Carcass characteristics of Bali duck (Anas sp.) Fed with Daucus carota Leaf flour

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Abstract
Since the use of antibiotics is prohibited to improve the quality of animal products, as well as increase product yields, researchers have begun to focus on the use of phytogenic compounds as non-antibiotic growth promoters. So this research is important to do to examine the effect of giving carrot leaf meal (CLF) in the ration to increase the quantity and quality of carcass in Bali ducks. This study used 240 male Bali ducks aged two weeks with homogeneous body weight in a completely randomized design with 4 treatments and 6 replications. The four treatments were a group of ducks fed without CLF as a control (A); ration with 3% CLF (B); ration with 6% CLF (C); and rations with 9% CLF (D). The results showed that giving 3-6% CLF in the diet significantly ($P<0.05$) increased feed consumption, body weight, carcass weight, carcass percentage, breast meat, and protein mass of duck meat compared to control (A) and 9% CLF(D). The percentage of abdominal fat and serum cholesterol levels in ducks that received treatment B, C, and D, decreased significantly ($P<0.05$) compared to treatment A. It can be concluded that the use of 3-6% carrot leaf flour in the ration can increase the percentage carcass and meat protein mass. On the other hand, it reduces abdominal fat and serum cholesterol levels in Bali ducks.

Keywords: carrot leaves, carcass, abdominal fat, cholesterol, Bali duck

Introduction
Since the use of antibiotics is prohibited to improve the quality of animal products, as well as increase product yields, researchers have begun to focus on the use of phytogenic compounds as non-antibiotic growth promoters. The use of herbal plant leaves in feed can increase feed intake, feed conversion ratio, weight gain, and can increase tissue oxidative stability \([1,2]\).

Utilization of carrot leaves as a source of natural provitamin A in producing animal products can be used as an alternative for natural fortification of animal products in an effort to overcome the problem of vitamin A deficiency \([3]\). In addition, natural provitamin A compounds are much safer to consume than synthetically made vitamin A. Therefore, a feed supplement is needed that is able to produce meat that is free of antibiotics or other chemical substances.

Interesting to study its efficacy as a natural feed supplement is carrot leaf. Carrot (Daucus carota L.) is a type of vegetable that is well-known as a source of provitamin A (carotenoids). In every 1 ha carrot plant has an actual productivity of 15 tons of carrot tubers and 5% of it as waste and is not used as human food \([4]\). The nutrient content of carrot leaf flour is quite good, namely 9.27% crude protein; 19.64% crude fiber; 1.20% crude fat; 0.65% calcium; 0.51% phosphorus; and contains 2487 kcal/kg metabolized energy \([5]\). The phytochemical compounds contained in it are: saponins, flavonoids, and tannins \([6]\) and several other phenolic compounds that have antimicrobial activity \([7]\). The antioxidant capacity of plants, mostly comes from phenolic compounds present in plant tissues and antioxidant activity decreases, as the amount of phenolic compounds present in plants decreases \([8]\). According to \([9]\) that supplementation of herbal leaf extracts as much as 50 mL/liter of drinking water given to broilers significantly reduced abdominal fat and cholesterol levels in broiler serum and yolk cholesterol in laying hens \([10]\). Giving carrot leaves up to a level of 6% in the ration, apparently reduced broiler weight gain, but had no impact on feed consumption and feed efficiency \([3]\). Fermentation of carrot leaf flour can increase its nutritional value and at a level of 6% in laying hens rations can increase egg production and reduce cholesterol content in yolks \([11]\). Ürüşan et al. \([12]\) reported that supplementation of carrot seed oil in broiler feed significantly increased carcass percentage.
Based on this, researchers are interested in studying the effect of *Daucus carota* leaf meal supplementation in the ration to increase carcass and reduce fat and cholesterol in male Bali ducks.

**Materials and Methods**

**Animals and experimental design**

This study used 240 male Bali ducks aged two weeks with homogeneous body weight in a completely randomized design with 4 treatments and 6 replications. The four treatments were a group of ducks fed without CLF as a control (A); ration with 3% CLF (B); ration with 6% CLF (C); and rations with 9% CLF (D). Each group treatment in six replications with 10 birds per cages. The size of each cages was: 150×100×60 cm³ (length x width x height). The floor of the cage was made of bamboo slats. Concentrated feed was mash form and birds were free access to feed and drinking water during the experiment period. Body weight and feed intake were registered every week. The carrot leaves used were post-harvest carrot leaves at the Carrot plantation in the Baturiti area, Tabanan Regency, Bali Province, Indonesia. Before being used in the ration, first the carrot leaves are crushed into small pieces with a grass crusher machine, then dried in the sun and crushed until smooth. More detail is presented in Figure 1.

![Fig 1: The process of making carrot leaf flour](image)

**Live performance**

Body weight gain (LWG), live weight (BW), feed consumption and feed conversion ratio for ducks were recorded separately every week. Feed consumption (grams per duck) was recorded every week in each replication (experimental unit). Total feed intake for each treatment was measured during the experimental period (age 2-8 weeks). Feed Conversion Ratio (FCR) is calculated as grams of feed consumed per gram of body weight gained. FCR is an indicator to measure the level of feed efficiency. The higher the FCR value, the lower the feed efficiency level. The rations given were commercial rations for ducks, containing 17% crude protein and 2900 kcal/kg metabolized energy.

**Slaughter procedures**

At the eighth week at the end of the study, all ducks were slaughtered to obtain carcass weight and carcass percentage. Carcass weight was obtained by slaughtering ducks by cutting the jugular vein in the neck to remove blood from the duck's body. Carcass percentage was calculated as fresh carcass weight divided by duck body weight before slaughter multiplied by 100%. The ducks that have been slaughtered are then cleaned of feathers, then their internal organs and digestive tract are removed. Head, crop, trachea, esophagus, heart, lung, and liver weights were excluded from the slaughter weights, to obtain carcass weights. Observation of serum cholesterol concentration was carried out when the ducks were 8 weeks old (at the end of the study). Blood was taken from the vein at the base of the duck wing in each experimental unit. Analysis of cholesterol content using the Lieberman-Burchad method of. The protein mass of the meat was obtained by analyzing a number of samples taken from the meat on the breast, when the ducks were 8 weeks old. The sample of finely ground meat was taken as much as 10 g to be analyzed for protein content by the Kjeldhal method. The mass of meat protein is calculated by the following formula:

\[
\text{Breast meat protein mass} = \text{meat protein (g)} \times \text{breast meat weight (g)}
\]

**Statistical analysis**

The data obtained were analyzed by one-way ANOVA, if there was a significant difference (\(P<0.05\)) between treatments, then continued with Duncan's multiple distance test.

**Results**

The results are presented in Table 1. Average feed consumption, body weight, carcass weight, percentage of carcass, breast meat, and breast protein mass in ducks between treatments showed significant differences (\(P<0.05\)). Feed consumption, body weight, carcass weight, percentage of carcass, breast meat, and protein mass of breast meat in group B and C ducks were significantly higher (\(P<0.05\)) compared to group A and D ducks. The highest percentage of carcass, breast meat, and meat protein mass was obtained in the duck group that was given 3-6% CLF (groups B and C), but when given 9% CLF (group D) there was a significant decrease (\(P<0.05\)) compared to group B and C ducks.
Table 1: Carcass characteristics of male Bali duck (Anas sp.) Aged 8 weeks given CLF.

<table>
<thead>
<tr>
<th>Variables</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed consumption (g/bird/hari)</td>
<td>87.17b</td>
<td>96.65a</td>
<td>94.19a</td>
<td>88.29b</td>
<td>1.293</td>
</tr>
<tr>
<td>Final BW (g)</td>
<td>1290.85b</td>
<td>1470.24a</td>
<td>1462.38a</td>
<td>1262.16b</td>
<td>22.909</td>
</tr>
<tr>
<td>Carcass weight (g)</td>
<td>712.29b</td>
<td>870.82a</td>
<td>862.07a</td>
<td>697.45b</td>
<td>42.805</td>
</tr>
<tr>
<td>Carcass percentage (%)</td>
<td>55.18b</td>
<td>59.23a</td>
<td>58.95a</td>
<td>55.26b</td>
<td>1.017</td>
</tr>
<tr>
<td>Breast meat (% carcass weight)</td>
<td>9.13b</td>
<td>9.85a</td>
<td>10.17a</td>
<td>9.24b</td>
<td>0.136</td>
</tr>
<tr>
<td>Breast meat (g)</td>
<td>65.03b</td>
<td>85.78a</td>
<td>87.67a</td>
<td>64.44b</td>
<td>4.183</td>
</tr>
<tr>
<td>Breast meat protein (%)</td>
<td>17.49a</td>
<td>18.25a</td>
<td>18.19a</td>
<td>17.36a</td>
<td>0.703</td>
</tr>
<tr>
<td>Breast meat protein mass (g)</td>
<td>11.37b</td>
<td>15.65a</td>
<td>15.95a</td>
<td>11.19b</td>
<td>1.108</td>
</tr>
</tbody>
</table>

Note: 1. Four levels of CLF in the diet, namely: 0%; 3%; 6%; and 9% as treatments A, B, C, and D, respectively
2. Standard error of the treatment means
3. Means with different superscripts within row values are significantly different (P< 0.05)

Table 2 presents the lipid profile of duck blood due to the administration of 3-9% CLF. Administration of 3-9% CLF in the diet of ducks from 2-8 weeks of age significantly (P< 0.05) reduced the total cholesterol concentration in duck serum compared to control (A). The concentration of triglycerides, high density lipoprotein (HDL), and low density lipoprotein (LDL) in duck serum between treatments did not show any significant difference (P>0.05). Total abdominal fat and total serum cholesterol levels in ducks that received treatment B, C, and D, decreased significantly (P< 0.05) compared to treatment A. More details are presented in Table 2.

Table 2: Blood lipid profile and abdominal fat of male Bali ducks fed a diet containing CLF.

<table>
<thead>
<tr>
<th>Variable</th>
<th>CLF level in ration (%)</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Blood lipid profile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cholesterol (mg/dL)</td>
<td>158.35a</td>
<td>142.71b</td>
</tr>
<tr>
<td>Triglycerides (mg/dL)</td>
<td>57.61a</td>
<td>49.62a</td>
</tr>
<tr>
<td>HDL (mg/dL)</td>
<td>88.27a</td>
<td>90.61a</td>
</tr>
<tr>
<td>LDL (mg/dL)</td>
<td>50.89a</td>
<td>44.57a</td>
</tr>
<tr>
<td>Pad-fat (% berat badan)</td>
<td>0.41a</td>
<td>0.39a</td>
</tr>
<tr>
<td>Abdominal-fat (% berat badan)</td>
<td>0.79a</td>
<td>0.67b</td>
</tr>
</tbody>
</table>

Note: 1. Four levels of CLF in the diet, namely: 0%; 3%; 6%; and 9% as treatments A, B, C, and D, respectively
2. Means with different superscripts within row values are significantly different (P< 0.05)

Discussion

The results showed that the use of 3-6% CLF in the ration significantly increased feed consumption. Likewise, body weight, carcass, carcass percentage, breast meat, and breast meat protein mass in ducks. This is caused by CLF which contains many phytochemical compounds, such as saponins, flavonoids, and tannins and several other phenolic compounds that have antimicrobial activity, for example saponins have proven antimicrobial properties.

The decrease in the number of pathogenic bacteria in the digestive tract of ducks will result in optimal absorption of nutrients, thus increasing the performance of ducks. Ekayuni et al. reported that supplementation of herbal extracts in broilers did not affect feed consumption, but could significantly increase body weight gain and feed efficiency. Similar results were reported by Prasetyo et al. that supplementation of herbal mixtures into broiler feed significantly increased live weight and feed efficiency. According to the use of CLF more than 4% in the ration can reduce body weight, while feed consumption and feed efficiency have no significant effect. So it is recommended that the use of CLF in feed is not more than the level of 2%. Contrary to the research results of who received a significant decrease in feed consumption in broilers that were given carrot supplements compared to broilers that were not given carrot supplements. Daucus carota contains many phytochemical constituents (carotenoids, phenolic compounds, polyacetylene), vitamins (vitamin A, beta-carotene, lutein zeaxanthin, riboflavin, niacin, pathetic acid, vitamin B₆, folate, vitamin C, vitamin K) and minerals.

Prasetyo et al. reported that CLF supplementation up to 6% in the diet had no effect on protein consumption and protein efficiency ratio, but could improve calcium retention. Reported by Pennyroyal herbal supplement reduces feed consumption and feed efficiency in broilers. According to the observed increase in broiler weight gain was due to the opening properties of plant extracts by increasing gastric digestive juices and establishing a more balanced intestinal flora with their antimicrobial effect. In contrast, found that rations with orange peel oil did not affect broiler body weight. Carcass weight, breast meat and breast meat protein mass in ducks increased with the supplementation of 3-6% CLF in the diet. However, at the 9% CLF level, there was a significant decrease in all these variables. One of the causes of this decrease was the high crude fiber content in CLF, which was 19.30%.

Poultry is not able to digest crude fiber, which is too high in the ration. As reported by rations containing high crude fiber sourced from rice bran cause the digestibility of the ration to decrease, so that the absorbed nutrients also decrease which has an impact on the growth of ducks.

Crude fiber cannot be digested by the digestive enzymes of the ducks, so it will soon be excreted through the feces, so the opportunity for absorption of nutrients in the digestive tract of ducks is reduced. As reported by poultry is only able to digest about 5-10% crude fiber by microbes in the cecum. The increase in the crude fiber content of the ration significantly increased the rate of passage in the digestive tract of ducks, so
that there was not enough time for the intestinal villi to absorb the digested nutrients [26]. Sirit et al. [27], stated that the increase in crude fiber content in the diet caused a decrease in fat absorption and energy digestibility (DE). According to [28], nitrogen absorption decreased, because the transit time of digesta in the digestive tract decreased, as a result of increased fiber content in the ration. Mangisah et al. [29] reported that the higher the crude fiber content of the ration, the lower the digestibility of the ration, which resulted in a decrease in the growth of ducks. According to [30], the mass of meat protein is an indicator to see the good or bad of protein deposition which is influenced by protein synthesis and degradation. Meat protein mass can increase if the synthesized protein exceeds the degraded protein, which will affect the productivity of chickens. The mass of protein in chicken meat is related to the mass of calcium in meat, because the total mass value of meat protein is influenced by calcium levels in the form of ions [31]. The use of carrot leaf flour in the ration at the level of 3-6% significantly increased the breast meat and protein mass of duck breast meat. This increase is closely related to the increase in protein consumption and the presence of phytochemical compounds in carrot leaves. Tang et al. [32] stated that the increased consumption of protein and amino acid lysine in broilers caused an increase in breast meat compared to lower consumption of protein and lysine. The same thing was reported by [33] that increasing protein consumption would increase carcass weight, carcass percentage, and breast meat. Contrary to the research results of [34] who found that the addition of carrot waste flour (2-6%) into the ration actually reduced the protein mass of the meat, while the calcium mass of the meat had no significant effect. Reported by [35] that cold-pressed carrot seed oil supplementation can cause an increase in slaughter weight, carcass weight, and broiler carcass percentage. The same thing was reported by [16, 17] that supplementation of herbal mixtures into broiler feed, significantly increased live weight and carcass characteristics of broilers. Giving 10% sweet potato leaf flour can increase the protein mass and calcium of meat [36].

Supplementation of 3-9% CLF in the diet significantly reduced abdominal fat and serum cholesterol levels in ducks. The decrease was due to the content of phytochemical compounds and the high content of crude fiber in CLF. Carrots demonstrated the effect of reducing cholesterol absorption in rats fed carrots [30]. The results of research by [19] showed that carrot intake may exert a protective effect against cardiovascular disease associated with atherosclerosis. Likewise, the results of the study by [37] which reported that pad fat and abdominal fat in ducks decreased with increasing crude fiber content in the ration. Crude fiber in the digestive tract of ducks is able to bind bile acids, bile acids function to emulsify fats from rations, so that they are easily hydrolyzed by lipase enzymes. When most of the bile acids are bound by crude fiber, the emulsion of lipid particles formed is less, so that the activity of the lipase enzyme is reduced. As a result, a lot of lipids will be excreted with feces because they are not absorbed by the body, so that body tissues will contain less lipids. Supplementation of herbal leaf extract as much as 50 ml/liter of drinking water in broilers significantly reduced abdominal fat and cholesterol levels in broiler serum [9] and cholesterol in yolks [10]. Samudera and Hidayatullah [37] stated that duck abdominal fat decreased with increasing crude fiber content in the ration. Ürüşan et al. [12] reported that the addition of carrot seed oil supplementation in the basal ration had no effect on the biochemical parameters of broiler serum. Furthermore, it was also reported that carrot seed oil supplementation resulted in positive changes in weight gain, carcass yield, number of lactic acid bacteria, and storage time of breast meat.

Conclusion

It can be concluded that the supplementation of 3-6% carrot leaf flour in the ration can increase feed consumption, carcass, breast meat, and breast meat protein mass in ducks. On the other hand, it reduces abdominal fat and total serum cholesterol levels in Bali ducks (Anas sp.).

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