Carcass and cut yields of broiler chickens fed diet containing purslane meal rich in omega-3 fats

LR Kartikasari*, B S Hertanto and A MP Nuhriawangsa

Department of Animal Science, Faculty of Agriculture, Universitas Sebelas Maret, Jl. Ir. Sutami no 36A, Kentingan Surakarta, Central Java, Indonesia 57126

*E-mail : lilikretna@staff.uns.ac.id

Abstract. The aim of the research was to investigate the effect of diets containing Portulaca oleracea (purslane) as a source of omega-3 fats on carcass and cut yields of broiler chickens. One-day old unsexed Lohmann broiler chickens (n= 180) were used and randomly allocated into 30 pens (each pen contained 6 birds). The pens were randomly assigned to five experimental diets with 6 replicates (36 birds per treatment). The diets were formulated by supplementing a basal diet with purslane meal at a level of 0, 1.5, 3.0, 4.5 and 6.0%. For a period of 42 days, water and diets were provided ad libitum. Feed intake and body weight gain were collected weekly to determine feed conversion ratio. The collected data were analysed using analysis of variance. If there were significant differences between treatment means, the analysis was continued by Duncan's New Multiple Range Test. Findings showed that diets enriched with omega-3 fats, alpha-linolenic acid did not change body weight and carcass percentage of broilers. In terms of cuts yield, there was no significant different on the percentage of breast, back and wings by feeding diets supplemented with purslane meal. However, the inclusion levels of dietary purslane meal significantly affected the percentage of thighs (P<0.05) with the highest weight achieved for diets supplemented with 3% purslane meal. Drumsticks tended to increase (P= 0.056) by feeding the experimental diets. It was concluded that the inclusion level of 6% purslane meal didn’t have negative effect on carcass and cut yields of broiler chickens.

Keywords: Broilers, Portulaca oleracea, carcass, fat

1. Introduction

Some investigators have reported the effects of dietary inclusion of omega-3 fats to broiler diets, such as fish oils or fish meal, on broiler performance and fatty acid compositions of meat [1,2]. In order to increase n-3 LCPUFA accumulation into chicken meat, dietary supplementation of fish oils or fish meal, or in combination with n-3 PUFA (alpha-linolenic, ALA) sources, is commonly considered [2]. But, the supplementation of marine sources in the altering of fatty acid profiles of meat or meat quality may cause negative effects on the sensory characteristics of the final products due to the presence of an off-flavour [3,4], and this leads to reduce in consumer preference.

An alternative to the supplementation of fish meal or fish oil to chicken diets is to enhance n-3 LCPUFA deposition in chicken products through the inclusion of plants or seed high in the n-3 PUFA, (ALA, 18:3n-3) which is the n-3 LCPUFA precursor. [5,6] have reported an increase in chicken tissue 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 [7] found that dietary inclusion of flaxseed oil into broiler diets enhanced n-3 fatty acid

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content of meat. Importantly, the use of plant sources rich in ALA does not negatively influence broiler performance and the sensory qualities of the meat. Therefore, feeding broiler chickens with plant seeds or oils rich in ALA can be one of dietary approach to increase n-3 fat content in chicken meat and may increase carcass quality.

Another plant that contains many biologically active compounds ($\beta$-carotene, alpha-tocopherol, and ascorbic acid) and high level of n-3 PUFA (ALA) is Portulaca oleracea (purslane) [8]. While several studies reported the effect of purslane rich in ALA on the accumulation of n-3 fat in eggs, egg quality and production performance of laying hens [9,10,11], there is little information in relation to the use of purslane in performance parameters or carcass quality. A study conducted by [12] showed that both on day 28 and 42, supplementation of purslane extract (0.4%) increased body weight gain and decreased feed conversion ratio of broilers. In addition, the dietary inclusion of 10% purslane seed did not affect the slaughter weight, carcass, and carcass cut yields of quails [13].

The growth pattern of broiler fat depots can be modified by dietary formulation and the decrease in lipid content of broiler chickens was strongly related to the dietary fatty acid composition [15]. Moreover, some investigators reported that broiler chickens fed diets containing high levels of ALA have less abdominal fat pad accumulation compared with chickens fed diets containing high levels of saturated fatty acids or monounsaturated fatty acids [15]. Therefore, the objectives of the current study were to investigate the effect of diets containing Portulaca oleraceae (purslane) as a source of omega-3 fats on carcass and cut yields of broiler chickens.

2. Materials and Methods

2.1. Research Materials
A total of 180 one-day old unsexed Lohmann broiler chickens were used in this experiment. The broilers were randomly allocated into 30 pens (each pen contained 6 birds). The pens were randomly assigned to five dietary treatments with 6 replicates (36 birds per treatment). The basal diet was the corn-soybean based diets containing crude protein 23% and energy 3090.79 kcal/kg (Table 1.)

2.2. Research Methods
One-way classification design was used for this experiment. The variable factor was varying levels of purslane meal (a source of ALA) in the diet. A total of five diets were formulated by supplementing a basal diet with 0 (F0), 1.5 (F1), 3 (F2), 4.5 (F3) and 6% (F4) Portulaca oleracea meal (w/w). Fat level of the dietary treatments was kept constant at ~ 5.8%. The composition of ingredient composition and nutrient value of diets were shown in Table 1. The broilers were immediately weighed upon arrival and housed in cage (n= six birds per cage). Each of the experimental diet was replicated six times (n = 6 chickens for each replication). Broiler chickens were fed for 42 days and water and feed were provided ad libitum for the duration of experimental period. The chickens were observed at frequent intervals during the first few days to ensure that chickens got adequate feed and water and to ensure that chickens were comfortable with the environmental conditions. Performance parameter data were collected for a 42-days experimental duration. Body weight and feed intake (FI) were recorded and determined on weekly basis. Body weight gain and feed conversion ratio (FCR) were determined throughout the experimental duration (kg feed/kg body weight). A total of 30 chickens of day 35 and 42 (n = 6 chickens for each treatment) were slaughtered to evaluate carcass quality and cut yields of chickens.

2.3. Data Analysis
The obtained data in this experiment were analysed using analysis of variance (ANOVA). When there were significant differences between treatment means, further analysed using Duncan’s New Multiple Range Test (DMRT) were conducted with significance level of P<0.05.
| Ingredient         | F0  | F1  | F2  | F3  | F4  |
|-------------------|-----|-----|-----|-----|-----|
| Yellow corn       | 32.00 | 31.52 | 31.04 | 30.56 | 30.08 |
| Rice polish       | 3.00  | 2.96  | 2.91  | 2.87  | 2.82  |
| Soybean meal      | 29.95 | 29.50 | 29.05 | 28.60 | 28.15 |
| CaCO₃             | 0.06  | 0.06  | 0.06  | 0.06  | 0.06  |
| Di-calcium Phosphate | 2.20  | 2.17  | 2.13  | 2.10  | 2.07  |
| L-Lysin           | 0.24  | 0.24  | 0.23  | 0.23  | 0.23  |
| DL-Methionin      | 0.40  | 0.39  | 0.39  | 0.38  | 0.38  |
| Premix            | 0.20  | 0.20  | 0.19  | 0.19  | 0.19  |
| Salt              | 0.50  | 0.49  | 0.49  | 0.48  | 0.47  |
| Limestone         | 1.00  | 0.99  | 0.97  | 0.96  | 0.94  |
| Purslane meal     | 0.00  | 1.50  | 3.00  | 4.50  | 6.00  |
| Coconut oil       | 4.50  | 4.43  | 4.37  | 4.30  | 4.23  |
| Copra meal        | 14.95 | 14.73 | 14.50 | 14.28 | 14.05 |
| DDGS              | 10.00 | 9.85  | 9.70  | 9.55  | 9.40  |
| Filler            | 0.99  | 0.97  | 0.96  | 0.94  | 0.93  |
| Vitamin E         | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  |
| **Total**         | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

| Nutrient value    |     |     |     |     |     |
|-------------------|-----|-----|-----|-----|-----|
| DM                | 86.97 | 87.07 | 87.17 | 87.27 | 87.37 |
| ME                | 3090.79 | 3069.71 | 3048.62 | 3027.53 | 3006.45 |
| Crude protein     | 23.10 | 23.03 | 22.96 | 22.89 | 22.82 |
| Ether extract     | 5.77  | 5.78  | 5.78  | 5.78  | 5.78  |
| Crude fiber       | 3.25  | 3.51  | 3.78  | 4.04  | 4.31  |
| Ash               | 3.97  | 3.95  | 3.92  | 3.89  | 3.87  |
| Nitrogen free extract | 38.09 | 37.51 | 36.94 | 36.37 | 35.80 |
| Calcium           | 1.07  | 1.12  | 1.18  | 1.23  | 1.29  |
| Phosphorus        | 0.87  | 0.86  | 0.86  | 0.85  | 0.84  |
| Available phosphorus | 0.57  | 0.56  | 0.55  | 0.55  | 0.54  |
| Lysine            | 1.22  | 1.21  | 1.20  | 1.20  | 1.19  |
| Methionine        | 0.65  | 0.65  | 0.66  | 0.67  | 0.68  |

3. Results and discussion
Dietary inclusion of *Portulaca oleracea* (purslane) meal up to a level of 6% into the diets of chickens did not influence the body weight, slaughter weight, carcass weight and yields of carcass cuts (Table 2 and 3). While a study found that the use of diets containing 5.0–7.5% flaxseed resulted in significantly lower weight gain, in this current study body weight of chickens was not different between purslane meal group and control group. These findings were in agreement with a study conducted by (2014), which found that dietary inclusion of flaxseed meal 80 g/kg did not adversely affect body weight gain, carcass weight and the composition of carcass. The results of the study were also supported by [13] which reported that the supplementation of 10% purslane seed did not affect the slaughter weight,
carcass, and carcass cut yields of quails [13]. The percentage of carcass in this study was approximately 72%. There were significant differences in cut yields of chickens such as thigh and drumstick. Increasing levels of dietary purslane tended to decrease thigh percentage with the lowest percentage for thigh from 6% purslane meal group (Table 3.). However, decrease in the percentage of thighs indicated not much of a difference compared to the control thighs and the difference in thigh percentage between control thighs and those from chickens fed 6% purslane meal was not significant. Based on the carcass characteristic data, it is indicated that there were no negative effects of including purslane meal up to a level of 6% to laying hen diets.

Importantly, the inclusion of dietary purslane meal caused a decrease in the weight and percentage of abdominal fat. It appears that feeding chickens with diets enriched with 4.5% purslane meal had a lower percentage of abdominal fat (0.53%) compared to those fed control diet (0.98%). These findings suggested that the decrease in lipid content in chickens was very associated with the composition of dietary fatty acid [15] The decreased in abdominal fat weight by feeding diets containing purslane meal is in agreement with the previous studies conducted by [15], who have reported 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).

Table 2. Body weight, carcass, cut yields and abdominal fat of broiler chickens at day 42

| Parameters                     | F0          | F1          | F2          | F3          | F4          | P value | Significance |
|--------------------------------|-------------|-------------|-------------|-------------|-------------|---------|--------------|
| Body weight (g)                | 1477.5      | 1512.5      | 1393.3      | 1445.8      | 1459.2      | 0.854   | NS           |
| Slaughter weight               | 1475.0      | 1509.2      | 1390.8      | 1444.2      | 1456.7      | 0.857   | NS           |
| Abdominal fat weight (g)       | 14.36a      | 8.90ab      | 8.20b       | 7.62b       | 6.77b       | 0.010   | **           |
| Abdominal fat (%)              | 0.98a       | 0.59ab      | 0.60ab      | 0.53b       | 0.46b       | 0.010   | **           |
| Carcass weight (g)             | 1053.4      | 1093.4      | 1007.2      | 1037.3      | 1050.1      | 0.867   | NS           |
| Breast weight (g)              | 327.7       | 340.7       | 318.3       | 327.3       | 341.3       | 0.950   | NS           |
| Back weight (g)                | 212.7       | 208.2       | 197.2       | 200.5       | 198.5       | 0.757   | NS           |
| Thigh and drumstick weight (g) | 299.7       | 313.2       | 271.7       | 269.7       | 290.5       | 0.345   | NS           |
| Thigh weight (g)               | 151.2       | 163.2       | 138.2       | 146.5       | 139.7       | 0.340   | NS           |
| Drumstick weight (g)           | 148.0       | 149.7       | 134.0       | 131.7       | 151.0       | 0.368   | NS           |
| Wing weight (g)                | 100.3       | 105.8       | 105.7       | 116.7       | 102.7       | 0.326   | NS           |

F0: Basal diet + 0% purslane meal, F1: basal diet + 1.5% purslane meal, F2: basal diet + 3% purslane meal, F3: basal diet + 4.5% purslane meal and F4: basal diet + 6% purslane meal

** (P<0.01); NS= not significant

Table 3. Percentage of carcass and cut yields of broiler chickens at day 42

| Parameters         | F0          | F1          | F2          | F3          | F4          | P value | Significance |
|--------------------|-------------|-------------|-------------|-------------|-------------|---------|--------------|
| Carcass (%)        | 71.24       | 72.41       | 72.52       | 71.97       | 72.12       | 0.921   | NS           |
| Breast (%)         | 30.89       | 31.25       | 31.46       | 31.49       | 32.16       | 0.855   | NS           |
| Back (%)           | 20.27       | 19.00       | 19.67       | 19.34       | 19.03       | 0.306   | NS           |
| Thigh and drumstick| 28.40ab     | 28.59a      | 26.89ab     | 26.06b      | 27.72ab     | 0.025   | *            |
| Thigh (%)          | 14.35ab     | 14.92a      | 13.60ab     | 14.12ab     | 13.33b      | 0.041   | *            |
| Drumstick (%)      | 14.00ab     | 13.63ab     | 13.34ab     | 12.7b       | 14.4a       | 0.028   | *            |
| Wing (%)           | 9.53b       | 9.70b       | 10.55ab     | 11.26a      | 9.76b       | 0.000   | **           |

F0: Basal diet + 0% purslane meal, F1: basal diet + 1.5% purslane meal, F2: basal diet + 3% purslane meal, F3: basal diet + 4.5% purslane meal and F4: basal diet + 6% purslane meal

* significant (P<0.05); ** (P<0.01); NS= not significant
4. Conclusions
Based on the data, we concluded that dietary inclusion of *Portulaca oleracea* (purslane) meal up to a level of 6% didn’t have negative effects on carcass quality and cut yields of broiler chickens.

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