International Journal of Life Sciences
Available online at www.sciencescholar.us
Vol. 6 No. 3, December 2022, pages: 89-96
ISSN: 2550-6994 E-ISSN: 2550-6986
https://doi.org/10.53730/ijls.v6n3.13549

The Effect of Giving Tuna Fish Oil on Feed on the Productivity and Quality of Isa Brown Chicken Eggs

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Manuscript submitted: 27 August 2022, Manuscript revised: 9 September 2022, Accepted for publication: 18 October 2022

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Keywords

egg production;
egg quality;
laying hens;
Omega-3 in egg yolks;
tuna fish oil;

Abstract

This study aims to study the productivity and quality of Isa Brown chicken eggs that were given tuna fish oil in the ration. The design used was a completely randomized design (CRD) with 200 chickens with 4 treatments and 5 replications and each replication consisted of 10 chickens. P0: Ration without the use of fish oil, P1: Ration with the use of 0.25 % fish oil, P2: The ration with the use of 0.50% fish oil, P3: The ration with the use of 0.75% fish oil. The feed used is composed of feed ingredients, namely corn, bran, and KLS Super Plus. The variables observed included daily egg production, ration consumption, egg weight, egg index, egg pH, HU (haugh unit), egg yolk color, FCR (Feed Conversion Ratio), and cholesterol in eggs. The results showed that the use of fish oil of 0.25%, 0.50%, and 0.75% in the ration gave significant results (P<0.05) on ration consumption, egg weight, egg pH, and egg yolk color. The results were not significantly different (P>0.05) in daily egg production, egg index, HU (Haugh Unit), FCR (Feed Conversion Ratio), and egg cholesterol. Based on the results of the study, It can be concluded that giving fish oil 0,50% and 0,75% in feed can increase daily egg production, reduce ration consumption, lower cholesterol levels in eggs, and increase omega-3 content in egg yolks.

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Contents

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1 Introduction

Laying hens are one of the livestock commodities that can be used as a means of meeting protein needs. Eggs are food ingredients that play an important role in helping to meet nutritional needs where egg protein is a type of high-quality animal protein with a protein content of 12% and 11% fat (Muharlien, 2010). There is an assumption that eggs are a food ingredient that can cause atherosclerosis because of the high fat and cholesterol content in eggs. The cholesterol content of eggs is quite high, which is 200-250 mg/grain and the omega-3 content is relatively low (Jiang & Sim, 1991).

Feed is the largest cost portion (70%) in poultry farming. Good feed is feed that contains the nutrients needed by poultry according to the type and breed of poultry, age, body weight, sex and production phase (Djaelani, 2016). The appearance of laying hen production can be seen in ration consumption, ration conversion, and egg production. One of the supports for optimizing the growth of laying hens is energy requirements. One of the poultry feed that is often used in laying hens as an energy source is fish oil (Hassan et al., 2013).

Tuna is one of the many fish that live in Indonesian waters. This fish contains high nutrients that are beneficial for health. The content of vitamin B12, vitamin B6, vitamin D, omega-3 fatty acids, iron, iodine, and potassium in tuna contributes to health. Tuna is a fatty fish that contains omega-3 fatty acids. These fatty acids can help reduce bad cholesterol levels in the body (Xin et al., 2011; Deng et al., 2012).

Waste from the manufacture of canned tuna in the form of oil can be used as a cheap and easy source of energy and essential fatty acids (Astrini et al., 2021). With the high content of omega-3 fatty acids in the waste oil, it can be used as a product that has added value. Tuna fish oil is produced from pressed tuna and has an energy content of 8260 KCal/kg, omega-3 fatty acids mainly EPA (Eicosapentaenoic) 33.6-44.85% and DHA (Docosahexaenoate) as much as 14.64% and contains 55% fat. ,8% (Sudibya & Santoso, 2007). According to Sestilawarti et al. (2013), the use of fish oil microcapsules in quail rations to a level of 6% does not affect product performance. By doing research, the use of tuna fish oil in the ration can reduce the increase in daily egg production (hen day production), lower cholesterol in eggs, and increase the content of omega-3 in egg yolks (Wang et al., 2017; Singh et al., 2009).

2 Materials and Methods

Place and time of research

This research was carried out in the laying hens of CV. Kembang Sari Lestari which is located in Pesedahan Village, Manggis, Karangasem, Bali and in 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 5 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 0,25% fish oil, P2: Ration using 0.50% fish oil, P3: Ration using 0.75% 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). Daily egg production (hen day production), 2) Ration consumption, 3) Egg Weight, FCR (*feed conversion ratio*), 5). Egg index, 6). Egg pH, 7) HU (haugh unit), 8) Egg yolk, 9) Cholesterol in eggs, 10) Omega-3 in egg yolk.

Data analysis

The data obtained were analyzed utilizing 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

The results of the study on the effect of tuna fish oil in the ration on the productivity of laying hens can be seen in Table 1.

Table 1
The effect of using tuna fish oil in the ration on the productivity of laying hens

Variable	Treatment[1]				SEM[2]
	P0	P1	P2	P3	
Hen day production (%)	89.33^{a}[3]	90.10^{a}	90.12^{a}	91.64^{a}	1.06
Feed consumption (g/head/day)	114.56^{a}	116.11^{a}	112.38^{b}	110.96^{b}	008
Egg weight (g/item)	60.71^{a}	61.20^{a}	60.77^{a}	59.21^{b}	0.52
FCR (*feed conversion ratio*)	1.89^{a}	1.90^{a}	1.85^{a}	1.88^{a}	0.02
Egg index	78.09^{a}	77.91^{a}	77.23^{a}	78.26^{a}	0.94
Egg pH	6.96^{a}	6.96^{a}	7.00^{a}	7.01^{a}	0.07
HU (*Hough unit*)	88.97^{a}	87.71^{a}	88.25^{a}	88.39^{a}	1.64
Egg yolk color	8.00^{ab}	8.15^{a}	8.85^{a}	7.95^{b}	0.19
Cholesterol (mg/100 g)	408.07^{a}	401.91^{a}	365.55^{a}	311.15^{a}	96.92
Omega-3 in egg yolk (*docosanoate*) (%)	0.50^{b}	0.46^{b}	3.31^{a}	3.52^{a}	0.22

Information:
1. P0: Ration without the use of fish oil, P1: Ration with the use of 0.25 % fish oil, P2: Ration with the use of 0.50% fish oil, P3: Ration with the use of 0.75% 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 daily egg production in laying hens fed rations without the use of tuna fish oil as a control (P0) was 89.33% (Table 1). The average daily egg production in laying hens fed rations using tuna fish oil 0.25% (P1) 0.50% (P2) and 0.75% (P3) were 0.86% and 0.88%, respectively and 2.52% higher than the P0 treatment and statistically not significantly different ($P>0.05$). The use of tuna fish oil of 0.25%, 0.50%, and 0.75% in laying hens rations did not provide statistically significant results on daily egg production (hen day production), although the effect was not significant but numerically higher. The level of administration of tuna fish oil tends to increase the percentage of HDP. It can be seen that treatments P1, P2, and P3 gave higher egg production than P0 as a control. This was because the ration consumed was used to increase production numerically but the lower egg weight was statistically very significant (P<0.05). According to Indi et al. (2014), stated that fish oil contains fatty acids which are needed in the egg development process.

feed consumption of chickens fed rations using tuna fish oil 0.25% (P1) was 1.33% higher than treatment P0 and statistically not significantly different (P>0.05). Meanwhile, chickens fed rations using tuna fish oil 0.50% (P2) and 0.75% (P3) were 1.91% and 3.14%, respectively, which were lower than treatment P0 and statistically significantly different (P<0.05). This significant effect was due to the difference in the level of tuna fish oil added to the ration which produced different energy levels. The EM content of fish oil is quite high, reaching 3,691 Kcal/g (Sestilawarti et al., 2013), so the greater the amount of tuna fish oil given, the maximum fulfilment of energy needs can be achieved.

The effect of treatment egg weight of chickens fed rations using tuna fish oil 0.25% (P1) and 0.50% (P2) were 0.81% and 0.10%, respectively, higher than treatment P0 and statistically different not significant (P>0.05). Meanwhile, chickens fed rations using 0.75% tuna fish oil (P3) were 2.47% lower than the P0 treatment and statistically significantly different (P<0.05). Satria et al. (2016), stated that high egg weight is caused by high feed consumption, which affects egg production. The decrease in egg weight in P3 treatment using fish oil 0.75% egg weight decreased significantly, this was because the protein in the ration absorbed in the form of amino acids used to increase daily egg production was numerically not significantly different (P>0,05).

The average FCR (feed conversion ratio) in chickens fed rations without the use of tuna fish oil as a control (P0) was 1.89 (Table 1). The average FCR (feed conversion ratio) in chickens fed rations using tuna fish oil was 0.25% (P1) 0.53% higher than the P0 treatment than chickens fed rations using tuna fish oil 0.50% (P2) and 0.75% (P3) were 2.12% and 0.53% lower than treatment P0 and statistically not significantly different (P>0.05). The use of 0.75% tuna fish oil in the ration did not cause a significant difference in the FCR (feed conversion ratio). Puspita (2019), explains that FCR is closely related to ration consumption and egg production. The lower the ration conversion value obtained, the more efficient the livestock.

The average egg index in chickens fed rations using tuna fish oil 0.25% (P1) and 0.50% (P2) were 0.23% and 1.10%, respectively, lower than the treatment P0 and statistically different and not significant (P>0.05). Meanwhile, chickens fed rations using 0.75% tuna fish oil (P3) were 0.22% higher than the P0 treatment and statistically not significantly different (P>0.05). The addition of 0.75% tuna fish oil in the ration did not have a significant effect on the egg index, this was influenced by age, production period and feed, according to Darmawanti et al. (2016), which states that the egg shape index is influenced by genetic factors, age of the parent, production period, age of sexual maturity, reproductive tract and feed quality. Yuwanta (2010), states that the range of egg index values is 65-82% and ideally is between 70-75%.

The results showed that the average pH of eggs in chickens fed rations without the use of tuna fish oil as a control (P0) and chickens fed rations with 0.25% tuna fish oil (P1) was 6.96 (Table 3).) and statistically not significantly different (P>0.05). Meanwhile, chickens fed rations using tuna fish oil 0.50% (P2) and 0.75% (P3) were 0.57% and 0.71%, respectively, higher than the treatment P0 and statistically not significantly different. (P>0.05). In this study, the pH of the eggs obtained was in the normal range, this was because the eggs used were fresh eggs according to Kunaifi et al. (2019), Fresh eggs stored for 0-14 days had a pH of 7 because they did not provide an opportunity for microbes to break down proteins and fats in eggs, so that there is no damage to eggs by microbes (Whitehead, 2004; Janczak & Riber, 2015).

The average HU (haugh unit) of eggs in chickens fed rations using tuna fish oil was 0.25% (P1), 0.50% (P2), and 0.75% (P3) were 1.42%, respectively. 0.81%, and 0.65% lower than the P0 treatment and statistically not significantly different (P>0.05). The Haugh Unit (HU) which is the relationship between albumen thickness or height and the overall egg weight, is the basis for measuring the egg quality index. 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 new and fresh (Tugiyanti & Iriyanti, 2012).

The average egg yolk color in chickens fed rations using tuna fish oil 0.25% (P1) and 0.50% (P2) were 1.84% and 9.60%, respectively, higher than the treatment P0 and statistically not significantly different (P>0.05). Meanwhile, chickens fed rations using 0.75% tuna fish oil (P3) were 0.63% lower than the P0 treatment and statistically not significantly different (P>0.05). Yolk color determination is done using a Yolk Color Fan. In this study, statistically significant results were obtained, but the increase in color from P0 to P3 did not lead to an increase. This is because the added fish oil does not contain too much -carotene in the feed (Charles et al., 2021; Chantachum et al., 2000).

The average cholesterol in laying hens fed rations using tuna fish oil 0.25% (P1) 0.50% (P2) and 0.75% (P3) were 1.51% 10.42%, and 23.75% lower than the P0 treatment 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 tuna fish oil in the ration. Sources of omega-3 are mostly obtained from tuna fish oil, the decrease in cholesterol levels in the treatment is caused because fish oil is a source of omega-3 polyunsaturated fatty acids (PUFA) which can reduce triglycerides in chicken eggs when compared to feeding containing saturated fatty acids (SFA) (Ehr et al., 2017; Bautista-Ortega et al., 2009).

The average omega-3 in chicken egg yolks fed rations with 0.25% tuna fish oil (P1) was 8% lower than the P0 treatment and statistically not significantly different (P>0.05). Meanwhile, chickens fed rations using tuna fish oil 0.50% (P2) and 0.75% (P3) were 84.89% and 85.80%, respectively, higher than the P0 treatment and statistically significantly different (P<0.05). Judging from the results of the study showed that the administration of fish oil with a level of 0.50% and 0.75% was able to increase the content of omega-3 in egg yolks, this was due to the content of omega-3 fatty acids in the ratio which affected the increase in content and concentration of omega-3 fatty acids. 3 in eggs. In Sudibya's (2013) study, the addition of PUFA fatty acids up to a level of 4% was able to reduce quail egg cholesterol levels from 988mg/dl to 922 mg/dl and was able to increase omega-3 fatty acid levels in eggs from 4.81 % to 7.40% and omega-6 levels from 27.74% to 37.30%. According to Piliang & Djoyosoebagio (2006), omega-3 fatty acids play a role in regulating cholesterol metabolism which includes cholesterol transport and excretion.

4 Conclusion

Based on the results of the study, it can be concluded that the use of tuna fish oil 0.50% and 0.75% in the ration can increase daily egg production, reduce ration consumption, reduce cholesterol content in eggs, and increase omega-3 content in egg yolks.

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

References

Astrini, N. K. M. S., Putri, B. R. T., & Hellyward, J. (2021). Business strategy of laying hens towards new normal era. *International Journal of Life Sciences*, *5*(3), 148–155. https://doi.org/10.53730/ijls.v5n3.1599

Bautista-Ortega, J., Goeger, D. E., & Cherian, G. J. P. S. (2009). Egg yolk omega-6 and omega-3 fatty acids modify tissue lipid components, antioxidant status, and ex vivo eicosanoid production in chick cardiac tissue. *Poultry Science*, *88*(6), 1167-1175. https://doi.org/10.3382/ps.2009-00027

Chantachum, S., Benjakul, S., & Sriwirat, N. (2000). Separation and quality of fish oil from precooked and non-precooked tuna heads. *Food chemistry*, *69*(3), 289-294. https://doi.org/10.1016/S0308-8146(99)00266-6

Charles, A. L., Abdillah, A. A., Saraswati, Y. R., Sridhar, K., Balderamos, C., Masithah, E. D., & Alamsjah, M. A. (2021). Characterization of freeze-dried microencapsulation tuna fish oil with arrowroot starch and maltodextrin. *Food Hydrocolloids*, *112*, 106281. https://doi.org/10.1016/j.foodhyd.2020.106281

Darmawati, D., Rukmiasih, R., & Afnan, R. (2016). Daya tetas telur itik cihateup dan alabio. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan*, *4*(1), 257-263.

Deng, W., Dong, X. F., Tong, J. M., & Zhang, Q. (2012). The probiotic Bacillus licheniformis ameliorates heat stress-induced impairment of egg production, gut morphology, and intestinal mucosal immunity in laying hens. *Poultry science*, *91*(3), 575-582. https://doi.org/10.3382/ps.2010-01293

Djaelani, M. A. (2016). Kualitas telur ayam ras (Gallus L.) setelah penyimpanan yang dilakukan pencelupan pada air mendidih dan air kapur sebelum penyimpanan. *Buletin Anatomi Dan Fisiologi dh Sellula*, *24*(1), 122-127.

Ehr, I. J., Persia, M. E., & Bobeck, E. A. (2017). Comparative omega-3 fatty acid enrichment of egg yolks from first-cycle laying hens fed flaxseed oil or ground flaxseed. *Poultry Science*, *96*(6), 1791-1799. https://doi.org/10.3382/ps/pew462

Hassan, M. M., Morsy, A. S., & Hasan, A. M. (2013). Egg yolk cholesterol and productive performance of laying hens influenced by dietary crude fiber levels under drinking natural saline water. *Journal of Animal and Poultry Production*, *4*(3), 161-176.

Indi, A., Agustina, D., & Erna, R. (2014). Pengaruh Penambahan Ikan Lemuru (Sardinella Longiceps) Terhadap Karakteristik Folikel Dan Siklus Ovulasi Pada Ayam Ras Petelur. *Jurnal Ilmu dan Teknologi Peternakan Tropis*, *1*(1), 45-53.

Janczak, A. M., & Riber, A. B. (2015). Review of rearing-related factors affecting the welfare of laying hens. *Poultry Science*, *94*(7), 1454-1469. https://doi.org/10.3382/ps/pev123

Jiang, Z., & Sim, J. S. (1991). Research note: egg cholesterol values in relation to the age of laying hens and to egg and yolk weights. *Poultry Science*, *70*(8), 1838-1841. https://doi.org/10.3382/ps.0701838

Kunaifi, M. A. M., Wirapartha. & Wiyana, I K. A. (2019). Effect of Storage for 14 Days at Room Temperature on External and Internal Quality of Duck Eggs in the Jimbaran Area. Tropical Farm. Denpasar. 7(1), 77 - 88

Muharlien, M. (2010). Improving The Egg Quality Trough Addition Of Green Tea In Diet On Laying Hen. *Jurnal Ilmu dan Teknologi Hasil Ternak (JITEK)*, *5*(1), 32-37.

Piliang WG, Djojosoebagio Al Haj S. 2006. Fisiologi Nutrisi Volume 2. IPB Press Bogor.

Puspita, S. (2019). E-Commerce Business Plan For Poultry Farming: Ternak Segar. *Jurnal Bina Manajemen*, *7*(2), 131-160.

Satria, E. W., Sjofjan, O., & Djunaidi, I. H. (2016). Respon pemberian tepung daun kelor (Moringa oleifera) pada pakan ayam petelur terhadap penampilan produksi dan kualitas telur. *Buletin Peternakan*, *40*(3), 197.

Sestilawarti, S., Mirzah, M., & Montesqrit, M. (2013). Pengaruh Pemberian Mikrokapsul Minyak Ikan dalam Ransum Puyuh terhadap Performa Produksi. *Jurnal Peternakan Indonesia (Indonesian Journal of Animal Science)*, *15*(1), 69-74.

Singh, R., Cheng, K. M., & Silversides, F. G. (2009). Production performance and egg quality of four strains of laying hens kept in conventional cages and floor pens. *Poultry science*, *88*(2), 256-264. https://doi.org/10.3382/ps.2008-00237

Steel, R. G., & Torrie, J. H. (1993). Prinsip dan prosedur statistika.

Sudibya, T. W., & Santoso, S. S. (2007). Transfer omega-3 melalui kapsulisasi dan L-karnitin pengaruhnya terhadap komposisi kimia daging kambing. *Laporan Hasil Penelitian Hibah Bersaing IX. Fakultas Peternakan Universitas Jenderal Soedirman. Purwokerto*.

Sudibya. (2013). Supplementation of PUFA fatty acids and carnitine precursors in fermented yellow corn rations has an effect on the chemical composition of quail eggs. Journal of Rural and Development. 4 (2).

Tugiyanti, E., & Iriyanti, N. (2012). Kualitas eksternal telur ayam petelur yang mendapat ransum dengan penambahan tepung ikan fermentasi menggunakan isolat produser antihistamin. *Jurnal Aplikasi teknologi pangan*, *1*(2).

Walukow S N, J Laihad, J R. Leke dan M Montong. 2017. Production Appearance of MB 402 Laying Chickens fed a Ration Containing Skipjack I (Katsuwonus pelamis L) Waste Oil.Jurnal Zootek, 37(1):123-134

Wang, J., Yue, H., Wu, S., Zhang, H., & Qi, G. (2017). Nutritional modulation of health, egg quality and environmental pollution of the layers. *Animal Nutrition*, *3*(2), 91-96. https://doi.org/10.1016/j.aninu.2017.03.001

Whitehead, C. C. (2004). Overview of bone biology in the egg-laying hen. *Poultry science*, *83*(2), 193-199. https://doi.org/10.1093/ps/83.2.193

Xin, H., Gates, R. S., Green, A. R., Mitloehner, F. M., Moore Jr, P. A., & Wathes, C. M. (2011). Environmental impacts and sustainability of egg production systems. *Poultry Science*, *90*(1), 263-277. https://doi.org/10.3382/ps.2010-00877

Yuwanta, T. 2010. Eggs and egg quality. Gadjah Mada University Press, Yogyakarta.

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