Effect of dietary supplementation of frutescens seeds (Perilla Frutescens L.) on growth performance, slaughter weight, carcass weight, and meat quality of male local duck

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Abstract. This experiment was aimed to observe the effects of Frutescens seeds (Perilla frutescens L.) levels in the diet on the growth performance, slaughter weight, carcass weight, and meat quality of male local duck. A total of 90 ducks were divided into 3 treatment groups with five replicates. The treatments were: basal diet without supplementation frutescens seeds meal (P0), experimental diets with 2.5% frutescens seeds meal (P1); and 5% frutescens seeds meal (P2). The experiment was conducted for 60 days. Average daily gain (ADG), slaughter weight, carcass weight, crude protein and fat contents of duck meat were observed. The data were analyzed with one way analysis of variance (ANOVA). If there was significant differences among treatments, Duncan's multiple range test (DMRT) were applied. The body weight, feed intake, slaughter weight, carcass weight, dry matter, and meat protein content were not affected by the dietary treatments. However, the effect of the Frutescens supplementation in the diets significantly affected ADG, non-carcass weight, and fat content in the duck meat. The highest fat content of meat has been found in the duck raised with 5% of Frutescens seeds supplementation in the diet. These results suggested that the use of 5% Frutescens seeds supplementation in the diet effectively increased ADG, non carcass weight, and fat content of meat. Whereas other traits observed in this study were not affected.

1. Introduction

The performance, production and quality of production of local duck genotypes, are still relatively small, to date more than chickens, both local breeds in the laying and broiler type [1]. Nutritional composition of duck meat (Anas platyrhynchos) water content 74.13-74.93%; 19.28-20.50% protein; 2.80-3.78% fat [2]. Perilla frutescens is an annual plant and the Lamiaceae family, which is native to Asian countries (India, China, Japan, Korea, Thailand, and several Asian countries). It is edible in medicinal plant and in cooking [3,4].

Frutescens seeds (Perilla frutescens) are a nice source of the α-linolenic acid (ALNA) and other aspects of their dietary value have been studied [3], perilla seed and meal are suited as animal feed [5]. Livestock meat can be enriched with n-3 polyunsaturated fatty acid (n-3 PUFA) by adding oilseed rich in α-linolenic acid [6]. Perilla frutescens oil, which constitutes approximately 40% of the seed weight, is primarily composed of fatty acids, such as palmitic acid (C16:0), stearic acid (C18:0), oleic acid (C18:1n-9), linoleic acid (C18:2n-6), and α-linolenic acid (ALNA)[4,7,8].

The fatty acids contained in perilla seeds are unsaturated fatty acids such as oleic acid 14-23%, linoleic acid 11-16%, linolenic acid 54-64%. Perilla seed oils also contains 6.7-7.6% saturated fatty acids [9]. In addition, researchers reported the plant perilla mint (Perilla frutescens) as another potential source of this fatty acid. Particularly, the seeds of this plant have been reported with high omega-3 contents. When used as feed in swine and chicken, perilla seed and meal were found to increase omega-3 fatty acid contents in meat and other animal products such as eggs [5]. Some researchers found that the inclusion of high dietary levels of flaxseed (10%) have been associated with a decrease in performance parameters such as reducing feed intake [10,11]. Therefore, research was needed on the...
effect of duck feed supplementation containing sources of omega-3 fatty acids (Alpha-Linolenic Acid) by using frutescens seed meal \textit{(Perilla Frutescens L.)} as a supplementation of Alpha-Linolenic Acid sources so that there is an increase in carcass quality and nutritional content of duck meat.

2. Materials and methods

2.1. Research materials

A total of 90 ducks were divided into 3 treatment groups, with 5 replicates. The feeding treatments were:
P0: basal diet without supplementation frutescens seeds meal (0%)
P1: treatment diet with 2.5% frutescens seeds meal, and
P2: treatment diet with 5% frutescens seeds meal

The experiment were conducted for 60 days.

2.2. Research methods

The diets were consisted of yellow corn, pollard, rice polish, soy bean meal and vitamin mix. The diets contained crude protein 18-19% and energy 2900-3000 Kcal/kg. Chemical composition of experimental diets were presented in Table 1. Treatment’s feedstuffs composition and nutrients content is presented in Table 2.

\begin{table} [h]
\centering
\caption{Chemical composition (on dry matter basis) of experimental diets.}
\begin{tabular}{|l|c|c|c|c|c|c|c|}
\hline
Ingredients & Crude protein (\%) & ME (Kcal/kg) & Ether extract (\%) & Crude fiber (\%) & Calcium (\%) & Phosphorus av (\%) \\
\hline
Yellow corn & 8.02 & 3321 & 0.97 & 1.77 & 0.02 & 0.069 \\
Pollard & 16.85 & 2446 & 3.47 & 9.15 & 0.09 & 0.234 \\
Rich polish & 11.2 & 2887 & 9.49 & 0 & 0.04 & 0.381 \\
Soy Bean Meal & 50.94 & 2577 & 2.11 & 3.73 & 0.29 & 0.18 \\
Frutescens seed meal & 25.01 & 3457.55 & 43.1 & 29.83 & 2.49 & 2.031 \\
Premix & 0 & 0 & 0 & 0 & 32.5 & 22 \\
\hline
\end{tabular}
\end{table}

\begin{table} [h]
\centering
\caption{Feedstuffs composition and nutrient content of treatment diets}
\begin{tabular}{|l|c|c|c|}
\hline
Treatment (% of diets) & P0 & P1 & P2 \\
\hline
Basal diet (%) & 100 & 97.5 & 95 \\
Treatment diet (%) & 0 & 2.5 & 5 \\
\hline
Feedstuffs composition & ME, kcal/kg & 2908.09 & 2994.53 & 3080.97 \\
Crude protein, % & 18.52 & 19.15 & 19.77 \\
Crude fiber, % & 4.29 & 5.04 & 5.79 \\
Extract ether, % & 3.13 & 4.21 & 5.29 \\
Ca, % & 0.90 & 0.96 & 1.03 \\
P av, % & 0.72 & 0.77 & 0.82 \\
\hline
\end{tabular}
\end{table}

P0: basal diet without supplementation frutescens seeds meal (0%); P1: treatment diet with 2.5% frutescens seeds meal, and P2: treatment diet 5% frutescens seeds meal.
2.3. Growth performance
The live weight and feed intake of the ducks were recorded weekly during the experimental period, except for the last period, which lasted seven days. Data on the average daily gain (ADG), and feed intake (FI) were calculated.

2.4. Carcass and non-carcass collection
Data collection of cut weight and carcass weight was carried out when the ducks were eight weeks old. Before slaughtering, two of the ducks were slaughtered in an experimental slaughterhouse with fasting form twelve hours. The process of slaughtering ducks is done by cutting the carotid artery, jugular vein, trachea, and esophagus. The carcass is the body part of ducks after slaughtering based on Islamic Shari'ah, with removal of feathers, and removal of offal, without head, neck and legs. The breast section is taken for meat chemical analysis. In addition, Non carcass weight is obtained by means of life weight reduced by the total weight of the head, neck, blood, hair, skin, legs and also the internal organs (viscera) [12].

2.5. Chemical analyses
The chemical composition of meat (crude protein and ether extract) [13] analysis was conducted in duplicate on freeze-dry samples of the breast and expressed on a fresh basis.

2.6. Data analyses
This research used one way randomized design. The data were analyzed using analysis of variance (ANOVA) and differences between treatment means were further analyzed using Duncan’s New Multiple Range Test (DMRT) with significance level of p<0.05.

3. Results and discussion
Addition of *Perilla frutescens* meal, as feed supplement up to 5% into the diets have significantly increased (p<0.05) average daily gain and non carcass weight (Table 3). There were no differences among the groups in body weight, feed intake of the diets, slaughter weight and carcass weight ducks with different levels of the diets. Perilla seed and meal are suited as animal feed. Perilla meal in animal feed is still not pervasive to use in animal feed because the limitation of it such as fiber composition is quite high (problem with monogastric animal). It is interesting to use for increase value in meat and egg due to the property is high with protein and omega-3 [5]. The use of plant sources rich in ALA does not negatively influence broiler performance and the sensory qualities of the meat. In addition, the 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 [14].

**Table 3. Productive performance and carcass characteristics of ducks fed diets**

| Treatments | P0 | P1 | P2 |
|------------|----|----|----|
| Body weight, g | 1183.35 | 1267.88 | 1237.40 |
| Feed intake | ns  | 102.21 | 103.74 | 103.51 |
| ADG, g | 21.44<sup>a</sup> | 25.49<sup>b</sup> | 26.56<sup>b</sup> |
| Slaughter weight, g | 1057.88 | 1115.10 | 979.38 |
| Carcass weight, g | 678.92 | 755.86 | 722.23 |
| Non carcass weight, g | 475.81<sup>a</sup> | 538.89<sup>b</sup> | 588.34<sup>b</sup> |

P0: basal diet without supplementation frutescens seeds meal (0%); P1: treatment diet with 2.5% frutescens seeds meal, and P2: treatment diet with 5% frutescens seeds meal.

<sup>a,b</sup> different superscript in the same row indicates significantly (P<0.05); ns = not significant.
There were significant differences in carcass parameters, average daily gain and non carcass weight of the ducks in this study. This result was caused by increased metabolism energy and extract ether accumulation in the pericardic zone as a consequence of the high content of ether extract from the ration with increased perilla seed and digestion supplementation higher than ether extract [6]. Animals fed a diet enriched with animal fat showed higher lumbar circumference, liver weight and carcass and retail cut weights than animals fed linseed or sunflower seed oil supplemented diets [15][16].

Table 4. Chemical composition of meat (on a dry matter basis)

| Treatments | P0 | P1 | P2 |
|------------|----|----|----|
| Dry matter, % | 26.47 | 25.39 | 25.17 |
| Crude protein, % | 19.22 | 19.74 | 19.98 |
| Fat, % | 2.51a | 2.60a | 3.39b |

P0: basal diet without supplementation Frutescens seeds meal (0%); P1: treatment diet with 2.5% frutescens seeds meal, and P2: treatment diet with 5% frutescens seeds meal.

4. Conclusions
It was concluded that diets enriched with supplementation Frutescens seeds (Perilla frutescens L.) meal up to 5% in the diet effectively increased ADG, non-carcass weight, and fat content of meat, on the other hand, other traits observed in this study were not affected.

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