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INCLUSION OF CARROT LEAF FLOUR (DAUCUS CAROTA) IN DIETS TO INCREASE BREAST MEAT AND PROTEIN MASS OF BREAST MEAT IN BALI DUCKS

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ABSTRACT

After harvesting carrot (*Daucus carota*) tubers, there is quite a lot of carrot leaf waste. The results of the preliminary survey showed that the ratio of carrot leaf waste to tubers was 50:50 (g/g). This study aims to examine the effect of using carrot leaf flour in the ration on breast meat and breast meat protein mass in male 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 the duck group which was given a ration without carrot leaf meal (CLM) as a control (A); ration with 3% CLM (B); ration with 6% CLM (C); and rations with 9% CLM (D), respectively. The results showed that the use of 3-9% CLM in the diet, significantly ($P<0.05$) increased carcass weight, carcass percentage, breast meat, and breast meat protein mass compared to control. On the other hand, the percentage of fat in meat and breast fat mass in ducks decreased significantly ($P<0.05$) compared to controls. The highest carcass weight was obtained at the level of 6% carrot leaves in the diet. It can be concluded that the use of 3-6% CLM in duck rations from 2-10 weeks of age can be recommended, because it can increase breast meat and breast meat protein mass, and reduce fat mass of breast meat.

KEYWORDS: Carrot leaves, meat protein mass, fat, Bali duck.

INTRODUCTION

The Bali duck (*Anas sp.*) is a native Indonesian germplasm that must be preserved and its productivity increased continuously. The highest percentage of meat in ducks is on the breast. Duck meat is a red meat which is very liked by consumers.[1]

There are many types of plants that have the potential for medicine and one of them is carrot leaf. Carrot (*Daucus carota L.*) is a type of vegetable that is well-known as a source of provitamin A (carotenoids). The content of carotenoids is very high and much higher than that of tomatoes. In addition, the production of carrots in Indonesia is also quite abundant. Carrot production in Indonesia reaches 350,170 tons and a large amount of leaf waste (40-50% of the carrot harvest) is used as a competitive alternative animal feed. 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; and 0.51% phosphorus.[2] Phytochemical compounds contained in it, namely: saponins, flavonoids, and tannins[3] and several other phenolic compounds that have antimicrobial activity.[4] The use of carrot leaf meal up to a level of 6% in the ration did reduce broiler weight gain, but had no impact on feed consumption and feed efficiency.[2] Ürüşan et al.[5] reported that carrot seed oil supplementation has resulted in positive changes in body weight gain, carcass yield, and shelf life of chicken breast meat. On the other hand, Prabowo et al.[6] stated that the application of carrot leaf flour into the feed reduced the protein mass of the meat, while the calcium mass of the meat had no significant effect. The use of 2-6% carrot leaf powder in the ration can activate the calcium activated neutral protease (CANP) enzyme, but reduce carcass protein.[7]

The carcass characteristics of broilers increased with the supplementation of herbal leaves into the feed.[8,9] The use of 10% sweet potato leaf meal in feed significantly increased the protein mass of meat.[10] A similar study by[11] reported that herbal leaf powder (*Moringa*) as a natural phytochemical antioxidant had a beneficial effect on the carcass and abdominal fat of broiler. The

inclusion of 2-6% *Indigofera zollingeriana* water exstract was able to increase carcass weight, breast meat, and breast meat protein mass than controls.[12] Teteh et al.[13] reported that the decrease in fat and cholesterol content in egg yolks was caused by increased levels of saponins contained in herbal leaves, as antinutrients that can reduce digestion and lipids. The content of beta-carotene in carrot leaves as an active substance for carcass color and yolk colour[14,15,16], so its role is very important in increasing carcass color which is very liked by consumers. Shete and Quadro[17] stated that β-carotene is the most abundant provitamin A carotenoid in human food and tissues.

Producing animal products that are high in beta-caroren and protein content, as well as low in fat, through the use of carrot leaf herbs will provide knowledge to small-scale farmers to achieve established food security, as well as increase the competitiveness of their businesses to increase their income. Based on this, researchers are interested to examine the effect of using carrot leaf flour in the ration on breast meat and breast meat protein mass in male Bali ducks.

MATERIAL AND METHODS

Animal treatments 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 the duck group which was given a ration without carrot leaf meal (CLM) as a control (A); ration with 3% CLM (B); ration with 6% CLM (C); and rations with 9% CLM (D), respectively. The ration used in this study was calculated based on the table of nutrient composition according to the[18] using ingredients such as: yellow corn, pollard, fish meal, soybeans, coconut oil, salt, and premix. The nutrient content of carrot leaf flour is 89.52% dry matter; 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.[2] The drinking water provided was sourced from the local drinking water company. Feed and drinking water were provided *ad libitum* throughout the study period. The addition of feed was carried out 2-3 times a day, and the feed place was filled with 3/4 parts.

Preparation of carrot leaf flour

Carrot leaves were obtained from post-harvest from carrot plants in carrot plantations owned by farmers in Penebel sub-district, Tabanan regency, Bali province. Before being mixed into the feed, first the carrot leaves were crushed with a grass crusher machine to a small size, then dried in the sun. After drying, then finely ground to a size of 1-2 mm. Carrot leaf flour was ready to be mixed into the feed. More detail was presented in Figure 1.

Figure 1: Carrot (*Daucus carota*) leaf flour.

Table 1: The ingredient and calculated nutrient content of the feed of duckling aged 2-10 weeks.

Ingredients (%)	Carrot leaf meal in diets (%)			
	0	3	6	9
Yellow corn	60.30	58.40	55.80	53.12
Pollard	20.70	19.40	18.72	18.00
Soybean	6.40	6.40	6.45	6.70
Fish meal (CP 45%)	11.80	12.00	11.96	11.92
Coconut oil	0.28	0.28	0.55	0.74
Carrot leaf meal (CML)	0.00	3.00	6.00	9.00
Mineral-B12*	0.27	0.27	0.27	0.27
NaCl	0.25	0.25	0.25	0.25
Total	100	100	100	100

Nutrient composition**

Metabolizable energy (kcal/kg)	2900	2900	2901	2901
Crude protein, (%)	16.03	16.04	16	16.01
Ether extract, (%)	5.67	5.6	5.78	5.92
Crude fibre, (%)	3.71	4.14	4.61	5.08
Calcium, (%)	1.1	1.13	1.15	1.16
Phosphorus, (%)	0.64	0.66	0.67	0.68
Arginine, (%)	1.12	1.11	1.09	1.07
Cysteine, (%)	0.30	0.29	0.29	0.28
Lysine, (%)	1.14	1.15	1.14	1.13
Methionine, (%)	0.39	0.39	0.38	0.37
Triptofan, (%)	0.22	0.56	0.21	0.21

Note:
*) The mineral composition of B12 per 10 kg contains: Calsium: 49%; Phosphor 14%; Iron: 40000 mg; Manganese: 27500 mg; Mg: 27.500 mg; Zinccum: 25 mg; Vit-B12: 4.50 mg and Vit D3: 500000 IU. PT. Eka Farma. Deptan RI No. D 8109127 FTS
**) Based on calculation according to Scott *et al*. (l982)
Sampling of ducks for slaughter was carried out at the end of the study. All ducks in each experimental unit were cut. Before slaughtering, the ducks were fasted for 12 hours. The ducks were cut with an incision in the jugular vein. Duck blood was collected, then put into a tube that had been given a treatment code, then weighed for laboratory analysis.

Separation of the duck body parts, preceded by the removal of feathers. To facilitate the removal of feathers, the dead ducks were immersed in hot water at a temperature of 70^0-80.2^0C for 0.5-1.0 minutes. Next, the duck body parts were separated, namely the expulsion of the digestive tract, internal organs, cutting of the legs and head, and finally the carcass was obtained. Removal of the digestive tract and internal organs was carried out with surgery on the abdomen, except for the crop. Especially for crop organs, it was removed by dissecting the layer of skin at the base of the ventral neck that covers the crop. Separation of the head and neck was done by cutting the *Altlanto occipitalis* joint, which was the junction between the atlas bone (*Vertebrae cervikalis*) and the skull. To separate the legs was done by cutting the joint *Tibio tarsometatarsus*.

Calculation of the mass of meat protein and fat mass:
The mass of protein and fat of meat was obtained by analyzing a number of samples taken from the breast meat without skin and bones at the age of 8 weeks. Samples of meat on the breast that have been finely ground, taken as much as 10 g to be analyzed for protein and fat content by the Kjeldhal method.[19] The mass of protein and mass of meat fat was calculated by the following formula.
Mass of meat protein (g/100 g breast meat) = meat protein (%) x weight of breast meat (g/100 g breast meat).
Meat fat mass (g/100 g breast meat) = meat fat (%) x breast meat weight (g/100 g breast meat).

Statistical Analysis
The data obtained were analyzed by means of variance (one-way ANOVA) and if there was a significant difference ($P<0.05$) between treatments, it was continued with Duncan's multiple distance test.

RESULTS

The results showed that the addition of carrot leaf flour into the ration at the levels of 3% (B), 6% (C), and 9% (D), significantly increased the carcass weight of ducks, namely: 8.82%; 24.25%, and 12.18% significantly ($P<0.05$) higher than control (A) or without the addition of carrot leaf flour (Table 2). The percentage of duck carcasses fed without carrot leaf meal was 58.25% (Table 4.1). The addition of carrot leaf powder in group B, C, and D ducks, significantly ($P<0.05$) increased the carcass percentage, namely: 5.29%; 5.77%; and 5.44% higher than control (A).

Table 2: Carcass characteristics of male Bali ducks aged 10 weeks fed a ration containing carrot leaf powder (*Daucus carota*).

Variables	Treatment grup[1]				SEM[2]
	A	B	C	D	
Carcass weight (g)	636.19c[3]	692.31b	790.46a	713.70b	16.37
Carcass percentage (%)	58.25b	61.33a	61.61a	61.42a	0.504
Breast meat percentage (g/100 g carcass)	8.27b	8.97a	9.04a	8.96a	0.063
Breast meat protein content (%)	15.52b	17.64a	18.78a	17.10a	0.347
Breast fat content (%)	14.77a	9.53b	9.10b	9.20b	0.208
Breast protein mass (g/100 g carcass)	1.28b	1.58a	1.70a	1.53a	0.035
Breast fat mass (g/100 g carcass)	1.20a	0.85b	0.82b	0.82b	0.059

Note
1. Standart error of the treatment means
2. [abc] Values Ration with the addition of carrot leaf meal: 0% (A); 3% (B); 6% (C); and 9% (D), respectively.
3. with different letters in the same row are significantly different (P<0.05)

The results of laboratory analysis showed that the protein content in breast meat in group A ducks was 15.52% (Table 2). There was a significant increase (P<0.05) in the protein content of breast meat in ducks fed carrot leaf flour, namely group B, C, and D ducks, namely: 13.66%; 21.01%; 10.18% higher than group A. In contrast, the fat content of breast meat in group B, C, and D ducks, experienced a significant decrease (P<0.05), namely: 35.48%; 38.39%; and 37.71% lower than control (A).

The percentage of breast meat in control ducks (A) was 8.27 g/100 g carcass weight (Table 2). The addition of carrot leaf flour into the diet of ducks in groups B, C, and D, significantly (P<0.05) increased the percentage of carcass meat, namely: 8.46%; 9.31%; and 8.34% higher than control (A). The inclusion of carrot leaf flour in groups B, C, and D, significantly (P<0.05) increased the protein mass of breast meat, namely: 23.44%; 32.81%; 19.53% higher than group A (control). In contrast, breast fat mass in groups B, C, and D, decreased significantly (P<0.05), namely: 29.17%; 31.67%; and 31.67% lower than control (A).

DISCUSSION

Carcass weight, breast meat weight, and breast meat protein mass increased in the presence of 3-6% carrot leaf meal in the ration. The increase was due to the fact that carrot leaves contain a lot of phytochemical compounds, such as saponins, flavonoids, and tannins[3] and several other phenolic compounds that have antimicrobial activity, such as saponins which have proven antimicrobial properties.[4] The decrease in the number of harmful bacteria in the digestive tract of ducks will result in optimal absorption of nutrients, which will have an impact on improving the performance of ducks.[21] Restiayanti et al.[21] reported that the inclusion of herbal extracts in broilers did not have a significant effect on feed consumption, but significantly increased weight gain and feed efficiency. Similar results were reported by[8,9] that supplementation of herbal mixtures into broiler feed, significantly increased live weight and feed efficiency. According to[2], the use of carrot waste flour of more than 4% in the ration can reduce final body weight, while feed consumption and feed efficiency have no significant effect. Thus, it is recommended that the use of carrot waste in feed is no more than 2%. Contrary to the research results of[22] who found that feed consumption decreased significantly for chickens that were given carrot supplements compared to chickens that were not given supplements. However, at the 9% level it started to decrease when compared to the 6% level, but it was still higher than the control. The use of 2-6% carrot leaf powder in the ration can activate the calcium activated neutral protease (CANP) enzyme, but reduce carcass protein.[7] One of the causes of this decrease was the high crude fiber content in carrot leaves, which was 19.64%.[2] Poultry is not able to digest crude fiber that is too high. Ration containing high crude fiber causes the digestibility of the ration to decrease[23], so that the absorbed nutrients also decrease. Prasetyo et al.[24] reported that the utilization of carrot flour up to 6% in the ration had no effect on protein consumption and protein efficiency ratio, but could improve calcium retention. Reported by[25] that Pennyroyal herbal leaf supplement reduces feed consumption and feed efficiency in broilers. According to[26], the increase in chicken weight gain is due to the opening properties of plant extracts by increasing digestive juices in the stomach and forming a more balanced intestinal flora with its antimicrobial effect. In contrast[27], found that rations with orange peel oil did not change broiler weight.

Increase in carcass weight, also as a result of mineral supplements sourced from carrot leaves. As reported[28] that carrots contain several important minerals in the form of calcium up to 55 mg, phosphorus 43 mg, and iron 1.67 mg. The minerals calcium and phosphorus play a very important role in the structural components of the body. Syafitri et al.[29] reported that calcium minerals are closely related to protein intake by forming Calcium Binding Protein (CaBP) bonds which will carry calcium into intestinal mucosal cells and transported by blood vessels to required tissues. Crude fiber and NSP cannot be digested by the digestive enzymes of the ducks, so they are quickly excreted through the feces, and the opportunity for absorption of nutrients in the digestive tract of ducks is reduced. As reported by[30], poultry is only able to digest about 5-10% crude fiber by microbes in the cecum. The increase in crude fiber in the diet significantly increases the rate of passage in the digestive tract of ducks, so that there is not enough time for the villi of the small intestine to absorb nutrients.[31] Bidura et al.[23], stated that an increase in crude fiber in the ration caused a decrease in fat absorption, and nitrogen absorption, because the transit time of digesta in the digestive tract of poultry decreased, as a result of increased fiber content in the ration. Mangisah et al.[32] reported that the higher the crude fiber content in the ration, the lower the digestibility of organic matter in the ration so that the growth of ducks decreased. Broiler carcass characteristics increased with the supplementation of herbal leaves into the diet.[8,9]

Inclusion of 10% sweet potato leaf flour can increase protein and calcium mass in meat.[10] According to[33] as much as 2.5-10% Noni flour given to boiler chickens causes a decrease in cholesterol levels in broiler breast meat. Ürüşan et al.[5], reported that carrot seed oil supplementation resulted in positive changes in body weight gain, carcass yield, lactic acid bacteria count, and shelf life of chicken breast meat. Contrary to the research results of[6] which stated that the addition of herbal leaf

flour (carrot leaves) into the ration could reduce the protein mass of the meat, while the calcium mass of the meat had no significant effect. The decrease was due to the high fiber content in carrot leaf flour, which caused a decrease in the digestibility of the ration. According to[34], 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.[35] The use of carrot leaf flour in the ration at a level of 3- 6% significantly increased the amount of breast meat and the protein mass of 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.[36] stated that the increased consumption of protein and amino acid lysine in broiler chickens caused an increase in the amount of breast meat compared to the lower consumption of protein and lysine.

Feeds containing high protein will increase the meat component in the carcass and feed containing high crude fiber will reduce the fat component of the carcass. The same thing was reported by[37] that increasing protein consumption would increase carcass weight, carcass percentage, and breast meat percentage. In addition, the crude fiber content in carrot leaves is quite high, so it will have an impact on protein absorption. This occurred in the 9% carrot leaf treatment, where the protein mass of the breast meat decreased compared to 6% carrot leaf flour. As reported by[23], that an increase in the crude fiber content of the ration will cause a decrease in protein digestibility and energy use. According to[38,39], the existence of these differences can be attributed to the antioxidant and antimicrobial properties of herbal leaves. Contrary to the research results of[6] who found that the addition of carrot waste flour (2-6%) into the ration reduced the protein mass of the meat.

CONCLUSION

Based on the results of this study, it can be concluded that the use of 3-6% carrot leaf flour (*Daucus carota*) in the ration of male Bali ducks from 2-10 weeks of age can increase carcass weight, carcass percentage, breast meat, and breast meat protein mass. On the other hand, it reduces the fat mass in breast meat.

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