire experimental period from 29 to 40 weeks of age. Athulya birds showed significantly ($p<0.05$) higher mean per cent hen day egg production during the three periods as well as during the experimental period from 29 to 40 weeks of age. The result is in agreement with the reports of All India Co-ordinated Research Project (AICRP) on Poultry Improvement (2017).

The interaction effect between fish oil level and breed was significant ($p<0.05$) for mean per cent hen day egg production during period Π and also from 29 to 40 weeks of age as shown in Table 2(b). During period Π, a significantly ($p<0.05$) higher hen day egg production was observed in Athulya birds fed with 3.0 per cent oil followed by 1.5 per cent oil fed group.The mean hen day egg production per cent of Athulya birds in the control group was comparable with the 3 per cent and 1.5 per cent fish oil fed groups.However, significantly lower hen day egg production was noticed in Native birds fed with 1.5 and 3.0 per cent oil when compared with the control group during period II.

The overall mean hen day egg production per cent was statistically similar for Athulya hens fed with different levels of fish oil whereas in native hen, hen day egg production was significantly ($p<0.05$) lower in 1.5 and 3.0 per cent oil fed groups compared to control. Athulya birds fed with 3.0 and 1.5 per cent fish oil showed numerically higher overall mean per cent hen day egg production even though the values were statistically similar.

The effect of fish oil at different levels in the diet was significant for mean daily feed consumption during period I and for the overall daily feed consumption from 29 to 40

weeks of age as shown in Table 3(a). Significantly ($p<0.05$) lower feed consumption was noticed in 3.0 and 1.5 per cent oil fed groups compared to control group during period I as well as for the overall feed consumption from 29 to 40 weeks of age.

Table 2(a). Mean hen day egg production on different levels of inclusion of fish oil in Athulya and Native hens, per cent

Item	Period/age in weeks			
	Period I 29-32	Period II 33-36	Period III 37-40	Overall mean 29-40
Fish oil, %				
0	78.96±2.20	80.06^{a}±2.61	74.60±2.69	77.88±1.81
1.5	79.92±2.20	66.95^{b}±2.61	72.84±2.69	73.11±1.81
3.0	73.48±2.21	71.69^{ab}±2.58	72.48±2.66	72.09±1.79
Breed				
Athulya	89.72^{a}±1.75	90.05^{a}±2.09	89.74^{a}±2.19	89.88^{a}±1.43
Native	65.18^{b}±1.83	55.74^{b}±2.07	56.87^{b}±2.24	59.17^{b}±1.54
p-value				
Fish oil, %	0.086	0.002*	0.830	0.076
Breed	0.000**	0.000**	0.000**	0.000**
Fish oil, % ×Breed	0.076	0.015*	0.444	0.015*

Means bearing same superscript within a column do not differ significantly ($p<0.05$)

* Significant ($p<0.05$)** Highly significant ($p<0.01$)

Similar to the present findings, Gonzalez-Esquerra and Leeson (2000) observed slightly lower feed intake during last 28 days in White Leghorn hens subjected to four per cent menhaden oil from 19 to 55 weeks of age compared to the hens on diets containing two per cent menhaden oil. Dong *et al*. (2018) also reported significantly ($p<0.05$) lower overall feed intake in fish oil fed group compared to vegetable oil added groups at eight per cent concentration for 20 weeks of feeding trial.

Table 2(b). Mean hen day egg production with significant fish oil level×breed interaction, per cent

Item	Period Π (33-36 week)	Overall mean (29-40 week)
0% fish oil × Athulya	89.38^{ab}± 5.59	84.76^{a}±4.90
1.5% fish oil × Athulya	82.99^{b}±4.95	87.33^{a}±2.71
3.0% fish oil× Athulya	94.64^{a}±0.84	92.02^{a}±1.19
0% fish oil × Native	68.14^{c}± 5.14	62.77^{b}±4.91
1.5% fish oil × Native	47.14^{d}±5.66	54.87^{c}±4.86
3.0% fish oil× Native	50.41^{d}±5.11	51.59^{c}±3.84

Means bearing same superscript within a column do not differ significantly ($p<0.05$)

Table 3(a). Mean daily feed consumption per bird on different levels of inclusion of fish oil in Athulya and Native hens, g

Item	Period/age in weeks			
	Period I 29-32	Period Π 33-36	Period Ш 37-40	Overall mean 29-40
Fish oil, %				
0	102.11^{a}±1.90	100.64±2.28	96.43±3.41	99.73^{a}±1.78
1.5	96.24^{b}±1.90	92.48±2.28	94.43±3.41	94.38^{b}±1.18
3.0	94.45^{b}±1.90	94.39±2.28	91.56±3.41	93.46^{b}±1.17
Breed				

Athulya	112.36[a]±1.01	109.11[a]±1.61	111.44[a]±2.17	110.97[a]±0.92
Native	82.57[b]±2.72	82.83[b]±2.42	76.84[b]±3.52	80.75[b]±1.23
p-value				
Fish oil, %	0.027*	0.428	0.100	0.047*
Breed	0.000**	0.000**	0.000**	0.000**
Fish oil, % ×Breed	0.011*	0.052	0.606	0.024*

Means bearing same superscript within a column do not differ significantly ($p<0.05$)

* Significant ($p<0.05$)** Highly significant ($p<0.01$)

Table 3(b). Mean daily feed consumption per bird with significant fish oil level×breed interaction, g

Item	Period I (29-32 week)	Overall mean (29-40 week)
0% fish oil × Athulya	111.77[a]±2.37	110.90[a]±1.01
1.5% fish oil × Athulya	112.34[a]±1.37	109.77[a]±1.61
3.0% fish oil× Athulya	112.98[a]±1.89	112.24[a]±2.17
0% fish oil × Native	92.44[b]±4.37	80.95[b]±4.91
1.5% fish oil × Native	80.14[c]±2.68	78.99[c]±2.42
3.0% fish oil× Native	75.92[c]±2.50	74.69[c]±3.52

Means bearing same superscript within a column do not differ significantly ($p<0.05$)

On contrary, Alvarez *et al*. (2004) reported no significant difference in feed consumption in Warren laying hens when fed with fish oilat three levels of incorporation (0, 14 and 20 g/kg) for 28 days of feeding trial.

The mean daily feed consumption was significantly ($p<0.01$) higher in Athulya

hens when compared to native hens (110.97 vs80.75 g) during all the three periods as well as during the entire experimental period from 29 to 40 weeks of age.The present results are in accordance with the reports of AICRP (2017).

The interaction effect between fish oil at various levels and breed was significant ($p<0.05$) as shown in Table 3 (b) for feed consumption during period I and overall feed consumption from 29 to 40 weeks of age. The feed consumption in Athulya hens were statistically similar at all levels of fish oil whereas in native chicken, the mean daily feed consumption was significantly ($p<0.05$) lower in 1.5 and 3.0 per cent fish oil fed groups compared to control. The decreased feed consumption in the native birds fed with fish oil might have resulted in decreased egg production.

CONCLUSION

Results of the present study indicated that egg production of Athulya hens remained at optimal level at two levels of inclusion of dietary fish oil whereas a negative impact was noticed in native hens. Lower egg production in native hens fed with higher levels of fish oil in diet could be due to decreased feed consumption of birds in these groups. Further research has to done using different fat sources like vegetable/animal origin oil and marine algae at various levels of inclusion to hens diet.

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