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Short Communication

Assessment of Egg Sensory Quality in Quails Fed with a Diet Containing Betel Leaf (*Piper betle* L.) Meal and Extract

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Abstract | Betel leaves contain phenolic compounds that are useful as antimicrobials, so they are widely used as additional feed in livestock rations. The purpose of this study was to examine the effect of betel leaf meal and extract on the sensory quality of quail eggs. The design used was a Completely Randomized Design with three treatments, which were then analyzed by the Kruskal-Wallis test. The variables observed were hedonic tests with a 5-point hedonic scale and hedonic quality (egg yolk color, egg white color, flavor, taste, and texture of quail eggs). This treatment showed that in the preference test, the ratio of betel leaf meal content had a significant ($P < 0.05$) effect on the color of the egg yolk. Nevertheless, in terms of hedonic quality, the proportion of betel leaf meal content markedly ($P < 0.05$) influenced texture. Additionally, the inclusion of rations containing betel leaf extract substantially diminished the fishy odor of eggs. The color of the egg yolk, when supplemented with betel leaf meal, was preferred over that with betel leaf extract. Similarly, in the hedonic quality assessment, the use of betel leaf powder resulted in a texture that was comparatively more chewy than that observed in other treatments. These results demonstrate that supplementation of betel leaves in quail's diet has beneficial effects on the sensory quality of eggs.

Keywords | Organoleptic test, *Piper betle*, Quail eggs, Egg sensory quality

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INTRODUCTION

The use of antibiotic feed additives that increase immunity, ration efficiency, and growth promoters has been prohibited, especially in poultry feed. The reason for the ban on the use of antibiotics in the ration is because it causes resistance to bacterial strains (Chattopadhyay, 2014). The decline in livestock performance due to the prohibition of antibiotics as feed additives causes farmers to experience economic losses. Many alternative antibiotics have been used to overcome this, including herbal plants with secondary metabolite compounds that act as antibacterial (Vlaicu et al., 2021) and function as medicine (Alexis et al., 2020).

Studies on the use of betel (*Piper betle* L.) leaf meal in chickens increased the population of non-pathogenic bacteria and reduced the population of pathogenic bacteria in the intestines (Pradikdo et al., 2019), increased body weight gain, improved feed efficiency, and reduced production costs (Patagao and Gannapao, 2006). In another study, the inclusion of betel leaf extract in broiler chickens was able to substitute Zn-bacitracin and improve nitrogen retention and ration metabolizable energy (Sudrajat et al. 2015). Research on the effect of *Piper betle* in feed on quail egg quality is still rare. The study conducted by Eka Widjaya et al. (2018), supplementing with betel leaf infusion resulted in a significant increase in egg weight, a decrease in eggshell weight, and an increase in egg albumin weight. While, there was no discernible difference in the other fac-

tors related to egg quality.

The inclusion of herbs and spices in human food increased appreciation and consumption (Dougkas et al., 2019). The bioactive compounds contained in herbal plants are thought to affect the food taste and aroma which in turn enhances the appetite of the eaters (El-Sayed and Youssef, 2019). *Piper betle* leaves contain some essential oil, chavicol, tannins, phenyl, propane, sesquiterpene, cyneole, alkaloid, sugar, stimulant, antibacterial, anti protozoan, carminative, anti-fungal and aphrodisiac (Kljak et al., 2021; Shah et al., 2016). Besides, betel leaves have high β-carotene content (Vernekar & Vijayalaxmi, 2019). Furthermore, plant carotenoid contained in laying hen feed was found to affect yolk colour, carotenoid levels, oxidative stability, and sensory properties of eggs (Kljak et al., 2021). These findings have brought a question whether the use of *Piper betle* leaf in animal feed could also affect the aroma and acceptance of livestock products. This study was conducted to address this question as it examined the sensory quality of eggs of quails fed rations containing *Piper betel* leaf meal and extract.

MATERIALS AND METHODS

The experiment was carried out in the poultry production laboaratory, Department of Aninmal Science, Djuanda University, Bogor Indonesia. The care and use of animals were conducted in this research following all applicable international, national, or institutional ethics, standards, or protocols (SNI 01-3907-2006; No. 54/Permentan/OT.140/9/2019, Keputusan Menteri Pertanian No. 13/OT.140/1/2010).

The betel leaves were obtained from a local market. Betel leaf meal was prepared by drying the leaves in an oven at 60°C for 24 hours. Dried betel leaves were then pounded and smashed using a blender. Simultaneously, betel leaf extract was prepared by using the ethanol solvent extraction method of Haryanti et al., (2020). Betel leaf meal was macerated using ethanol for 24 hours. The resulting solution was filtered and the filtrate was evaporated to produce a condensed extract of betel leaf.

A total of 120 laying quails (*Coturnix coturnix-japonica*) aged 45 days with an initial body weight of 173.00±17.98 grams were used in this study. The quails were kept in cages with lighting for 16 hours, fed rations to their requirement, and given drinking water ad libitum. The eggs produced by the quails were used as consumption eggs. Egg samples were collected from each treatment and boiled for testing for hedonic and hedonic quality. Eggs were selected whose shells and condition were good and clean. The eggs used come from a day old eggs.

Treatment rations were for formulated as iso-protein (CP 20%) and iso-calorie (ME 2900 kcal/kg) (NRC, 1994). They were composed of soybean meal, fish meal, yellow corn, corn gluten meal (CGM), premix, calcium carbonate ($CaCO_3$), crude palm oil (CPO), dicalcium phosphate (DCP), mineral mix, and premix (Table 1).

Table 1: Feed ingredient and nutrient composition of Experimental Diets

Feed Ingredients (%)	Control Diet	Betel Leaf Meal Diet	Betel Leaf Extract Diet
Corn Meal	62	60.7	60.7
Corn Gluten Meal	6.5	6.5	6.5
Soybean Meal	13.00	13.15	13.15
Fish Meal	8.4	8.4	8.4
Premix	1	1	1
$CaCO_3$	5.6	5.6	5.6
CPO	1	1.5	1.5
DCP	2	2	2
Betel Leaf Meal	0	1	0
Betel Leaf Extract	0	0	1
Nutrients:			
Crude Protein (%)	20.4	20.3	20.4
Metabolizable Energy (Kcal/kg)	2932	2935	2900
Calcium (%)	2.72	2.72	2.72
Phosphorus (%)	0.60	0.60	0.60

Note: CPO (crude palm oil), DCP (Dicalcium phosphate),

A completely randomized design (CRD) with three treatments and five replications, each containing eight quails was used. The treatment rations consisted of a control diet, the inclusion of piper betel meal by 1%, and the inclusion of piper betel extract by 1%. The variables in this study were two sensory tests namely the hedonic and the hedonic quality test. Measurements were taken on yolk colour, flavour, taste, and texture of eggs. Samples were given a three-digit code for each treatment which was placed on a plate containing the samples. Thirty panellists were asked to rate their level of preference in the range of 1-5 (1 = strongly dislike, 2 = dislike, 3 = neutral, 4 = like, 5 = very much like) for the hedonic test. Hedonic quality testing with 5 categories of variables and assessment scores is presented in Table 2.

At the end of a week before the completion of the study, quail eggs were collected. Egg samples were boiled for 10-15 minutes. Before the panellists' assessment, boiled sample eggs were cut into 2 pieces and placed in plastic cups labelled with a 3-digit code. The panellists come from animal husbandry students. Before the assessments were conducted, 30 semi-trained panellists were briefed on the steps for filling out the hedonic test (Stone and Siddel,

1985) and hedonic quality forms by the research team. Data were subjected to a Kruskal-Wallis test using SPSS software and significant differences were considered when P-value is found <0.05.

Table 2: Hedonic quality test assessment score

Parameters	Score	Criteria
Flavor	1	Not fishy
	2	Less Fishy
	3	Fishy
	4	Fishier
	5	Very fishy
Texture	1	Not chewy
	2	Less chewy
	3	Chewy
	4	Chewier
	5	Very chewy
Egg Yolk Color	1	Pale yellow
	2	Yellow
	3	Yellow to orange
	4	Orange
	5	Very orange
Egg White	1	Not white
	2	Slightly white
	3	White
	4	More white
	5	Very white
Taste	1	Very undelicious
	2	Undelicious
	3	Delicious
	4	More Delicious
	5	Very delicious

RESULTS

Assessment of the sensory test included the hedonic test and hedonic quality test. The hedonic test was carried out to assess the level of preference of the panellists on the sample with a range of 1 – 5 (Table 3). It was shown that the inclusion of betel leaf in quail rations gave significantly ($P < 0.05$) different hedonic test results on egg yolk colour but not on the other parameters. The egg yolk of quails treated with betel leaf meal diets was found to be more orange than the egg yolk of those in control and betel leaf extract diets.

The hedonic quality test is a more specific quality test than the hedonic test. In this study, results of the hedonic quality test showed that there were significant ($P < 0.05$) differences in the flavour and texture but not in the colour and taste of egg white and egg yolk (Table 4). The inclusion of 1% betel leaf extract reduced the fishy smell and improved the texture of the eggs.

DISCUSSION

Colour is an important indicator of food quality because colour can affect consumer acceptance of the quality and intensity of aroma and taste (Loetscher et al., 2013). In this study, the colour of egg whites was not significantly different. The average egg white colour ranged from 3.30-3.63, indicating that the panellists' perception of the egg white colour tended to be neutral-like. However, panellists' assessment of egg yolk colour showed significantly different results. The highest score of 3.8 was given by the panellists to the egg yolk colour of quails fed a ration containing 1% betel leaf meal indicating that they tended to like it better than the egg yolk colour of those in control (3.16) and betel leaf extract (3.23) treatment groups. These findings were in accordance with what was found by (Kljak, et al., 2021) that egg yolk colour was strongly influenced by the type of pigment contained in the ration consumed. Especially foods that contain carotenoid pigments namely xanthophylls and carotene. Feeding feed containing carotenoids including xanthophylls, resulted in egg yolk which was reddish orange in color (Yamamoto et al., 2007; Kljak et al., 2021). Xanthophylls is carotenoids containing at least one oxygen atom in the molecule, and the almost complete exclusion of carotenes (Marounek & Pebriansyah, 2018). Betel leaves also contain high level of carotenoids namely β-carotene (6693 µg) (Vernekar & Vijayalaxmi, 2019). The results of research by Kojima et al. (2022) showed that high levels of carotenoids in the diet can improve the colour quality of chicken eggs.

The flavour, taste, and texture of quail eggs in this study were found to be not different. The average rating of egg flavour was within the range of 2.93-3.26 indicating that the panellists' preference for the flavour of quail eggs was neutral. Similar neutral panellists' preference was shown in the egg taste (3.00-3.33) and egg texture (3.36-3.50). The taste scores were shown to be within the range of 3.00-3.33, meaning that the level of preference of panellists was within the neutral range. A similar neutral preference was also found in the egg texture as indicated by the scores which fell into the range of 3.36-3.50. Water content was believed to have an effect on the texture of eggs and reduced water content made the eggs have harder texture (Kastaman et al., 2010).

Colour is the sensory aspect that consumers first see in food. It was shown in this study that scores for the egg white colour were within the range of 1.83-2.20 indicating that the panellists considered the colour of the egg yolk to be in the non-white range. Likewise, the scores for yolk color were within the range of 3.03-3.33 indicating that the panellists considered that the color of the yolk was in the range from yellow to orange. Increased preference for

Table 3: Effect of treatment on hedonic test variables

Parameters	Treatments		
	Control Diet	Betel Leaf Meal Diet	Betel Leaf Extract Diet
Colour of Egg White	3.63±0.76	3.43±0.56	3.30±0.91
Colour of Egg Yolk	3.16±1.08[a]	3.80±0.76[b]	3.23±0.72[a]
Flavour	3.26±0.82	3.26±0.69	2.93±1.01
Taste	3.23±0.50	3.33±0.88	3.00±0.78
Texture	3.36±0.80	3.50±0.82	3.50±0.77

Note: Different superscripts in the same row are significantly different (P < 0.05).

Table 4: Effect of treatment on hedonic quality test variables

Peubah	Treatments		
	Control Diet	Betel Leaf Meal Diet	Betel Leaf Extract Diet
Colour of Egg White	1.83±0.83	2.20±0.61	2.00±0.87
Colour of Egg Yolk	3.33±0.75	3.03±0.31	3.20±0.96
Flavour	3.10±0.66[b]	3.46±0.81[b]	2.40±0.85[a]
Taste	3.06±0.73	3.06±0.78	3.23±0.77
Texture	2.90±0.88[a]	3.40±0.89[b]	2.93±0.78[a]

Note: Different superscripts in the same row are significantly different (P < 0.05).

egg yolk due to an increase in the intensity of the egg yolk colour was found in the work of Kartikasari et al. (2019).

The egg flavour was found to be significantly different. Eggs of quails in the control (3.10) and betel leaf meal (3.46) groups were perceived to be fishier than the eggs (2.40) of those in betel leaf extract group. In comparison, the results of (Anggraeni et al., 2021) showed that adding Star Goosberry dried leaf extract the ration resulted in a significantly different egg flavour. Panellists considered that the taste of quail eggs in all treatment groups was similarly delicious as indicated by the scores which were within the range of 3.06-3.23. In contrast, the egg texture of quails was significantly different. Quails treated with control and betel leaf extract diets were found to produce eggs which were perceived as less chewy (2.90-2.93) while the eggs produced by quails treated with betel leaf meal diets were perceived as chewy (3.40). It was suspected that the coagulation of egg white during the heating process made the eggs have a chewy texture. In another study, the inclusion of coriander meal in rations was found to produce quail eggs with significantly different texture (Wahyuni and Sudrajat, 2021).

CONCLUSIONS

The inclusion of betel leaf meal in the ration by 1% increased the panellists' preference on egg yolk colour and texture of quail eggs. At the same time, the inclusion of 1% betel leaf extract improved the flavour quality of quail eggs.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

NOVELTY STATEMENT

Adding betel leaf meal to the diet can improve the yolk color and texture of quail eggs. Meanwhile, betel leaf extract can improve the aroma of quail eggs.

AUTHOR CONTRIBUTIONS

Conceptualization, Methodology, Investigation, Writing – Original Draft, Writing – Review and editing, Funding Acquisition, Resources, Supervision, [Deden Sudrajat]; Methodology, Investigation, Formal Analysis [Dewi Wahyuni]; Manuscript proofreading and editing [Dede Kardaya] [Burhanudin Malik].

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