International Journal of Life Sciences
Available online at www.sciencescholar.us
Vol. 7 No. 1, April 2023, pages: 1-9
e-ISSN: 2550-6986, p-ISSN: 2550-6994
https://doi.org/10.53730/ijls.v7n1.13829

Physical and chemical quality of chicken eggs (Lohman brown strains) feed conventional feed with the addition of Lemuru fish oil

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Manuscript submitted: 09 October 2022, Manuscript revised: 18 November 2022, Accepted for publication: 27 December 2022

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Keywords

egg quality;
feed conventional;
fish oil;
laying hens;
Lohman Brown;

Abstract

This study aims to determine the quality of chicken eggs of the Lohman Brown has given fish oil in rations. The design used was a completely randomized design (CRD) with a total of 160 chickens with 4 treatments and 4 replications and each replication consisted of 10 chickens. P0: Ration without fish oil, P1: Ration using 0.2% fish oil, P2: Rations using 0.3% fish oil, P3: Rations using 0.4% fish oil. The feed used is composed of feed ingredients, namely corn, bran, concentrate, mineral, and fish flour. The variables observed included egg weight, egg white weight, egg yolk weight, shell thickness, shell weight, yolk color, Haugh units, yolk index, fat content, protein content, and cholesterol. The results showed that the use of fish oil of 0.2% in the ratio gave significantly different results (P<0.05) on egg weight, yolk weight, shell thickness, Haugh unit, or yolk index, while the results showed no significant difference (P>0.05) on white weight, shell weight, yolk color, fat content, protein content, cholesterol in eggs. Based on the results of the study it can be concluded that the use of fish oil 0.2% in the ration can have a significant effect on egg weight, yolk weight, skin thickness, Hugh units, and yolk index (P<0.05).

Contents

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1 Introduction

Eggs are a food source of animal protein that is cheap and easy to obtain for Indonesian people. Eggs as a food ingredient have many advantages, for example, the high nutritional content of eggs (Darmawati & Nurullita, 2009). Fresh-breed chicken eggs are eggs that have not undergone a cooling process and have not undergone preservation and do not show clear signs of embryonic growth, the yolk has not been mixed with albumen, intact and clean (SNI, 2006).

Along with the increasing population and animal needs, consumers prefer eggs that have good quality. According to Andri et al. (2017), that purebred chicken eggs contain high nutrition, continuous availability and relatively cheaper prices compared to other eggs so purebred chicken eggs are in demand by consumers. Determination of egg quality can be grouped into two factors, namely external egg quality consisting of egg weight, shell weight, and egg index, while internal egg quality consists of egg white weight (Eddin et al., 2019).

Today, chicken eggs are getting more and more attention because of the rise in negative news regarding eggs as a source of fat and cholesterol, especially in egg yolks. This is possible because most of the fat in eggs is found in the yolk, which is up to 32%, while the egg white does not contain fat. The total fat in chicken egg yolks ranges from 31.92% -34.80% and cholesterol is 5.20% (Kusmanto, 2004). High levels of fat and cholesterol in chicken egg yolks can affect health.

Laying hens is to meet their energy needs, in addition to other nutritional elements such as protein, minerals and vitamins (Rahmawati & Irawan, 2020). One way to fulfil protein, minerals, and vitamins is to use fish oil. Fish oil comes from the oily tissues of certain fish. Some of the ingredients contained in fish oil such as omega 3, omega 6, squalene, vitamin A, vitamin D, vitamin E, and vitamin K (Turgeon et al., 2013). Commercial fish oil has an unsaturated fatty acid content of approximately 29-34% (Maehr et al., 1994). Commercial fish oil usually contains 95% or more triglycerides. About 1% of fish oil is phospholipids and 2-5% is in the form of saponified parts, for example, cholesterol, hydrocarbons, and fat-soluble vitamins. Cholesterol levels are around 0.7% (Opstvedt et al., 2003; Rusnadi et al., 2022). The use of 3% and 6% fish oil in feed fish oil in broiler chicken feed does not have a negative impact on its use so it can be used as a source of energy in feed (Sukerta et al., 2020; Sukada et al., 2021). To do research, the use of fish oil in the ration can reduce lower cholesterol in eggs.

2 Materials and Methods

Place and time of research

This research will be carried out in the kendang owned by Mr Putu Ari Astawa which is located in Candikusuma Village, Melaya District, Jembrana Regency and the Laboratory of the Faculty of Animal Husbandry, Udayana University. The study was conducted for 8 weeks.

Research design

In this study, the design used was a completely randomized design (CRD) using 4 treatments with 4 replications each consisting of 10 chickens. The treatments used in this study were P0: ration without the use of fish oil, P1: ration with the use of 0,2% fish oil, P2: Ration using 0.3% fish oil, and P3: Ration using 0.4% fish oil.

Cage

The cage used in this study was a battery cage, each 1 plot of the cage was filled with 1 chicken. The roof of the cage uses spandex and the base of the cage uses boards. The cage is equipped with a feed container using a paralon pipe and a drinking water container using a nipple. Each cage plot will be labelled according to the treatment.

Variable

The variables observed in this study were as follows: 1). Egg weight, 2) egg white percentage, 3) Egg yellow percentage, 4) eggshell percentage, 5). Eggshell thickness, 6). Yolk colour, 7) HU (haugh unit), 8) yolk index, 9) fat content, 10) protein content. 11) cholesterol level.

Data analysis

The data obtained were analyzed using a variance. If between treatments there were significantly different results (P < 0.05), the analysis was continued with Duncan's multiple distance test (Steel & Torrie, 1993).

3 Results and Discussions

Table 1
The effect of using fish oil in the ration on the physical and chemical quality of laying hens (Lohman Brown strain)

Variable	Treatment 1				SEM2
	P0	P1	P2	P3	
Egg Weight (gram/grain)	62.48[a]	64.99[b]	64.42[b]	64.66[b]	0.28
Egg White Weight (gram/grain)	35.94[a]	36.73[a]	36.48[a]	36.47[a]	0.29
Egg Yellow Weight (gram/grain)	17.45[a]	19.78[b]	17.49[a]	18.39[a]	0.3
Eggshell Weight (gram/grain)	8.82[a]	9.29[a]	9.00[a]	9.13a	0.09
Thick Eggshell	0.42[a]	0.45[b]	0.43[ab]	0.44[b]	0.04
Egg Yolk Color	10.56[a]	10.88[a]	10.69[a]	10.63[a]	0.10
HaughUnit(HU)	98.63[a]	106.01[b]	99.14[a]	99.36[a]	1.12
Yolk Index	0.42[a]	0.50[b]	0.47[b]	0.46[ab]	0.10
Fat Level	12.62[a]	12.87[a]	13.02[a]	13.42[a]	0.13
Protein Level	13.69[a]	14.6[a]	14.96[a]	15.1[a]	0.26
Cholesterol(mg)	402.8[a]	378.31a	366.90[a]	361.08[a]	8.58

The results of the study on the effect of Fish oil on the ratio of the physical and chemical quality of laying hens (Lohman Brown strain) are in Table 1.
Information:

1. P0: Ration without the use of fish oil, P1: Ration with the use of 0.2 % fish oil, P2: Ration with the use of 0.3% fish oil, P3: Ration with the use of 0.4% fish oil,
2. SEM: Standard Error of the Treatment Means,
3. The same superscript in the same line is not significantly different (P>0.05)

The results showed that the average egg weight of chickens that were given rations without the use of fish oil as a control (P0) is 62.48 g/grain (Table 5.1). The average egg weight of chickens fed rations with the use of fish oil was 0.2% (P1), 0.3% (P2) and 0.4% (p3) respectively 7.14%, 4.76% and 3.48% higher than the treatment P0 and statistically significantly different (P<0.05). Whereas in chickens given rations using Lemuru fish oil 0.3% (P2) and 0.4% (P3) were 0.87 and 0.50% lower than treatment P1 and were not statistically significantly different (P> 0.05). In general, the effect of giving fish oil to a level of 0.4% increased egg weight, with the highest egg weight being 64.99 g/egg. This is because fish oil in feed is not only a source of energy for egg production but also a source of fat-soluble vitamins, namely vitamins A, D, E, K. In addition, egg size and weight are influenced by linoleic fatty acids and the amino acid methionine. Fish oil is a linoleic fatty acid (omega-3) (Farell, 1995). Linoleic fatty acid is required as a constituent of the lipoprotein complex, synthesized in the liver by estrogen stimulation and then transferred for follicle formation and directly controls egg weight (March & Mc Milan, 1990).

The results showed that the average egg white weight of chickens that were given rations without the use of fish oil as a control (P0) was 35.94 g (Table 1). Average egg white weight in chickens given rations with the use of fish oil 0.2% (P1), 0.3% (P2) and 0.4% (p3) respectively 2.19%, 1.50% and 1.47% higher than treatment P0 and statistically not significantly different (P<0.05). Giving fish oil as much as 2 - 4% increases the weight of egg whites, this is probably caused by the influence of the fat contained in fish oil. According to Sell et al. (2002), the addition of fat in the ration will improve the quality of the egg whites, this may be caused by a decrease in the speed of the ingested flow in the digestive tract so that the nutrients needed for the formation of egg whites are more available.

The results showed that the average weight of egg yolk in chickens that were given rations without the use of fish oil as a control (P0) was 17.45 g (Table 1). The average weight of egg yolk in chickens given rations with the use of fish oil 0.2% (P1) was 13.35% higher than the treatment P0, P2 and P3 which was statistically significantly different (P<0.05). Whereas in chickens given rations with the use of fish oil 0.3% (P2) and 0.4% (p3) was 0.22% and 5.38% higher than treatment P0 and were not statistically significantly different (P> 0.05).

The results of the analysis showed that fish oil supplementation in treatments P0, P2 and P3 had no significant effect (P>0.05) on egg yolk weight. Fish oil containing omega-3 is strongly associated with egg yolk weight. The use of fish oil will reduce the weight of the yolk. The decrease in egg yolk weight is related to omega-3, namely estradiol circulation which functions in the process of lip genesis for the formation of egg yolks. Giving fish oil in this study can still be received by chickens so that the weight of the egg yolk is still stable. This is due to the effect of L-carnitine in utilizing omega-3 fatty acids for energy (Owen et al., 2001).

The results showed that the average eggshell weight of chickens that were given rations without the use of fish oil as a control (P0) was 8.82g (Table 1). The average eggshell weight of chickens fed fish oil was 0.2% (P1), 0.3% (P2) and 0.4% (p3) respectively 5.32%, 2.04% and 3.51% higher than that of treatment P0 and statistically not significantly different (P<0.05). The results showed that the average eggshell thickness of chickens that were given rations without the use of fish oil as a control (P0) was 0.42g (Table 1). The eggshell thickness of chickens fed rations with Lemuru fish oil 0.2% (P1) and 0.4% (p3) was 4.01% and 3.10%, respectively, higher than treatment P0 and statistically significantly different (P<0.05). Whereas in chickens given rations with the use of fish oil 0.3% (P2) was 2.38% higher than treatment P0 and was not statistically significantly different (P> 0.05). The results of the study showed that the level of fish oil in the P1 and P3 treatments compared to the P0 treatment had a significant effect (P<0.05) on the thickness of the Lohmann Brown chicken eggshells, P1 and P3 were significantly different (P<0.05) with P0, but P0 was not significantly different (P>0 .05) with P2. This is probably due to P0 and P2, one of which has a low consumption of rations compared to the other treatments. Following the opinion (Tyler and Wilcox, 1942 quoted by Keshavarz, 1999) that the quality of the shell is strongly influenced by the level of minerals, namely Ca and vitamin D in the ration, and an increase in Ca consumption can be done by substitution of calcium sulfate or calcium carbonate. Another factor that influences shell quality is the content of linolenic acid (Omega-3) (Scheideler & Froning, 1996). Van Elswyk (1997), states that the use of fat with high levels of linolenic acid affects the quality of eggshells.

Bell & Weaver (2002), stated that the percentage of eggshell weight has a range of 10-12% of the egg weight. According to Krebeab et al. (2009), the calcium content in feed can affect shell weight and shell thickness. The main nutritional factors related to shell quality are calcium, phosphorus and vitamin D (Leeson et al., 2001). Djaelani (2016), stated that the thickness of the eggshells of ducks kept in dry cages reached 0.34-0.47 mm. According to Jazil et al. (2013), shell thickness is affected by strain, age, feed, stress and disease. Hargitai et al. (2011), explained that the older the chicken, the thinner the eggshell because the chicken is unable to produce sufficient calcium for the formation of the eggshell.

The results showed that the average yolk color of chickens that were given rations without the use of fish oil as a control (P0) was 10.86 (Table 1). The mean yolk color of chickens fed fish oil 0.2% (P1), 0.3% (P2) and

0.4% (p3) respectively was 3.03%, 1.23% and 0.66% higher than with treatment P0 and statistically not significantly different (P<0.05). Yolk color determination is done by using a Yolk Color Fan. This study got results that had no significant effect. This is because the added fish oil does not contain too much β-carotene in the feed. The higher the color of the yolk, the better the quality of the egg (Muharlien, 2010). The color of poultry egg yolk is orange-yellow due to the presence of carotenoids which contain lots of zeaxantim, cryptoxantim, and lutein (xanthophyll) (Arunde et al., 2018). Yuwanta (2010), suggested that the color of the yolk is determined by the content of β-carotene found in the yolk.

The results showed that the Haugh average of egg units in chickens that were given rations without the use of fish oil as a control (P0) was 98.86 (Table 1). Haugh's mean of egg units in chicks fed rations with the use of 0.2% fish oil (P1) was 7.48% higher than the treatment P0, P2 and P3 which was statistically significantly different (P<0.05). Whereas in chickens given rations with the use of fish oil 0.3% (P2) and 0.4% (p3) was 0.51% and 0.74% higher than treatment P0 and were not statistically significantly different (P> 0.05).

This is probably due to P0, P1 and P3 having very low ratio consumption compared to other treatments. Following the opinion of Card & Nesheim (1998), and USDA standards (1964) that the "Haugh Unit" value of 73 to 100 belongs to class AA. The higher the egg white, the higher the HU value, and the better the quality of the egg which also indicates that the egg is still white. new and fresh (Tugiyanti & Iriyanti, 2012). This is reinforced by Andi (2013) states that the haugh unit value is influenced by the ovomucin content contained in the egg white, the higher the egg white, the higher the haugh unit value obtained.

The Haugh Unit in this study has given good results because it reaches an average HU value of 87.71-88.97 which is following the Haugh Unit value theory of more than 72 categorized as AA quality eggs, 60-72 as A quality eggs, grades 31-60 as quality B eggs and scores less than 31 are categorized as quality C eggs (USDA, 2000).

The results showed that the mean egg yolk index in chickens that were given rations without the use of fish oil as a control (P0) was 0.42 (Table 1). The average yolk index in chickens given rations with the use of fish oil was 0.2% (P1) and 0.3% (P2) respectively 19.04% and 9.52% higher than the P0 treatment and statistically significantly different (P<0.05). Whereas in chickens given rations with the use of fish oil 0.4% (P3) was 11.90% higher than treatment P0 and was not statistically significantly different (P> 0.05).

The results showed that the level of fish oil administration in the P1 and P2 treatments compared to the P0 treatment had a significant effect (P<0.05) on the Lohmann Brown chicken egg yolk index. This is probably because the formation of the yolk is strongly influenced by the size of the fatty acids consumed, the more fatty acids consumed, the greater the yolk formed. The yolk index is affected by the season, the index is winter high yolk compared to heat. Eggs of young or adult hens have a lower yolk index during the spring change and until the mid-summer season (Hunter et al, 1936 in Romannof & Romannof, 1963).

The results showed that the average egg fat content in chickens that were given rations without the use of fish oil as a control (P0) was 12.62 (Table 1). The average fat content of eggs in chickens given rations with the use of fish oil was 0.2% (P1), 0.3% (P2) and 0.4% (p3) respectively 1.50%, 2.40% and 6.33% higher than treatment P0 and statistically not significantly different (P<0.05). The results of this study indicate that the fat content in eggs has increased with the addition of fish oil to the ratio. Many sources of fat are obtained from fish oil. Fish oil contains long-chain fatty acids which when consumed will increase the fat content in the body. Improving the function of these fatty acids required compounds that can help metabolism. One of the compounds that can help metabolize fatty acids is L-carnitine (Eslick et al., 2009; Rubio-Rodríguez et al., 2012). The addition of fish oil containing L-carnitine is expected to accelerate the metabolism of fatty acids contained in fish oil because of the presence of L-carnitine which functions to help metabolize fatty acids so that the utilization of fat as an energy source can be optimal. Utilization of energy from the oxidation of these fatty acids can save the formation of energy from protein. So that protein in the body can be used to increase production and improve egg quality. The addition of L-carnitine in fat-containing feeds is needed. L-carnitine plays a role in the transfer of long-chain fatty acids across the membrane and mitochondria to the matrix to the mitochondria (Owen et al., 2001).

The results showed that the average egg protein content in chickens that were given rations without the use of fish oil as a control (P0) was 13.69 (Table 1). Average egg protein content in chickens given rations with the use of fish oil was 0.2% (P1), 0.3% (P2) and 0.4% (p3) respectively 6.64%, 9.27% and 10.29% higher than treatment P0 and statistically not significantly different (P<0.05). The results of this study indicate that the protein content in eggs has increased with the addition of fish oil to the ratio. Through a certain processing process, fish oil is rich in nutrients (Janczak & Riber, 2015; Singh et al., 2009). The content consists of Omega 3, Omega 6, vitamin A, protein, fat, antioxidants, and glucose. Protein is a very important structure for soft tissues in the animal body such as tendons, fabrics, binders, collagen, skin, feathers, nails and beaks (Yuwanta, 2010). Factors that affect protein requirements in laying hens are size and nation of chickens, ambient temperature, stage of production and energy content in the ration. Chickens that lack protein and amino acid intake at their growth age will slow down sexual maturity and reduce the size of the eggs produced (Siahaan et al., 2013).

The results showed that the average egg cholesterol in chickens that were given rations without the use of fish oil as a control (P0) was 402.80 (Table 1). The average egg protein content in chickens fed rations with the use of fish oil 0.2% (P1), 0.3% (P2) and 0.4% (p3) were respectively 6.07%, 8.91% and 10.35% lower than with treatment P0 and statistically not significantly different ($P<0.05$). The results of this study showed that the cholesterol content in eggs decreased with the addition of fish oil to the ratio. Many sources of omega-3 are obtained from fish oil, and chickens that consume more fish oil will produce eggs that contain high omega-3 fatty acids with low cholesterol levels. Omega-3 fatty acids can inhibit the occurrence of cholesterol biosynthesis and reduce cholesterol (Griffin, 1992). The decrease in cholesterol levels in the treatment was because fish oil is a source of omega-3 polyunsaturated fatty acids (PUFA) which can reduce triglycerides in chicken eggs when compared to the provision of feed containing saturated fatty acids (SFA).

4 Conclusion

Based on the results of the study it can be concluded that the use of 0.2% fish oil in the ration can increase egg weight, egg white weight, egg yolk weight, eggshell weight, eggshell thickness, egg yolk color, yolk index and haugh unit and can reduce cholesterol

Acknowledgements
The authors thank the Rector ofUdayana University, and the Dean of the Faculty of Animal Science at Udayana University for their help in providing various facilities for their research, so it could be done accordingly.

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Basudewa, I. G. B., Astawa, I. P. A., Cakra, I. G. L. O., & Nuriyasa, I. M. (2023). Physical and chemical quality of chicken eggs (Lohman brown strains) feed conventional feed with the addition of lemuru fish oil. International Journal of Life Sciences, 7(1), 1–9. https://doi.org/10.53730/ijls.v7n1.13829