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The Effects of Diet Containing Fish Oil on Some Blood Parameters and the Performance Values of Broilers and Cost Efficiency

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Abstract: This study aimed to investigate the effects of feed containing no fish oil and feed containing 2 % and 4 % fish oil on the performance and some blood parameters of broilers. It was found that the differences among the groups were significant regarding the performance values. It was found that high-density lipoproteins HDL in blood parameters of females, Aspartate aminotransferase AST in males were higher in the group including 4 % fish oil compared to the group control ($p<0.01$). The highest gross margin in the treatment groups was observed in the group 2% FO and then the group C fallowed this group.

Key words: Broiler, fish oil, performance, blood parameters

Introduction

In the last twenty five years the researches have showed that the improvements relating to poultry have developed rapidly (Cahaner *et al*., 2001). As those improvements coming up today, it has been seen that the works of multi aspects feeding which are done for getting maximum good quality product has been carried out successfully. The fundamentals of those improvements vanished the reasons threatening the health of human and animals. There has been endeavored for protecting the health of human and animals by the methods of feeding (Özdogan and Aksit, 2003; Alçiçek *et al*., 2003).

If the poultry is expected to show high performance, their needs of high energy and protein should be provided. Providing their needs of high energy is an obligation to use different fat sources (López-Ferrer *et al*., 2001; Sanz *et al*., 2000; Senköylü, 2001).

The importance of proportion and source of fat, the measure of saturated-unsaturated fatty acids have been determined by different researchers for productivity of the fat which is added to the poultry ratios (NRC, 1984; Yalçin and Çiftçi, 1996).

When the researches related to single or mixed fat on the feeding performance and body fat accumulation of broilers was summarized, the adding fat to diets increased the performance and fatty too (Tuncer *et al*., 1987; Kirkpinar *et al*., 1999; Abas *et al*., 2004), there are also some works which determine that the composition of the fatty acids in which fat were added to feed affected the feeding performance indirectly, it affects the body fat and carcass composition directly (Mandal *et al*., 2000; López-Ferrer *et al*., 1999).

Because of the idea supporting the positive participation of physiological, metabolical long chain fatty acids in fish oil. Possibility of using them for chicken feeding was searched and has been kept on searching. As some of those improvements have been searched the participation of omega-3 fatty acids on the health of human and animal (Bezard *et al*., 1994; Mandal *et al*., 2000; Tuncer *et al*., 1987; Pike, 1999; Manilla *et al*., 1999; Abas *et al*., 2004), the other important part of researches have been seen to become intense on the transition to animal products of omega-3 and their help to human health (López-Ferrer *et al*., 1999, 2001; Özpinar *et al*., 2002; Kahraman *et al*., 2004; Grashorn, 1995).

This study aimed to investigate the effects of diet containing 2% and 4% fish oil level being rich omega-3 fatty acids on the live weight, live weight gain, feed consumption, feed conversion ratio, mortality and some blood parameters of broilers.

Materials and Methods

Two hundred seventy Ross 308 female and male 1-d-old chicks were used. The birds were individually wing-banded, weighed, and placed in randomly 30 chicks each pen in 9 floor pens. There were three dietary treatments with three replicates (pens) each. Animals were given starter diet on the first three weeks (starter period), finisher diet on the 4th - 5th week and withdrawal diet on the 6th week (Table 1). The experiment lasted 42 days. The diets were fed as *ad libitum*.

The diets including no fish oil control (C), 2 % fish oil (2% FO) and 4 % fish oil (4% FO) were prepared for research in the experiment. The composition and calculated nutrients contents of experimental diets were given in Table 1.

Data collection and laboratory analysis: As the live weight and live weight gain of broilers were recorded individually. The feed consumption and feed conversion ratio were calculated in each pen. The samples of blood were taken from two male and female broilers in each pen randomly.

Table 1: The composition and calculated nutrients contents of starter, finisher and withdrawal diet in experiment, %

Feedstuffs	Starter Diet			Finisher Diet			Withdrawal Diet		
	C	2% FO	4% FO	C	2% FO	4% FO	C	2% FO	4% FO
Corn	60.68	58.75	52.87	49.93	51.33	51.18	50.12	51.52	51.42
Soybean meal	10	10	14.2	4.50	2.70	11.80	4.02	3.00	11.80
Full fat Soybean	--	9	8.4	28.00	29.40	18.60	28.88	29.00	18.50
Sunflower meal	4.7	1.3	--	--	--	--	--	--	--
Corn gluten meal	11.5	8.4	4.25	3.50	3.00	2.85	3.00	3.00	2.80
Middlings	--	--	6	5.00	5.00	5.00	5.00	5.00	5.00
Fish meal	7	7	7	3.00	3.00	3.00	3.00	3.00	3.00
Sunflower oil	2.5	--	--	2.50	--	--	2.50	--	--
Fish oil	--	2	4	--	2.00	4.00	--	2.00	4.00
Limestone	1	1	1	1.10	1.10	1.10	1.10	1.10	1.10
Dicalcium phosphate	1.3	1.3	1.25	1.50	1.50	1.50	1.50	1.50	1.50
Salt	0.3	0.3	0.3	0.30	0.30	0.30	0.31	0.31	0.31
Vitamin premix[1]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Mineral premix[2]	0.1	0.1	0.1	0.10	0.10	0.10	0.10	0.10	0.10
DL-Methionine	--	0.20	0.18	0.12	0.12	0.12	0.12	0.12	0.12
L-Lysine	0.47	0.20	--	--	--	--	--	--	--
Coccidiostat	0.1	0.1	0.1	0.10	0.10	0.10	--	--	--
Biyonat	0.1	0.1	0.1	0.10	0.10	0.10	0.10	0.10	0.10
Calculated nutrients contents									
Crude protein	23	23	23	21	21	21	21	21	21
Crude fat	7.0	7.0	8.0	10	10	10	10	10	10
Lysine	1.32	1.32	1.20	1.1	1.1	1.1	1.1	1.1	1.1
Methionine	0.53	0.52	0.60	0.48	0.48	0.48	0.48	0.48	0.48
Metabolizable energy, kcal/kg	3100	3100	3100	3200	3200	3200	3200	3200	3200

For each kg of the diets; Vitamin A 12000 IU, Vitamin D_3 1500 IU, Vitamin E 50.0 mg, Vitamin K_3 5.0 mg, Vitamin B_1 3.0 mg, Vitamin B_2 6.0 mg, Niacin 25.0 mg, Ca–D–Pantothenate 12.0 mg Vitamin B_6 5.0 mg, Vitamin B_{12} 0.03 mg, Folic acid 1.0 mg, D-Biotin 0.05 mg, Apo–Carotenoic Acid Ester 2.5mg, Choline–Chloride 400 mg. [2]For each kg of the diets; Manganese 80.0 mg, Iron 60.0 mg, Zinc 60.0 mg, Copper 5.0 mg, Cobalt 0.2 mg, Iodine 1.0 mg, Selenium 0.15 mg.

Before slaughtering, the samples of blood were taken from the wing vein by injection into the vacuum tubes. Firstly, the blood samples were centrifuged at 5000 rpm during 5 minutes and then serum was collected for analysis. The amount of triglyceride, cholesterol, high-density lipoproteins (HDL), low-density lipoproteins (LDL) and Aspartate aminotransferase (AST) in serums were determined by using commercial kit (Kone commercial kit, Japan), in autoanalyser (Kone Optima 60i autoanalyser, Japan).

Data analysis: Data were analyzed by variance analysis using the procedure described by the SPSS (2004). For significant differences according to $P<0.05$, means were compared by using the least significant difference method of the same statistical package. During the total experiment period (0-6 week),

The results of the experiment were evaluated in terms of economical properties using the methods of cost efficiency data (Inan, 2001). The variable expenses such as labor, care and injection, slaughtering etc. were assumed as fixed except for the feedstuffs. The gross margin was determined as subtracting the expenses of feed from the gross product value.

Results and Discussion

When the effect of adding fish oil on the values of live weight gain was evaluated periodically (Table 2), a statistical difference was seen at starter period ($P<0.05$). In the starter period the lowest live weight gain was determined in the group C and the highest live weight gain was determined in the group 2% FO in all groups. In the withdrawal period and finisher period, the effects of adding fish oil was not seen on the live weight gain. When the live weight gain was evaluated in the full experiment period during 0-6th weeks, it was found no statistical difference. Different fat sources (oil and animal fat source) didn't affect live weight gain of poultry as a important degree in other researches related to using fat levels at poultry feeding (Tuncer *et al*., 1987; Liarn and Yang, 1992; Abas *et al*., 2004) and the results of our findings showed similarity with the results of these research.

Although there was no significant difference observed in feed consumptions (Table 2) in starter and finisher periods, significant difference was seen in the withdrawal period ($P< 0.01$). The results of decreasing feed consumptions in groups fed with 2% and 4% FO diets were obtained in other all periods excepting starter period. This case was related to the increasing sensitivity of adult chicks to fishy smell. It was thought that the unwillingness in feed consumption of chickens caused by increasing sensitivitiy to fishy smell is the reason. There are some studies that explain this

Table 2: Means ± standard errors for Live weight gains, feed consumptions and feed conversion ratio of treatment groups, g

Groups	Starter period	Finisher period	Withdrawal Period	0 - 6th week
Live weight gains				
C	494.0±111.17 [a]	923.6 ± 127.15[a]	626.4 ± 55.10[a]	2044.1 ± 189.30[a]
2% FO	675.4±24.71[b]	970.4 ± 41.93[a]	586.2 ± 31.28[a]	2226.0 ± 89.04[a]
4% FO	606.9±60.03[ab]	952.0 ± 74.63[a]	564.0 ± 28.01[a]	2123.0± 57.73[a]
Significance	*	NS	NS	NS
feed consumptions				
C	911.8±224.01[a]	1800.0 ± 239.04[a]	1259.8 ± 70.10[b]	3971.6 ± 460.22[a]
2% FO	1140.9±40.66[a]	1657.1 ± 65.89[a]	1003.0 ± 55.73[a]	3800.7 ± 157.14[a]
4% FO	1110.1±47.10[a]	1762.7 ± 44.80[a]	1068.2 ± 33.94[a]	3941.0 ± 91.10[a]
Significance	NS	NS	**	NS
feed conversion ratio				
C	1.83±0.035 [a]	1.94 ± 0.032[b]	2.01 ± 0.16[b]	1.94 ± 0.038[b]
2% FO	1.68±0.047 [a]	1.70 ± 0.035[a]	1.70 ± 0.061[a]	1.71 ± 0.040[a]
4% FO	1.83±0.11 [a]	1.85 ± 0.13[ab]	1.89 ± 0.12[ab]	1.86± 0.049[a]
Significance	NS	*	*	*

[ab]: Means within columns for each characteristic with no common superscript differ significantly. * : P<0.05, ** P<0.01, NS: Not Significant

Table 3: Means ± standard errors for some blood parameters of treatment groups

Groups	Triglyceride (mg/dl)	Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	AST (IU/l)
C	25.67 ± 7.84[a]	125.50±19.61[a]	73.00±6.54[a]	35.00±7.56[a]	154.12 ± 4.02[a]
2% FO	25.17 ± 6.85[a]	113.50±11.50[a]	80.00±7.13[ab]	28.17±4.15[a]	172.25 ± 16.47[a]
4% FO	24.00 ± 3.10[a]	109.83±8.80[a]	81.67±5.24[b]	31.00±4.15[a]	177.00 ± 33.99[a]
Significance	NS	NS	**	NS	NS
C	29.33 ± 4.97[a]	127.17±7.57[a]	83.50±4.55[a]	37.50±5.05[a]	155.87 ± 7.35[a]
2% FO	24.88 ± 8.33[a]	123.67±5.92[a]	83.67±3.56[a]	34.17±1.33[a]	173.49 ± 14.12[ab]
4% FO	25.33 ± 4.37[a]	122.50±10.01[a]	84.83±6.55[a]	33.67±4.50[a]	178.50 ± 21.33[b]
Significance	NS	NS	NS	NS	**
Min.- max.of blood parameters	125-200 mg/dl[1]	30-190 mg/dl[2]	Female>40 mg/dl[2] Male >35 mg/dl[2]	<130 mg/dl[2]	30-170 IU/ l[3]

[ab]: Means within columns for each characteristic with no common superscript differ significantly. ** P<0.01, NS: Not Significant.
Altintas and Fidanci (1993). [2]Duman and Erden (2004). [3]Karagül *et al.* (2000)

situation (Tuncer *et al.*, 1987; Zollitsch *et al.*, 1996; Pike, 1999; Sanz *et al.*, 2000; Abas *et al.*, 2004). However, there has been a report that the diets containing fish oil did not induce any significant differences in feed consumption, when the chickens fed diets containing no fish oil compared to the chickens fed diets containing fish oil (Sklan and Ayal, 1989). There was no statistically significant difference in feed consumption when the duration of whole experiment (0-6th weeks) was considered.

When the feed conversion ratio was tested in respect of period (Table 2), it was seen that the difference among the groups was statistically important in the finisher period and the withdrawal period ($p<0.05$). No significant difference was seen statistically in the starter period. Although feed conversion ratio was evaluated for during the experimental period (0-6th weeks), The difference among the groups was found important about it statistically ($p<0.05$). In during the three periods and between 0-6th weeks, the group 2% FO had the best value of feed conversion. Another group 4% FO followed this group. The highest feed conversion ratio in all treatment groups was seen in the group C. There has been a similar work interested in these results (Sanz *et al.*, 2000). Abas *et al.* (2004) has confirmed that the source of different fats and the rates of use didn't affect the feed conversion ratio.

The analysis of blood triglyceride, cholesterol, HDL, LDL and AST of male and female chickens were done for purposing to determine the effects of adding fish oil on the some blood parameters and the results were shown in Table 3.

The tryglyceride values of males and females were found no difference statistically among the groups. It was seen that the highest male and female tryglyceride values in all groups was in the group C.

The cholesterol values of the females were not different among the groups statistically. It was seen that the group C had the highest values in all groups. The similar results of cholesterol were found for males and females.

The values of HDL in females were high when they were compared with the group C to the group 4% FO ($P<0.01$). No statistical difference was seen among groups in males but the highest value of HDL was determined in the group 4% FO and the lowest value was determined in the C group numerically. It can be said that this situation occured because of the fish oil which is rich in

Table 4: Evaluation for cost efficiency data of treatment groups

Economic parameters		Groups		
		C	2% FO	4%FO
Diet consumption, kg	Starter	0.911	1.140	1.110
	Finisher	1.800	1.657	1.762
	Withdrawal Period	1.259	1.002	1.068
Diet price, $/kg diet	Starter	0.50	0.53	0.55
	Finisher	0.43	0.47	0.48
	Withdrawal Period	0.43	0.47	0.48
Live weight, kg		2.079	2.266	2.161
Production value[1], $		3.84	4.19	3.99
Diet cost[2], $		1.77	1.85	1.97
Gross product value, $		2.07	2.34	2.02

[1]Production value was calculated taking live weight price into consideration, and that value was assumed as 1.848 $/kg.
[2]Feed cost was calculated taking the prices of starter, finisher, and diet before slaughter into consideration.

omega 3 fatty acid oil (Pike, 1999; Manilla *et al*., 1999). The LDL values of males and females weren't significant in treatment groups. However, in general, the best results of LDL values both of males and females were seen in the group containing fish oil.

In the previous study related to HDL and LDL levels in blood (Bachorik *et al*., 1991), it was claimed that in a healthy body the level of LDL is low and the level of HDL is high and the eaten diet was affect on the levels of HDL and LDL.

As the addition of fish oil was not affected the AST values of females in treatment groups, the AST values in group 4% FO was higher ($P<0.01$) than the group C in males. In males and females as the highest AST value in the treatment groups was found in the groups 4% FO, the lowest AST value in the treatment groups was seen in the group C. Increased AST value related to increasing fish oil level was observed in the both males and females. The main reason of this situation has been thought as because of the diets being rich in oil, the arrival of excessive fatty acids to the liver and so the degeneration of the secretion and oxidation mechanisms in hepatosits was asserted (Karadas *et al*., 1999).

The economic evaluation of adding fish oil was made with a purpose of observing the cost using the methods of cost efficiency, and to suggest the results of this experiment for the use of producer conditions. The highest gross margin in the treatment groups was observed in the group 2% FO and then the group C fallowed this group, although, the lowest gross margin in the treatment groups was seen in group 4% FO (Table 4).

In conclusion, when all the data that are about the performance, blood parameters and economic analysis were evaluated together, the positive effects of adding 2% FO to broiler diets or tendency for forming positive effect were determined. In this respect, it was decided that producers could be suggested to use 2% FO in broiler diets.

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