

# The Supplementation Effect of Fish Oil, Corn Oil, and Zinc in Fiber Ration on Cholesterol Profile, Omega-3 and Omega-6 of Alabio Duck Egg

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## Abstract

*As a complete nutrient product, the egg of Alabio duck contains high cholesterol, therefore it needs some attention. This research was conducted to reduce this cholesterol level and at the same time to improve its deposit of omega -3 and omega-6 in the egg, by providing fiber ration containing fish oil, corn oil, and zinc (Zn). The experimental design being used was factorial of 2x5x2 with 100 ducks. The first factor was fiber (F) and the second one was oil and Zn (O). Results showed that the treatments were effective enough in reducing cholesterol and improving the omega -3 and omega- 6 of the egg. The best product was shown by treatment of F1O4 containing 6 % fiber (F1) with 2% fish oil + 4% corn oil + Zinc (O4), either in single or interaction, in decreasing cholesterol and LDL cholesterol at the same time improving HDL cholesterol in plasma, omega -3 (linolenate), and omega -6 (linoleate) of the Alabio duct egg.*

*Keywords: Alabio duck, Cholesterol, HDL, LDL, Omega-3 and- 6*

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## Introduction

The egg of Alabio (*Anas platyrhyncho*, Borneo) duck has been a big choice of consumers as it has high nutrient contents, such as 13.1% protein, 14.5% fat, 0.5 % carbohydrate, 1 % ash, and 19.9 g/100 g calory (Biyatmoko (2007<sup>a</sup>). This duck egg contributes as much as 54.14% out of total egg production with 67.32 % productivity in South Kalimantan (Biyatmoko, 2007<sup>b</sup>). However, since egg contains high cholesterol, it becomes a health concern (Froning *et al.*, 1990). Cholesterol is part of egg yolk (5.2%), 65.5 % triglyceride, and 28.3 % phospholipide (Sirait, 1986). Amrullah (2004) reported that cholesterol in an egg ranged from 198 to 208 mg/egg, even riched 270 mg/egg (Cotteril *et. al.*1977).

One of the efforts of reducing cholesterol is thru *gastrointestinal* system, by binding pancreatic bile mechanism. Supplementation of fish oil and plant oil could lessen egg cholesterol as a result of hipolipidimic effect, and improve omega-3 and-6 (Supriyatna, 1999). Ration rich of omega-3 comes from fish oil, while, omega-6 rom corn oil. Taneja *et al.*,(1995) described that addition of fish oil and corn oil without buffer supplementation could give negative impact on other nutrient absorption. Zinc as a buffer, has several roles, such as in cellular activity, synthesis and metabolism of protein (Lloyd, 1978). **The absence of buffer would cause lost of appetite leading to anorexia, slow growth and production, as well as misabsorbsion of nutrient, including lipid.**

The objective of this research was to decrease cholesterol and improve omega-3 and omega-6 in Alabio duck egg thru the inclusion of fiber ration containing fish oil, corn oil, and zinc.

## Materials and Methods

This research was carried out for three months utilising 100 Alabio ducks. Experimental design being used was randomised block in factorial of 2 x 5 and 2 replication with five ducks for each replication. Diets were formulated as iso calory-protein based on production stage, containing 18% CP (crude protein) and EM (energy metabolic) of 2750 kcal/kg. **Factors implemented were:**

First Factor, levels of fiber (F), were F1= 6% and F2= 8%.

Second Factor, levels of oil (O), were

O1 = 6% fish oil + Zn

O2 = 4% fish oil + 2 % corn oil + Zn

O3 = 3% fish oil + 3 % corn oil + Zn

O4 = 2% fish oil + 4 % corn oil + Zn

O5 = 6% corn oil + Zn

Variables evaluated were cholesterol, HDL-plasma cholesterol, LDL-plasma cholesterol, omega-3, and omega-6. Data were analysed as Anova, if there is found a significant difference, followed by DMRT.

## Results and Discussion

Cholesterol contents (Table 1) of the egg were not affected ( $p>0.05$ ) by interaction of fiber and oil levels. However, fiber level or oil diet treatment significantly ( $p<0.01$ ) affected egg cholesterol. **Fiber of 6% (F1) and 2% fish oil + 4% corn oil+ Zn (O4) were considered as the best treatment. Supplementation of fish oil and corn oil which are rich MUFA and PUFA were able to decrease the cholesterol as they have hypolipidemic effect, decreasing the capacity transfer of LDL and increasing plasma HDL thus lowering the egg cholesterol (Abbey *et. al.*,1990).**

The same pattern happened in high density lipoprotein (HDL), the individual factors showed significant differences ( $p < 0.05$ ) (Table 2). The 6% fiber diet (F1) was the best in improving plasma HDL (215.890 mg.dl<sup>-1</sup>), while the 2 % fish oil + 4 % corn oil + Zn (O4) increased the highest HDL (248.575 mg.dl<sup>-1</sup>). Fish oil plays some roles of reducing transfer capacity of LDL cholesterol and plasma lesitin (cholesterol acyltransferase), as well as stimulating thromboxane and improving the ratio of HDL<sub>2</sub>:HDL<sub>3</sub> (Abbey *et al.*, 1990).

The plasma low density lipoprotein (LDL) cholesterol showed significant respond ( $p < 0.05$ ) on the interaction of fiber and oil supplementation in lowering the LDL (Table 3). The best combination was found in F1O4 with the lowest LDL (13.58 mg.dl<sup>-1</sup>). Mechanism of cholesterol reduction by fish oil was effective in reducing plasma LDL, playing a role as antiagregasion and reducing plasma triglyceride (Eritsland *et al.*, 1994 and Sinclair, 1996) as a result of the oxidation of EPA dan DHA (Jandacek *et al.*, 1991). Besides, this supplementation altered the structure of LDL and LDL receptor in the hepatic cells to be active to uptake the LDL cholesterol, thus lowering the plasma LDL cholesterol in the egg (Schechtman *et al.*, 1996).

The omega-3 (Table 4) was also affected significantly ( $p < 0.01$ ) by the interaction of fiber and oil. The best combination was contributed by F1O4 (6% fiber+ 2 % fish

Table 1. Averages of Alabio Duck Egg Cholesterol (mg.g<sup>-1</sup>) with Fiber and Oil Diets

Fiber levels (F) (%)	Oil and Zn (O)					Averages
	O1	O2	O3	O4	O5	
F1	11.768	7.434	7.428	6.333	7.296	8.051 <sup>A</sup>
F2	12.253	7.560	7.673	7.003	7.362	8.370 <sup>B</sup>
Averages	12.010 <sup>c</sup>	7.497 <sup>b</sup>	7.550 <sup>b</sup>	6.668 <sup>aa</sup>	7.329 <sup>b</sup>	8.210

Note Different superscripts within coloumns were different very significantly ( $p < 0.01$ ) and within rows ( $p < 0.05$ ).

Table 2. Averages of Alabio Duck Egg HDL Cholesterol (mg.dl<sup>-1</sup>) with Fiber and Oil Diets

Level of fiber (F1)	Oil and Zn (O)					Averages
	O1	O2	O3	O4	O5	
F1	195.000	195.860	213.220	253.820	221.550	215.890 <sup>A</sup>
F2	196.880	195.270	195.010	243.330	216.660	209.430 <sup>B</sup>
Averages	195.940 <sup>a</sup>	195.565 <sup>a</sup>	204.115 <sup>b</sup>	248.575 <sup>c</sup>	219.105 <sup>c</sup>	212.660

Note Different superscripts within coloumns were different very significantly ( $p < 0.01$ ) and within rows ( $p < 0.05$ ).

Table 3. Averages of Alabio Duck Egg LDL Cholesterol (mg.dl<sup>-1</sup>) with Fiber and Oil Diets

Level of fiber (F)	Oil and Zn (O)					Averages
	O1	O2	O3	O4	O5	
F1	57.098 <sup>c</sup>	32.449 <sup>d</sup>	15.36 <sup>b</sup>	13.58 <sup>a</sup>	15.51 <sup>b</sup>	26.799
F2	16.828 <sup>c</sup>	32.555 <sup>d</sup>	38.745 <sup>c</sup>	15.223 <sup>b</sup>	16.5 <sup>c</sup>	23.970
Averages	36.963	32.502	27.052	14.401	16.005	25.384

Note: Different superscripts within the same rows and columns were different significantly (p<0.05)

Table 4. Averages of Alabio Duck Egg Omega-3 (mg.100 g<sup>-1</sup>) with Fiber and Oil Diets

Level of Fiber (F)	Oil and Zn (O)					Averages
	O1	O2	O3	O4	O5	
F1	192.5 <sup>c</sup>	179.3 <sup>ab</sup>	177.8 <sup>ab</sup>	236.2 <sup>c</sup>	170.6 <sup>ab</sup>	191.28
F2	169.3 <sup>ab</sup>	168.3 <sup>ab</sup>	166.3 <sup>a</sup>	202.5 <sup>d</sup>	181.4 <sup>bc</sup>	177.56
Averages	180.90	173.80	172.05	219.35	176.0	184.42

Note: Different superscripts within the same rows and columns were different significantly (p<0.05)

Table 5. Averages of Alabio Duck Egg Omega-6 (mg.100 g<sup>-1</sup>) with Fiber and Oil Diets

Level of Fiber (F)	Oil and Zn (O)					Averages
	M1	M2	M3	M4	M5	
F1	1773.1 <sup>c</sup>	1604.6 <sup>b</sup>	2072 <sup>d</sup>	2632 <sup>c</sup>	2669 <sup>c</sup>	2150.14
F2	1750.1 <sup>b</sup>	1332.8 <sup>a</sup>	1644 <sup>b</sup>	1756 <sup>b</sup>	1763.1 <sup>b</sup>	1649.13
Averages	1761.60	1468.70	1858.00	2194.00	2216.05	1899.63

Note: Different superscripts within the same rows and columns were different significantly (p<0.05)

oil + 4 % corn oil + Zn (236.2 mg.100 g<sup>-1</sup>). This high level of omega-3 was due to the fact that corn oil contain  $\alpha$  linolenic dan linoleic (Kreutler, 1980). There were two reasons for the lowering effect; first, the high fiber content (8%) in F2O1 and F2O2, dan second, the level of zinc (29 ppm) as limited factor.

The best combination increased the omega-6 was given by F1O5 (6% fiber + 6% corn oil + Zn (O4) that was 2669 mg.100 g<sup>-1</sup> (Table 5). The increase of omega-6 in an egg would be linearly correlated to the level of omega-6 PUFA being consumed from the diet. Scaife *et al.*, (1994) stated that omega-6 in diet is absorbed and

deposited without any changes. However, its deposit in the egg was found high only in the corn oil with a certain proportion.

## Conclusion

The inclusion of fiber ration with fish oil, corn oil, and zinc was effective in reducing cholesterol, at the same time increasing the omega-<sub>3</sub> and omega-6 of Alabio duck egg. The best recommendation was given to the ration containing 6% fiber and 2% fish oil + 4% corn oil + Zinc, as its interaction or as individual in lowering cholesterol and LDL and increasing the plasma HDL cholesterol as well as omega-3 (linolenic) and omega-6 (linoleic) in Alabio duck egg.

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