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UTILIZATION OF CARROT LEAF FLOUR IN THE DIET TO INCREASE EGG PRODUCTION AND YOLK COLOR IN LAYING HENS

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ABSTRACT

This study aims to examine the effect of including carrot leaf meal in the ration on egg production and yolk color in Lohmann Brown laying hens. A total of 270 Lohmann Brown hens aged 60 weeks were housed individually in open cages that accommodated two rows of cages. Each treatment consisted of six randomized replication cages with 15 laying hens aged 60 weeks. All laying hens had free access to food and water throughout the experiment. Two feed groups contained carrot leaf meal (CL) at levels of 3% (CL3) and 6% (CL6), respectively. One feed group did not contain carrot leaf meal (CL0) as a control. The results showed that there was a significant increase ($P \leq 0.05$) in egg production, hen-day production, feed efficiency, and yolk color in the presence of 3-6% carrot leaf powder (CL) in the ration. The inclusion of CL in the ration had no significant effect ($P \geq 0.05$) on feed consumption and final body weight. It can be concluded that 3-6% CL in the ration can increase egg production and yolk color of Lohmann Brown laying hens.

KEYWORDS: Carrot, egg production, yolk color, hens.

INTRODUCTION

The prohibition of the use of antibiotics as a growth booster for livestock has an impact on reducing the productivity of poultry livestock which results in losses for farmers, especially in small and medium scale businesses.

Researchers are beginning to focus on the use of phytogenic compounds as non-antibiotic growth promoters. The general advantages of herbal medicines are effectiveness, product safety, breeder acceptability, and affordability. Positive impacts on animal health and performance can be achieved through stimulation of appetite and feed consumption, increased secretion of endogenous digestive enzymes, activation of immune responses and antiviral, antioxidant and anti-worm actions.[1]

Recently, there have been various types of growth promoter in livestock which have been and are being developed as a substitute for antibiotics. Ingredients that are natural and do not cause problems with bacterial resistance or harmful residues, such as probiotics, prebiotics, synbiotics, phytogenics, enzymes, immune stimulants, and others. There are many studies investigating the use of herbal plants as growth boosters, which can improve livestock health, and the quality of poultry production, namely eggs and meat.[2,3,4,5,6,7,8,9,10] According to[11], the advantages of herbal medicines in general are effectiveness, product safety, farmer acceptance, and affordability.

Yellow corn is generally used as a source of egg yolk color in chicken feed, because yellow corn contains high levels of xanthophyll, lutein and zeaxanthin dyes.[12] However, the use of yellow corn as a feed ingredient is still competing with human food needs. The color of the yolk is very dependent on the high and low presence of corn in the feed due to the carotenoid dyes it contains. It is interesting to study the use of carrot leaf flour in feed as a source of beta-carotene (BC). Carrot production is quite high, that is, in every 1 hectare of carrot crop, the actual productivity is 15 tons of carrot tubers and 5% of them as carrot leaf waste which is not used as human food.[13] The β-carotene compound in carrot leaves is effective in egg yolk pigmentation. The main carotenoid compounds in carrot leaves are carotenoids α-carotene, β-carotene, and β-cryptoxanthin.[14] In addition, the antioxidant properties of BC will be able to prevent damage to eggs, because β-carotene is stored in egg yolks[15], and BC can enhance the immune system by increasing antibody responses in poultry and preventing acute respiratory infections. The phytochemical compounds contained in carrot leaves are: saponins,

flavonoids, and tannins[16] and several other phenolic compounds that have antimicrobial activity.[17]

Lack of carotenoid dyes can cause egg yolks to turn pale and this is not liked by consumers, because it looks unhealthy.[18] Producing quality egg products with high feed efficiency through the use of carrot leaves will provide knowledge to small-scale farmers to increase the competitiveness of their business, thereby increasing their income and welfare. This study aims to examine the effect of adding carrot leaf meal to laying hen feed on egg production and yolk color.

MATERIAL AND METHODS

Animals, treatments, and experimental design

Sample analysis was carried out at the Animal Product Technology Laboratory, Faculty of Animal Husbandry, Udayana University, Denpasar. While the observation of the feeding trial was carried out in the research cage in Penebel Village, Tabanan, Bali. A total of 270 Lohmann Brown hens aged 60 weeks were housed individually in open cages that accommodated two rows of cages. Individual cage sizes: front side 20 cm; side side 35 cm; and 40 cm high, made of strong aluminum wire. Feeding was done twice a day in the morning and evening, and drinking water was taken freely. Chicken weight was recorded at the start of the experiment and distributed randomly into 3 feed groups, and each feed group used 90 chickens. Each treatment consisted of six randomized replication cages with 15 laying hens aged 60 weeks. All laying hens had free access to food and water throughout the experiment. Two feed groups contained carrot leaf meal (CL) at levels of 3% (CL3) and 6% (CL6), respectively. One feed group did not contain carrot leaf meal (CL0) as a control. All rations contain crude protein (CP 17%) and metabolic energy of 2750 kcal/kg. The rations were formulated to meet the nutritional requirements for poultry[19] for a 10 week trial.

Preparation of Carrot leaf meal

The process of making carrot leaf flour, which was collecting carrot leaves from post-harvest carrots, thinly sliced and dried in the sun for 1-2 days, then the carrot leaves were ground into fine powder (CL) and ready to be mixed into the rations.

Laying hens performance

All chickens were housed in closed cages and provided with continuous lighting at night. Weighing of chickens was carried out at the beginning of the experiment and at the end of the experiment. Eggs in each cage were collected daily, as well as the weight of the eggs recorded, and then used to calculate the average egg weight for all experimental periods. Total egg weight was calculated by adding up all the intact eggs recorded each day during the 70 days of observation. Feed consumption in each cage was calculated every day. Feed conversion ratio or FCR (grams of feed/grams of egg weight) was calculated every week. The value of egg yolk color (scale 1-15) was measured with a Roche yolk color fan.

The data obtained were analyzed by one-way ANOVA to determine whether there were differences between treatments. If differences were found, further analysis was performed with Duncan's multiple range test at the 5% level.

RESULTS

The results of the study are presented in Table 1. The addition of carrot leaf meal (CL3 and CL6) to the ration had no significant effect on final body weight, feed consumption, and average egg weight of Lohmann Brown hens. However, the inclusion of carrot leaves in the feed significantly (P≤0.05) increased egg number, hen-day production, feed efficiency, and egg yolk color.

Giving carrot leaf flour to the CL3 and CL6 group chickens significantly increased the number of eggs, namely: 3.23% and 4.00% significantly (P≤0.05) higher than the control (CL0). In the same way, there was a significant increase (P≤0.05) in the hen-day production of CL3 and CL6 group chickens, namely: 3.24% and 4.00% significantly (P≤0.05) higher than the control (CL0).

Feed conversion ratio or FCR is the ratio between feed consumption and total egg weight. The lower the FCR value, the higher the feed efficiency. CL3 and CL6 group chickens had FCR values, namely: 5.96% and 4.13% significantly (P≤0.05) lower than control group chickens (CL0). The inclusion of carrot leaf powder in the feed significantly (P≤0.05) increased the color of egg yolks. The yolk color of CL3 and CL6 group chickens had a yolk color of 37.71% and 43.72% significantly (P≤0.05) higher than the control group chickens (CL0). More detail is presented in Table 1.

Table 1: Effect of carrot leaf meal in feed on egg yolk production and color of Lohmann Brown chickens aged 60-70 weeks.

Variables	Carrot leaf flour level in rations (%).			SEM
	0	3	6	
Final body weight (g/head)	1985.92±12.64	2035.71±15.35	2018.52±16.81	20.315
Feed consumption (g/head/day)	132.33±1.19	128.45±1.05	131.94±1.14	1.478
Egg numbers (egg/70 days)	60.70±0.83a	62.66±0.79b	63.13±0.69b	0.457
Hen-day production (%)	86.71±0.58a	89.52±0.49b	90.18±0.52b	0.653
Egg weight (g/eggs)	59.71±0.17	60.24±0.19	60.45±0.18	0.187
Feed conversion ratio (FCR)	2.18±0.021a	2.05±0.025b	2.09±0.022b	0.035
Yolk color (1-15)	7.16±0.52b	9.86±0.49b	10.29±0.37b	0.517

Note: [a,b]different superscripts on the same line show significantly different (P≤0.05); FCR (feed consumption:egg weight); SEM= standar error of the treatment means

DISCUSSION

The inclusion of carrot leaf meal in the ration at a level of 3-6% significantly increased the egg production of Lohmann Brown laying hens in the observation period of 60-70 weeks of age. The increase in egg production is due to the properties of carrot leaves which contain many active phytochemical compounds, such as saponins, flavonoids, tannins, and several other phenolic compounds that have antimicrobial activity.[10,16] The use of herbal leaves of *Moringa* leaf flour in feed significantly increases egg production, egg mass, egg number, feed efficiency and feed digestibility compared to control.[20] Also reported by [2] that the administration of herbal extracts of *Sauropus* leaves and Garlic leaves in drinking water significantly increased egg production and total egg weight. The same result was also reported by[21,22] that the addition of garlic herb powder in feed, showed an increase in chicken egg production. The increase in feed efficiency is also caused by the presence of active phytochemical compounds in carrot leaves.[16]

The increase in egg production in carrot group chickens was also due to increased feed digestibility caused by the phytochemical compounds contained in carrot leaves. Increased nutrient digestibility will have a positive impact on egg production. This result is supported by[11], that the provision of herbal leaf flour in rations can significantly increase body weight gain and feed efficiencies. The same thing was reported by[23,24], that herbal leaves can be used as an effective feed supplement in poultry to increase feed efficiency in poultry, because the phytochemical compounds in herbal leaves in the digestive tract of chickens can improve the absorption of protein, energy and minerals.

Color is an important quality criterion that influences consumer satisfaction in food products. The color of the egg yolk, which is different from the original product, is often rejected by consumers. This has been a problem for the poultry industry for many years.[25] As shown in Figure 1, the value of the color of the yolk in the CL3 and CL6 group chickens increased significantly compared to the control (CL0 group). The increase was due to the high content of beta-carotene in carrot leaves, namely 20550 µg/100 g.[16]

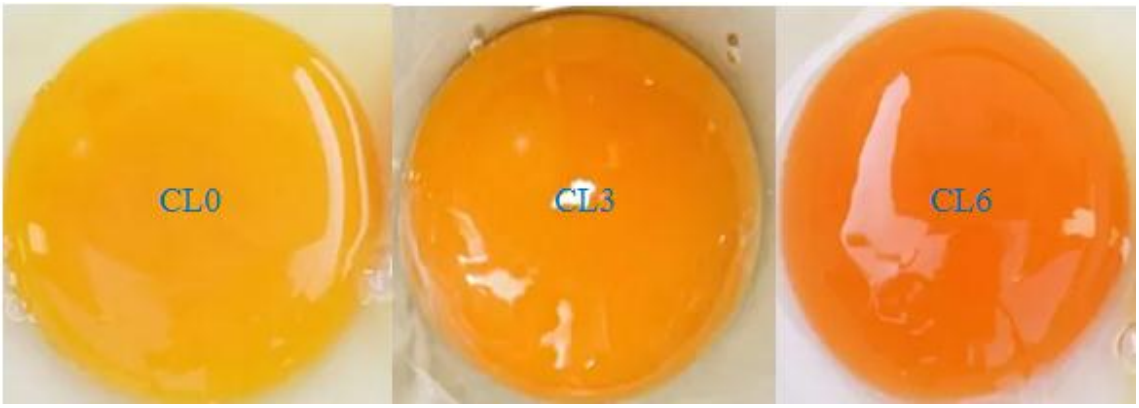

Fig 1. Differences in yolk color in control laying hens (CL0), by giving 3% carrot leaves (CL3) and 6% carrot leaves (CL6).

The content of beta-carotene in egg yolk increases significantly with the inclusion of CL in the feed.[20,27] According to[28], egg yolk enrichment in terms of increasing carotenoid content, will be beneficial to human health. One of the carotenoid compounds suitable for this purpose is β-carotene and provitamin A.[29] The type of carotenoid that plays an important role in increasing egg yolk pigmentation is xanthophyll, while the type of carotenoid in carrot flour is β-carotene. According to[14], the type and amount of carotenoid pigments consumed by chickens are the main factors affecting pigmentation.

Pigments obtained from feed will accumulate in the tissues, then will be absorbed into the blood and distributed throughout the body, which in turn will have a pigmentation effect on the skin color of carcasses or egg yolks.[1] According to[30], the content of β-carotene in chicken egg yolk ranges from: 1.07-2.12 µg/kg, whereas according to[31] ranged from: 0.16-1.62 µg/kg egg yolk. The content of β-carotene in poultry eggs varies greatly, and depends on the feed consumed.[15] The results of this study are supported by[14,32] that adding carrot flour to laying hen rations significantly increased the color value of egg yolks. According to[30] that egg yolk pigmentation is largely determined by xanthophyll, canthaxanthin, and lutein dyes.

CONCLUSIONS

It was concluded that the inclusion of 3-6% carrot leaf meal in the feed can increase egg production and yolk color of Lohmann Brown laying hens. Yolk color is an important quality criterion for eggs that influences consumer satisfaction in food products.

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