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The Effect of Teak Leaf Extract Addition (*Tectona grandis* Linn. *f)* to Feed on External Egg Quality of Quails

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----------ABSTRACT----------
The research aimed to evaluate teak leaf extract addition (Tectona grandis Linn. f) in feed to quails' external egg quality. The materials used were 240 laying quails aged 21 days old. The method used was an experiment in a completely randomized design, which classified into four treatments and six repetitions using ten quails for each experiment. The treatments applied were P0 (basal feed), teak leaf extract additions to feed P1 (0.8%), P2 (1.2%), and P3 (1.6%). The variables applied to this research were egg weight, egg index, yolk index, shell thickness, Haugh unit, and yolk color score. The data were analyzed using ANOVA and Duncan Multiple Range Test, only if it has significant results. The result showed that teak leaf extracts significantly affected shell thickness and yolk color score. In conclusion, this research found that the inclusion of 1.6% teak leaf extract as a feed additive increased quails' egg quality.

Keywords: *Teak Leaf, egg quality, laying quails*

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I. INTRODUCTION

Quail is a poultry type that grows and breeds in Indonesia, also the second-biggest egg producer after laying hens. The quail farming business's advantages are high in egg production, cheap cost, faster quail growth, and no need for a large field. Quail has an excellent potential to be developed because it is one of the animal protein sources. The type of feed that quail farmers often use is commercial feed. In terms of production cost, feed cost is the most significant component, which spends about 60-70%. Since there is a prohibition of using antibiotics, an alternative replacement is needed, one of which is teak leaf extract. The teak leaf contains a phytochemical compound, including flavonoid, which functions as an antioxidant [1].

Egg quality must be observed because it can determine customers' interests and physical egg condition, both internal and external. Several factors that affect the egg quality of quails are genetic, feed, environment, and maintenance management. The determination and measurement of egg quality consist of two aspects; internal and external. External quality includes egg weight, egg index, yolk index, Haugh unit, shell thickness, and yolk color score. Besides, egg weight is affected by several factors, like the type of poultry, laying season, genetic, adult body weight, and feed consumed.

Based on the understanding above, it needs to research to determine the effect of teak leaf extract as a feed additive on quails' external and internal egg quality.

II. MATERIAL AND METHODS

Material

The research applied 240 quails (*Coturnix coturnix japonica*) aged 21 days old and were classified into four treatments and six repetitions, each repetition comprised ten quails. Feeding was conducted every day with 25g/bird/day, while drinking water was supplied *ad libitum.* Teak leaf extract with the different levels was added into feed with corn, wheat flavor, soybean meal, bone and meat powder, corn glutter, wheat bran, DDGS, palm oil, methionine, lysine, methionine, and cystine. Furthermore, the result of proximate feed nutrient analysis applied in this research is arranged in Table 1. And the phytochemical nutrient value of teak leaf extract applied as a feed additive can be seen in Table 2.

Table 1. The Result of Feed Nutrient Analysis

Nutrient	Basal Feed	Teak leaf powder
Crude Protein (%)	21.59	9.44
Dry Matter (%)	89.93	89.62
Water Level (%)	10.07	10.38
Ash (%)	10.17	12.97
Crude Fat (%)	4.32	3.80
Crude Fiber (%)	5.09	29.44

Note: Proximate Analysis Result of Laboratory of Animal Feed, Department of Animal Husbandry and Fisheries, Blitar Regency

Table 2. Biochemical Compounds of Teak Leaf Extract

Analysis	Analysis Result
Flavonoid	6.24 µg/ml
Antioxidant IC50	11.64 µg/ml

Note: Analysis Result of State Polytechnic Malang Laboratory

Methods

The method applied in this research was a field experiment with a completely randomized design using ANOVA, in which data were classified into four treatments and six repetitions. Every repetition has ten quails with the level of teak leaf extract as follows:

P0 = Basal feed
P1 = Basal feed + 0.8% teak leaf extract
P2 = Basal feed + 1.2% teak leaf extract
P3 = Basal feed + 1.6% teak leaf extract

The observed variables in this research are egg weight (gram/item), egg shape index (mm), yolk index (mm), shell thickness (mm), HU (Haugh Unit), and yolk color score.

III. RESULT AND DISCUSSION

The result of utilizing teak leaf extract as a feed additive on feed towards the internal and external egg quality, including egg weight, egg shape index, yolk index, eggshell thick, (HU) Haugh Unit, yolk color score, can be seen in Table 3.

Table 3. Result of Quail Egg's External Quality

Variable	Treatment			
	P0	P1	P2	P3
Egg Weight (g/item)	10.17 ± 0.39	10.27 ± 0.65	10.30 ± 0.41	10.87 ± 0.35
Egg Index	79.27 ± 1.75	80.42 ± 2.05	79.63 ± 2.15	77.88 ± 1.09
Yolk Index	0.40 ± 0.02	0.41 ± 0.01	0.40 ± 0.01	0.40 ± 0.03
Shell Thickness (mm)	0.22 ± 0.01^{a}	0.22 ± 0.00^{a}	0.23 ± 0.01^{ab}	0.24 ± 0.01^{b}
Haugh Unit (HU)	89.86 ± 1.52	89.90 ± 2.30	89.34 ± 3.28	90.07 ± 2.85
Yolk color score (1-15)	2.47 ± 0.33^{a}	3.00 ± 0.18^{b}	3.57 ± 0.15^{c}	5.67 ± 0.21^{d}

Note:- P0 (basal feed), P1 (basal feed with 0.8% of teak leaf extract), P2 (basal feed with 1.2% of teak leaf extract), P3 (basal feed with 1.6% of teak leaf extract)
- Different notation in the same column showed highly significant differences (P<0,01)

Egg Weight

The statistic analysis in Table 3 showed that the additional teak leaf extract to feed did not significantly influence quail egg weight (P>0.05). The average of quail egg weight on Table 3 from the lowest until highest are P0 (10.17 ± 0.39) g/bird/day, P1 (10.27 ± 0.65) g/bird/day, P2 (10.30 ± 0.41) g/bird/day P3 (10.87 ± 0.35) g/bird/day. The average value showed that the highest egg weight was obtained on treatment P3 (10.87 ± 0.35) g/bird/day by adding 1.6% teak leaf extract.

The principal factor in the feed that affects egg weight is protein consumed; 50% of yolk weight is protein, feed consumption, and nutrients such as protein, fat, carbohydrate, and vitamin. The average egg weight obtained from this research was 10.17 – 10.87 g/item. It complies with [2] that quail egg weight is 7 - 8% of broodstock, and the average quail egg weight of each item is approximately 9.22-9.34 g/item. Other factors that influenced egg weight are genetic, body weight, adult genitals, nutrition, environment temperature, and lighting during the production phase [3].

Egg Shape Index

Table 3 showed that adding teak leaf extract toward egg shape index has no significant influence (P>0.05). The averages of egg shape index from the lowest to highest are P3 (77.88 ± 1.09), P0 (79.27 ± 1.75), P2 (79.63 ± 2.15), P1 (79.27 ± 1.75). Those results showed that the highest average value of egg shape index is P1 by adding 0.8% of teak leaf extract to feed. [4] stated that the egg shape index tended to be taper with an average of 81.73%. Genetic types and processes occurred during egg formation, mainly when the egg through magnum and isthmus, will influence egg index.

The protein composition inside the feed did not significantly influence egg shape because the egg shape index's essential factor index is genetic. Each quail produced a particular egg shape index because the egg shape index is an inherited character. Variation of egg shape index is caused by egg cycle inside channel reproduction because the diameter of lumen channel reproduction determines the rhythm of channel reproduction pressure. Egg shape index was influenced by several factors such as oviduct muscular vessel, volume albumen, and isthmus size, types, descent, the first period of laying, and egg reproduction phase [5].

Yolk Index

The result of statistic analysis in Table 3 showed that the addition of teak leaf extract to feed did not significantly influence the yolk index (P>0.05). The average of yolk index from the lowest to the highest were P2 (0.40 ± 0.01), P0 (0.40 ± 0.02), P3 (0.40 ± 0.03), P1 (0.41 ± 0.01). Those analysis results showed that the yolk index's highest average value was P1 by adding 0.8% teak leaf extract to the feed. [6] asserted that measurement of yolk index is a method aiming to know inside of egg generally with comparing yolk high and diameter. The fresh egg had a yolk index of about 0.33 – 0.50, with an average yolk index at 0.42. The longer the stored egg, the yolk index's value will decrease because yolk increases in size due to water displacement.

Yolk formation was stimulated by estrogen hormone. Estrogen is a vitellogenin biosynthesis stimulus hormone to the liver. Vitellogenin is the ground substance of yolk formation. Vitellogenin, which is synthesized in the liver with estrogen's help, is secreted into the bloodstream towards the gonads, increasing the concentration of vitellogenin in blood. Therefore, a ripe egg yolk is formed and ready to be ovulated [7]. Yolk formation influenced egg weight if the shaped yolk was bigger. Thus, the egg obtained would be heavier. According to [8], the bigger yolk produced, the heavier egg obtained, and vice versa.

Shell Thickness

The statistic analysis in Table 3 showed that teak leaf extract addition in feed exerts a significant influence on shell thickness (P<0.01). The average of shell thickness from the lowest to the highest were P1 (0.22 ± 0.00), P0 (0.22 ± 0.01), P2 (0.23 ± 0.01), P3(0.24 ± 0.01). Those analysis results showed that the average highest shell thickness was P3 (0.24 ± 0.01), adding a 1.6% teak leaf extract to feed. It is due to the high content of calcium and phosphorus in teak leaf extract. According to [9], the calcium content of teak leaf extract is 2.4%, and phosphor content is 0.46%.

The average quail shell thickness was 0.22 mm. [10] stated that minerals that has a huge role in eggshell formation are calcium and phosphor. The thicker eggshell, the smaller pores, can hamper the egg quality because of evaporation and putrefaction, and in other words, the thicker eggshell, the better egg quality. Several factors that influenced eggshell quality are genetic, poultry age, environment temperature, feed, and disease. Poultry age affected eggshell formation. The older poultry, the thinner shell because the function of reproduction declined caused age [11].

Haugh Unit (HU)

Table 3 showed that teak leaf extract in the feed did not significantly influence the quail egg's haugh unit. The averages of HU egg from the lowest to the highest were P0 (89.86 ± 1.52), P2 (89.34 ± 3.28), P1 (89.86 ± 1.52, P3 (90.07 ± 2.85). Those analysis results showed that P3 has highest HU with teak leaf extract addition 1.6% in feed. Haugh Unit (HU) is a value unit to measure egg quality based on logarithm toward high albumen, and it is transformed into correction value of egg weight, the high of albumen is measured with spherometer from 1 cm distance of yolk outermost. [12] asserted that HU value depends on egg weight and albumen thickness. If egg weight decreased because of storage, albumen thickness and HU value tended to decrease as well.

The egg which had just been produced by poultry had 100 of HU value, and the egg had 75 of HU value categorized good quality while broken egg had under 50 of HU value. Egg stored at low temperature had HU changes from 80 to 68 after 19 days, while egg stored at room temperature had an average decline of 1.51 unit/day. [13] said that ovomucin had an essential role in water binding to shape albumen gel structure. If ovomucin had many and strong nets, albumen would be the more viscous, which meant high albumen viscosity and showed on the HU indicator.

Yolk Color Score

The score of yolk color was measured using Egg Yolk Color Fan with matching its yolk color. The result of analysis in Table 3 showed that the addition of teak leaf extract score has a significant difference in yolk color score ($P<0.01$). The average score of yolk color from the lowest to the highest were P0 (2.47 ± 0.33), P1 (3.00 ± 0.18), P2 (3.57 ± 0.15), P3 (5.67 ± 0.21). Those results showed that the highest yolk color score was P3 by adding 1.6% teak leaf extract in the feed. It caused flavonoid content from teak leaf to function as β-carotene. Egg pigments are carotene and riboflavin classified as lipochrome, namely xanthophylls. Therefore yolk color is getting reddish-orange. An antioxidant also influenced pigment deposition enhancement to the yolk [14].

Pale yolk color is caused by factors that inhibit the absorption of pigment from feed to be deposited on egg yolk, and these factors include worms, and other factors that affect liver function, lipid metabolism, pigment deposition in egg yolk, and Coccidiosis. The more extended egg storage also caused yolk color to evaporate. It is because of the process of white egg dilution, water absorption from albumen to yolk; consequently, yolk became younger and pale [15].

IV. CONCLUSION

The result showed that the addition of a 1.6% teak leaf extract could increase both external and internal quail egg quality, such as shell thickness and yolk color score.

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