Production Performance and Egg Quality in Native Chickens Fed Diet of Skipjack Fish Oil

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***Abstract*—The objective of the experiment was to investigate the production performance and egg quality in native chickens fed diet of skipjack fish oil. Two hundred native chickens 36 weeks of age, was use in this study for 8 weeks experiment. These were assigned by a completely randomized design with five dietary treatments, five replications and 8 native chicken in replication each. The data were analyzed using analysis of variance followed by Duncan's multiple range test. The diets were: R0 = 100 % Based Diet (BD) + 0 % Fish Oil (F0); R1 = 98,5 % BD + 1,5 % F0; R2 = 98 % BD + 2 % F0,R3 = 97,5 % BD + 2,5 F0; R4 = 97 % BD + 3 % F0. Feed and water were provided *ad libitum.* Feed consumption was measured weekly and FCR was calculated at the end of the trial. A total of 25 egg yolk samples of day 28 (n= 5 egg yolks for each treatment) were collected to analyse the egg quality native chickens. The results showed that Feed Intake, Hen Day Production, Eggmass, Feed Conversion, Eggshell weight, Egg Shell Thicknes, Egg yolk weight, Egg Color, Egg Cholesterol were significantly affected by skipjack Fish Oil, but did not significantly affect to egg weight, Haugh Unit, Shape index. It can be concluded that the use of fish oil in diet up to 3 % could improve production performance and egg quality in native chickens.**

***Index Terms*—fish oil, local hens, production, performance**

I. Introduction

Native chickens are typically raised in the backyards of rural households. They are commonly grown in small numbers of up to about 24 hens for egg production. Some farmers raise native chickens for meat, barter, or sale as an additional source of income for the household. According to experts, the number of native chickens in the country is still the same as that of hybrid or commercial stocks. Egg and poultry meat account for 35.56% of human animal protein requirements in the world with 13.12% for eggs only. Egg consumption and its high nutritive value results in an important production estimated to 1,140 billion in 2008 [1]. According to [2], egg nutretive value depens on geography and feed composition which influencvees egg size, egg weight, albumen ratio, yolk ratio, shell ratio. Poultry egg is a vehicle for reproduction, it also serves as a source of food human consumption.

Skipjack tuna *(Katsuwonus pelamis l*) is locally called "cakalang" is one of the most popular fish preserved through traditional smoking process in Bitung Municipality, North Sulawesi. It is estimated that more than 70 % of the total processing of processed fish fishery produces large amounts of solid waste and by-products. Fish fillet industry can produce waste that sometimes reaches 50 % of the total weight of processed fish [3]. Most by-products from fish processing are further processed into fish flour for feed. However, the by – products of processing products still have the potential to be developed into more economically valuable products, one of which is fish oil. [4] said that the waste obtained from the processing industry is still very rich in omega fatty acids. The demand for fish oil products continues to increasing, since it is known that fish oil is a good source of polyunsaturated fatty acids such as omega. Fish oil is the lipid fraction extracted from fish and fish by products. Generally, fish oils are more complex than land-animal oils or vegetable oils due to long –chain unsaturated fatty acids [5]. The objectiees of this study were to investigate the production performance and egg quality native chickens fed diet of skipjack fish oil.

II. Materials and Methods

A. *Preparation and Methods*

Skipjack fish at location Minahasa Selatan, North Sulawesi. Indonesia. P. T. Nichindo. Skipjack fish canning waste is liquid fraction mixed with meat of fish canning factory. Fish can be reduced to meal and oil in a number of ways. Methods of practical importance are the following processing steps. The wastes were collected and then were heated skipjack fish 10 – 15 minutes at 95^0C, and filtered for separating the solid fraction (meat residu) and Liquid fraction (Fish Oil). Pressing, which removes a large fraction of the liquids from the mass, Separation of the liquid into oil and water (stick water). This step may be omitted if the oil content of the fish is less than 5%. Until the fish oil turns into brown color then used as treatments. Fatty acid profiles of skipjack fish oil were shown in Table I.

Manuscript received July 5, 2018; revised November 26, 2018.

doi: 10.18178/joaat.6.1.43-47

TABLE I. FATTY ACID PROFILES OF SKIPJACK FISH OIL

Fatty Acid	(mg/100 g)
Caprilic acid (C8:0)	Ud
Capric acid (C10 :0)	Ud
Lauric acid (C12 : 0)	1
Miristic acid (C14 : 0)	56
Pentadekanoic acid (C15 :0)	Ud
Palmitic acid (C16 : 0)	518
Stearic acid (C18 :0)	250
Arakhidic acid (C20 : 0)	11
Total Saturated Fatty Acid	**836**
Miristoleic acid (C14 :1)	Ud
Palmitoleic acid (C16 : 1, n-7)	63
Oleic acid (C18 : 1, n-9)	170
Linoleic acid (C18:2, n-6)	26
α-Linolenic acid (C18:3, n-3)	13
11-Eicocanoic acid (C20:1, n-9)	14
Arakhidonic acid (C20:4, n-6)	Ud
EPA (C20:5, n-3)	84
DHA (C22:6, n-3)	601
Total Unsaturated Fatty Acid	**971**
Omega-3 Fatty Acid	0.69 %
Omega-6 Fatty Acid	0.03 %
Omega-9 Fatty Acid	0.18 %

Ud = Undetected

B. *Birds, Diets and Experimental Design*

Feeding trial was conducted at a native chicken in Kanaan Village, Central Manado, and the observation of egg quality was done at the Laboratory of technology, the Faculty of Animal Science, University Sam Ratulangi of Manado.

The research was subject to one-way completely randomized design, rationing it were used two hundred and 36-wk-old Native chicken were housed in individual cages within a room with environmental control. Birds were fed diets that met [6] nutrient guidelines. The birds were divided into five experimental diets and each was divided into five replicate groups of eight birds per replication using completely randomized design. Feed and water were provided ad libitum throughout the experimental period, and these treatments were administrated for a 8 week period.

The dietary treatments were formulated using similar feed with 45% yellow corn, 9% rice bran, 12% fish meal, 9% soybean meal, and 25% commercial diet. Fish oil was included in five experimental diets at levels of 0 %, 1.5%, 2,5% and 3%, respective to substitute based diet. The composition and nutrients of diets were shown in Table II.

C. *Production, Performance and Quality Eggs Native Chickens*

Feed intake. The diets were provided regularly at 8 Am daily with enough per weighted ration per each hen. Feed intake per each hen was calculated by figuring out the difference between the weights of offered feed and the remainded part at the end of week. Individual feed intake was determined on a weekly basis and used to calculate the average daily feed intake of hens, expressed as g/hen/day (g/h/d), during late production. Feed conversion ratio (FCR) were determinan by dividing the mean feed intake by the mean egg weight and expressed as gram feed per gram egg produced (g/g). Egg Weight: Eggs were collected and evaluated daily. Egg production and eggshell quality data recorded on individual basis at 36-48 weeks of age were pooled to calculate and statisucttical analyzed parameters means for the late production period. Daily egg number were recorded during the mentioned weeks and hen day egg production [7] was calculated and expressed as mean egg production (%). Individual egg weights were recorded for all eggs produced and used to calculate mean egg weight for the experimental period. After recording egg weight, individually marked eggs were broken in two halves at the equator [8], [9] and washed under slowly flowing water to remove adhering albumen. Washed shells were allowed to dry for an hour at room temperature, before eggshell thickness measurements were conducted. A micrometer (0.01 mm) was used to make three shell thickness measurements per measurements point on the blunt end, equator and sharp end individual eggs, resulting in a total of nine measurements readings per egg [10].

TABLE II. COMPOSITION AND NUTRIENTS OF THE DIETS

	R0*	R1*	R2*	R3*	R4*
Ingredients, %					
Based Diet	100	98.5	98	97.5	97
FO	0	1.5	2	2.5	3
Total	100	100	100	100	100
Calculated composition:					
Protein (%)	17.70	16.63	17.40	18.48	19.10
Fat (%)	4.4	5.40	6.44	7.66	8.00
Crude Fiber (%)	6.7	3.41	3.52	3.37	3.09
Ca (%)	2.32	2.32	2.29	2.31	2.28
P (%)	0.72	0.73	0.73	0.73	0.73
ME (Kcal/kg)	2704.94	2710.94	2776.84	2710.70	28412.79

FO = Fish oil

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After recording eggshell thickness, individual shell was stored for the determination of dry shell weight and shell ash content [11]. Eggshell is highly rich in calcium (90%) with little percentage (less than 5%) of phosphorus [12]. Phosphorus intake is important in maintaining egg shell quality [13], Egg shell thickness is influenced by phosphorus intake [14]

The hatching eggs were individually numbered and weighed using a precision scale with an accuracy of 0.01 g. Egg length and width were measured using a caliper, and used for the calculation of the egg shape index (SI = width/length x 100), The shapes most often encourtered are sharp, normal (standard), and round eggs which are enumerated on the mechanical behavior of chicken eggs under a compression load was investigated [15]. Eggs were classified according to egg shape index values, and the class interval of the data was determined as described below. The parameters measured for egg quality were egg color, egg shape index which was obtained by dividing maximum width by max leghth shell, albumin, yolk percentage were calculated as the proportion of their heights to their diameters. Albumin yolk index determined us the ratio of albumin weight to yolk weight.

Egg shell surface was computed using the formula on [16].

$$\text{Area} = 3{,}9782 \times W^{0{,}7065}$$

where, w resembles weight of fresh egg

Yolk calor was measured using standart yolk color fan. The cholesterol content was measured using standard method of [17]. Haugh's unit was calculated from the valves obtained from albumin height and weight by follows formula:

Haugh Units = 100 x log (H-1.7WO.37 + 7.57). (1.7, 7.57 and 0.37 are constant);
where: H = the height of thick albumen
w = the egg weight

Egg shell thickness: Shell were rinsed with tap water, the shell membranes manually removed and then dried at 100^0C for 2 hr. Shell thickness was measured to the nearest micron by using a metric micrometer equipped with a spherical tip. Estimates were done at the middle part of each egg. Eggs are rich in cholesterol (the average content ranges from 195 to 230 mg per egg) that can negatively influence the development of atherosclerosis and for this reason many people avoid egg consumption. However, eggs are also very valuable source of proteins and contains many substances with biological function beyond basic nutrition [18]-[20].

D. Statistical Analysis

The data were subjected to analyze for a variance technique using completely randomized design that was employed in one –way analysis of variance, and significant differences compared by Duncan's multiple range test [21]. Data was analyzed using IBM SPSS statistics 22 software was used for the statistical processing of data.

III. Results and Discussion

Data on production, performance and quality egg of native chicken affected by fish oil in diet is shown in Table III. The results showed that feed intake, Hen Day Production, Eggmass, feed conversion, eggshell weight, egg shell thickness, egg yolk weight, egg Color, Egg Cholesterol were significantly (P<0,01) affected by dietary treatments Skipjack Fish Oil, but did not significantly (P > 0.05) affected to egg weight, Haugh Unit, Shape index. [22] reported dietary oils on the production performances and polyunsaturated fatty acids and cholesterol level of yolk in hens. No significant difference (P > 0.05) in feed to egg ratio, egg white weight, and body weight were found amoung treatments. Egg mass of palm oil group was higher than soybean oil group (P < 0.05) and the average egg weight of fish oil group was higher than control group (P < 0.05) the yolk weight of fish oil group was higher than palm oil group (P 0,05) and hen weight gain of fish oil group was higher than soybean oil group (P < 0.05).

[23] reported feed intake decreased significantly in all experimental groups. Egg weight was decreased (P< 0.05) in the treatment groups except 1.25 % fish oil. Egg production was decreased by feeding fish oil. [24] reported human consumption of omega-3 Polyunsaturated Fatty Acids (n-3 PUFA) has increased due to reported health benefits. These data suggested that the addition of flaxseed and fish oil may negatively affect egg quality.

TABLE III. Effect of Fish Oil Diet on Production Performance and Quality Egg of Native Chicken

Parameters	Treatments					P-value
	0% FO	1.5% FO	2 % FO	2,5% FO	3% FO	
Feed Intake (g/bird/day)	78.82^a	79.82 ^{b}	80.37^{bc}	81.48 ^{c}	82.00^c	.000
Hen Day Egg Prod. (%)	39.09 ^{a}	39.34^a	39.92^{ab}	40.38 ^{b}	41.50^b	.000
Egg weight (g/egg)	40.70	40.90	41.52	41.41	41.90	.340
Eggmass	28.22 ^{a}	28.52 ^{a}	28.96^{ab}	28.84 ^{ab}	29.49^c	.045
FCR (g feed/g egg)	2.76 ^{a}	2.60 ^{ab}	2.78 ^{ab}	2.62^c	2.45^c	.013
Eggshell weight (g/egg)	3.38^a	3.64 ^{ab}	3.49 ^{abc}	3.50^{bc}	3.69 ^{c}	.020
Egg Shell Thicknes (mm),	0.34^a	0.34^{ab}	0.34 ^{abc}	0.35^{bc}	0.35^c	.047
Egg yolk weight (g/egg)	10.26^a	10.68^{ab}	11.12^{bc}	11.32^{cd}	11.68^d	.000
Yolk color score,	10.44^a	11.49^b	11.63^b	11.77^b	11.65^b	.000
Haugh Unit	82.50	82.56	82.69	82.69	82.63	.538
Shape index	0.77	0.76	0.76	0.77	0.77	.703
Egg Cholesterol (mg/100 g)	216^a	223^a	203^a	196^b	193^b	.000

Note: Different superscripts in the row were significantly different (P <0.01)
FO = Fish oil

The cholesterol level in the yolk of fish oil was significantly (P<0,01), this similar. [25] reported that when flaxed supplemental levels 2, 2,5 and 5 %, no significances were found among control group and experimental groups for cholesterol in egg yolks. [26] found that with the fish oil increased, the cholesterol in the yolk decreased.

Egg yolk cholesterol was increased significantly by feeding fish oil. [27] noted that reduction in cholesterol by dietary fish oil suggested mainly from the inhibition of hepatic VLDL production. Moreover, [28] observed that feeding fish oil at 1.25 % led to an increase (P < 0,01) in the long chain n-3 PUFA in the egg yolk lipids. [29] indicated that egg yolk n-3 fatty acids content was significantly increased when hens fed diets enriched with 3% fish oil. Egg enriched with n-3 PUFA may be associated with off–odours and in particular fishy taints. However, these can be minimized if the hens are fed 3,5% or less of high quality fish oil or 5% or less flaxseed [30].

IV. Conclusion

It can be concluded that the use of fish oil in diet up to 3% could improve production performance and egg quality in native chickens.

Acknowledgement

The authors wish to thank Ministry of Research, Technology and Higher Education of Indonesia for their financial supported and encouragement. (Penelitian Strategi Nasional 2018).

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