Effect of diets containing fish oil and different levels of purslane meal on production performance and carcass quality of broiler chickens

L R Kartikasari, B S Hertanto, S M Putra, Y Iswara and A M P Nuhriawangsaa
Department of Animal Science, Faculty of Agriculture, Universitas Sebelas Maret, Jl. Ir. Sutami No. 36A Surakarta 57126, Indonesia

Email: lilikretna@staff.uns.ac.id

Abstract. The aim of the study was to investigate the effect of dietary inclusion of purslane meal (Portulaca oleracea) and sardines fish oil as a source of omega-3 fats on production performance and carcass quality of broiler chickens. A total of 180 one-day old unsexed Cobb broiler chickens were used in this study. The broilers were randomly allocated into 30 pens with each pen consisted of 6 birds. The pens were randomly assigned to five dietary treatments with 6 replicates (36 birds per treatment). The diets were prepared from a basal diet (P0). The experimental diets were formulated by supplementing the basal diet containing 1.5% sardines fish oil and levels of purslane meal 0 (P1), 6 (P2), 12 (P3), and 18.0% (P4). Water and diets were provided ad libitum for a period of 35 days. Data production parameters were recorded weekly. The data were analysed using analysis of variance (ANOVA). Differences between treatment means were further analysed using Duncan’s New Multiple Range Test. Results showed that there were no significant effects on production parameters and carcass weight by adding of dietary purslane meal up to a level of 12%. However, supplementation of 18% purslane meal (P4) resulted in a decrease in body weight from 1718 g (P0) to 1278 g (P4) and in carcass weight from 1139 g (P0) to 811.5 g (P4). It was concluded that dietary levels of purslane meal up to a level of 12% didn’t have negative effect on production performance and carcass quality of broiler chickens.

1. Introduction
The effect of supplementation of broiler diets, such as fish meal or fish oil, on broiler performance and the accumulation of meat omega-3 long chain polyunsaturated fatty acids (n-3 LCPUFA) has been investigated by previous researchers [1, 2]. In order to increase the incorporation of n-3 LCPUFA into chicken meat, it is commonly considered to include fish meal or fish oils, alone or in combination with n-3 PUFA (alpha-linolenic, ALA) sources [2]. Unfortunately, there are some negative impacts on the sensory properties of chicken products by using marine sources to manipulate meat fatty acid profiles or meat quality. This is due to the presence of an off-odour or off-flavour [3, 4], and this causes the reduction of consumer acceptability. In order to enhance n-3 LCPUFA deposition in chicken products, the inclusion of plants or seed high in the n-3 PUFA, (ALA, 18:3n-3) which is the n-3 LCPUFA
precursor can be an alternative to the supplementation of fish meal or fish oil to chicken diets. Some results from previous studies [5, 6] showed an increase in chicken meat n-3 LCPUFA including eicosapentaenoic acid (EPA), docosapentaenoic acid (DPA, 22:5n-3), and docosahexaenoic acid (DHA) by enriching diets with ALA-rich plant sources. In addition, a study conducted by Kartikasari et al. [7] found that all n-3 fatty acid content and PUFA of meat increased as a result of dietary inclusion of flaxseed oil rich in ALA into broiler diets. Importantly, the use of flaxseed oil does not negatively affect broiler performance and the sensory qualities of the meat. Therefore, the dietary supplementation of plant seeds or oils rich in ALA for broiler chickens can be one of dietary strategy to enhance n-3 fat content in chicken meat and may improve the quality of carcass.

*Portulaca oleracea* (purslane) is a plant that contains many biologically active compounds, which are β-carotene, folic acid, alpha-tocopherol, ascorbic acid and calcium [8] and high level of n-3 PUFA, ALA [9, 10]. The effect of purslane that is rich in ALA on the accumulation of n-3 fat in eggs, egg quality and production performance of laying hens have been reported by some investigators [10,11,12]. For example, a study conducted by Kartikasari et al. [13] found the use of purslane up to a level of 6% did not influence performance parameters and egg quality such as egg weight, yolk weight, albumen index, yolk index and Haugh Unit. When the level of purslane was increased to 8%, the increase in egg weight, yolk weight, albumen weight, and the intensity of yolk colour was observed [12]. There is little information in relation to the use of purslane meal in performance parameters or carcass quality. In terms of carcass quality, a study conducted by Zhao et al. [14] showed that body weight gain improved and feed conversion reduced by adding purslane extract (0.4%) in the diets for both on day 28 and 42. In addition, there were no effects on slaughter weight, carcass, and carcass cut yields of quails when the diets were supplemented with 10% purslane seed [15]. Therefore, the objectives of the current study were to investigate the effect of diets enriched with purslane seed, as a source of ALA on performance parameters carcass and carcass quality of broiler chickens.

2. Materials and Methods

2.1. Research Materials

In this study, a total of 180 one-day old unsexed Cobb broiler chickens were used. Using 30 pens, broilers were randomly placed in the pens with each pen containing 6 birds. The pens were randomly assigned to five dietary treatments with 6 replicates so each treatment consisted of 36 birds. The basal diet was the corn-soybean based diets containing crude protein 23.43% and energy 3318.94 kcal/kg for starter diet, and crude protein 21.3% and energy 3317.73 kcal/kg finisher diet.

2.2. Research Methods

This experimental design used was a one-way classification design. The variable factor was varying levels of dietary purslane meal, as a source of ALA in the diet. There were a total of five diets comprised of a basal diet (D0) and four experimental diets. The diets were formulated by supplementing a basal diet containing 1.5% fish oil added with 0 (D1), 6 (D2), 12 (D3), and 18% (D4) *Portulaca oleracea* meal (w/w). The level of fat in the experimental diets was held constant at approximately 4% for both starter and finisher diets. Ingredient composition and nutrient content of dietary treatments were presented in Table 1. Upon arrival, the broilers were immediately weighed and housed six birds per cage. There were six replicates for each of the five dietary treatments (n = 6 chickens for each replication). Broiler chickens were fed for 42 days with water and feed provided ad libitum for the duration of period. During the first few days, the chickens were observed frequently to ensure that feed and water were available in adequate amount, and that they were comfortable with the environmental conditions. The data of performance parameters were recorded and measured for a 42-days period. Feed intake (FI) was recorded daily and body weight were determined on weekly basis. Body weight gain and feed conversion ratio (FCR) were calculated and determined throughout the experimental duration (kg feed/kg egg). At day 35 and 42, a total of 30 chickens (n = 6 chickens for each treatment) were slaughtered to evaluate carcass quality and cut yields of chickens.
2.3. Data Analysis

The observed data in this research were the performance data and carcass quality. The obtained data were analysed using analysis of variance (ANOVA). Differences between treatment means were further analysed using Tukey test with significance level of P<0.05.

3. Results and discussion

Adding *Portulaca oleracea* (purslane) meal into the diets influenced production performance including feed intake, weight gain, feed conversion and final body weight (Table 1). Feeding diets enriched with purslane meal at a level of 12 and 18% for 35 days significantly reduced (P<0.01) weight gain. This result was consistent with body weight of chickens, which was diet containing purslane meal 12% resulted in lower body weight compare to those fed diet enriched with 6%. However, while a study found that the use of diets containing 5.0–7.5% flaxseed resulted in significantly lower weight gain [15], in this current study weight gain and body weight of chickens were not different between dietary inclusion of 6% purslane meal and control group. Interestingly, we observed that feed conversion ratio of chickens fed diets supplemented with 12% purslane meal were relatively similar with basal diet (D0).

**Table 1.** Production performance of broiler chickens fed diets supplemented with *Portulaca oleracea* meal at day 35.

| Parameters          | D0            | D1            | D2            | D3            | D4            | P Value |
|---------------------|---------------|---------------|---------------|---------------|---------------|---------|
| FC                  | 534.11a       | 522.35ab      | 527.97a       | 496.68b       | 442.23c       | 0.000   |
| ADG                 | 46.04a        | 47.31a        | 45.592a       | 41.39b        | 32.88c        | 0.000   |
| FCR                 | 1.82bc        | 1.74c         | 1.83bc        | 1.94b         | 2.13a         | 0.000   |
| Body weight         | 1701.0a       | 1699.0a       | 1638.8a       | 1492.4b       | 1213.4c       | 0.000   |

D0: Basal diet, D1: basal diet containing fish oil 1.5%, D2: basal diet containing fish oil 1.5% + 6% purslane meal; D3: basal diet containing fish oil 1.5% + 12% purslane meal; D4: basal diet containing fish oil 1.5% + 18% purslane meal

**Table 2.** Carcass quality of broiler chickens fed diets supplemented with *Portulaca oleracea* meal at day 35.

| Parameters          | R0            | R1            | R2            | R3            | R4            | P value | Significance |
|---------------------|---------------|---------------|---------------|---------------|---------------|---------|--------------|
| Slaughtered weight  | 1718.00a      | 1720.50a      | 1783.83a      | 1553.50a      | 1278.5b       | 0.000   | ***          |
| Carcass weight      | 1139.00a      | 1143.17a      | 1164.30a      | 1008.17a      | 811.5b        | 0.000   | ***          |
| Carcass percentage  | 66.29ab       | 66.43a        | 65ab          | 65.23ab       | 63.47b        | 0.032   | **           |
| Breast weight       | 441.67a       | 397.33a       | 418.50a       | 359.33ab      | 288.00b       | 0.030   | **           |
| Thigh weight        | 161.50ab      | 183.50ab      | 188.67a       | 163.33ab      | 136.00b       | 0.000   | ***          |
| Drumstick weight    | 158.33ab      | 172.00a       | 166.83a       | 141.17b       | 117.83c       | 0.000   | ***          |
| Back weight         | 243.17a       | 266.50a       | 256.33a       | 230.33a       | 172.50b       | 0.000   | ***          |
| Wing Weight         | 121.83ab      | 126.83a       | 128.50ab      | 107.50b       | 90.50e        | 0.000   | ***          |
| Abdominal fat weight| 35.84a        | 35.27a        | 36.17a        | 27.29ab       | 20.27bc       | 0.001   | ***          |

D0: Basal diet, D1: basal diet containing fish oil 1.5%, D2: basal diet containing fish oil 1.5% + 6% purslane meal; D3: basal diet containing fish oil 1.5% + 12% purslane meal; D4: basal diet containing fish oil 1.5% + 18% purslane meal

**D** significant (P<0.01); *******(P<0.001)

Dietary inclusion of *Portulaca oleracea* (purslane) meal up to a level of 12% into the diets of chickens did not influence the slaughter weight, carcass weight and carcass percentage (Table 3). Similarly, carcass cut yields such as breast weight, thigh weight and back weight tended to decrease when the diets were supplemented with purslane meal beyond 12%. It appears that drumstick weight of chickens fed 12% purslane meal had a lower weight compare to those fed diets containing 6%. 

![Image](image-url)
The results of the study were supported by Konca et al. [15] which reported that the dietary inclusion of 10% purslane seed did not influence carcass and carcass cut yields of quails. The percentage of carcass in this study was approximately 65%. Importantly, the inclusion of dietary purslane meal caused a decrease in the weight of abdominal fat. It appears that chickens fed diets containing 12% purslane meal had a lower weight of abdominal fat (20.27 g) compared to those fed control diet (38.84 g). The reduction of lipid content in broiler chickens was strongly associated with the composition of dietary fatty acid [16]. The decreased in abdominal fat weight by feeding diets containing purslane meal is in agreement with the previous studies conducted by Kartikasari et al. [17], who reported that dietary inclusion of 6% purslane meal reduced abdominal fat. In addition, a study conducted by Ferrini et al. [18] showed that abdominal fat significantly decreases in chickens fed diets supplemented with linseed oil rich in n-3 PUFA at a level of 10% (P < 0.05).

4. Conclusions
It was concluded that diets enriched with Portulaca oleracea (purslane meal) up to a level of 12% decreased weight gain and body weight but didn’t have negative effects on slaughter weight, carcass quality and cut yields of broiler chickens. The dietary inclusion of Portulaca oleracea meal up to 6% can be applied without affecting production performance and carcass quality of the chickens.

Acknowledgment
This study was supported by the research grant “Penelitian Dasar Unggulan Perguruan Tinggi (PUPT-DIKTI)” Project Number: 474/UN27.21/PP/2018.

References

[1] Lopez-Ferr S, Baucells M D, Barroeta A C and Grashorn MA 2001 Poult. Sci. 80 741-52
[2] Hulan H W, Proudfoot F G, Ackman R G and Ratnayake W M 1988 Can. J. Anim. Sci. 68 533-547
[3] Bou R, Guardiola F, Barroeta A C and Codony R 2005 Poult. Sci. 84 1129-1140
[4] Chekani-Azar A, Shahriar H A and Maheri-Sis M 2008 Asian J. Anim. Vet. Adv. 3 62-69
[5] Febel H, Mezes M, Palf T, Herman A, Gundel J, Lugasi A, Balogh K, Kocsis I and Blazovics A 2008 J. Anim. Physiol. Anim. Nutr. (Berl) 92 369-376
[6] Zelenka J, Schneiderova D, Mrkvicova and Dolezal P 2008 Vet. Med. 53 77-85
[7] Kartikasari L R, Hughes R J, Geier M S, Makrides M and Gibson R A 2012 Prostaglandins Leukot. Essent. Fatty Acids 87 103-109
[8] Irawan D, Hariyadi P and Wijaya H 2003 Indonesian Food and Nutrition Progress 10 (1)
[9] Uddin M K, Juryaimi A S, Hossain M S, Nahar M A U, Ali M E and Rahman M M 2014 Scientific World J. 1-6
[10] Aydin R and Dogan I 2010 J. Sci. Food Agric. 90 1759-63
[11] Evaris E, Sarmiento-Franco L A, Segura-Correal J C and Capetillo C M 2015 Trop. Subtrop. Agroec. 18 33-38
[12] Kartikasari L R, Hertanto H S, Pranoto D, Salim W N and Nuhiawangsya A M P 2017 Int. Conf. on Food Science and Engineering 2016, 18-19th October 2016, Surakarta, Indonesia IOP Conf. Series: Materials Science and Engineering 193 (2017) 012027 doi:10.1088/1757-899X/193/1/012027
[13] Kartikasari L R, uhiraiawangsya A M P, Hertanto B S and Swastike W 2015. J Anim Production 2015, 41(1) 7-12.
[14] Zhao X H, He X, Yang X F and Zhong X H 2013 Poult. Sci. 92 1343-1347
[15] Konca Y, Beyzi S B, Karabacak M and Yaylak E 2015 Tavukçuluk Araştırmaları Dergisi 12 1-6
[16] Mridula D, Kaur K, Nagra S S, Barnwal P, Gurumayum S and Singh K K 2015 J. Applied Anim. Res. 43 345-351
[17] Kartikasari L R, Hertanto B S and Nuhriawangsa A M P 2017 *Int. Conf. on Food Science and Engineering* 2016, 18-19th October 2016, Surakarta, Indonesia *IOP Conference Series: Earth and Environmental Science* 102 (2017) 012088 doi:10.1088/1755-1315/102/1/012088

[18] Ferrini G, Baucells M D, Esteve-García E and Barroeta A C 2008 *Poult. Sci.* 87 528-535