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Evaluation of Onion Peel as Feed Additive on Performance Production Broiler

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Abstract. This study evaluated the impact of adding onion (Allium cepa L.), shallot (Allium ascalonicum L.), and garlic (Allium sativum L.) peels as additives to the broiler production. The material used was 189 one-day-old commercial broiler chicken Lohmann strain (unsexing) and assigned to nine treatments and three replications: T0(-): basal diet, T0(+): basal diet + antibiotic (zinc bacitracin 0.1%), T1: basal diet + 0.5% garlic peel, T2: basal diet + 0.5% shallot peel, T3: basal diet + 0.5% onion peel, T4: basal diet + 0.25% garlic peel and 0.25% shallot peel, T5: basal diet + 0.25%. garlic peel + 0.25% onion peel, T6: basal diet + 0.25% shallot peel + 0.25% onion peel, T7: basal diet + 0.167% garlic peel + 0.167% shallot peel + 0.167% onion peel. Feed intake, final body weight, feed conversion ratio (FCR), mortality, productivity index, and income over feed cost were the variables that were observed in the current study. The data were analysed using Analysis of Variance (ANOVA). The results of the study show that the addition of the three garlic powders do not give any effect (P>0.05) on feed intake, final body weight, FCR, mortality, production index and IOFC. The conclusions of this study showed that garlic peel, shallot peel, and onion peel could be used as feed additive. This choice yields positive effects on production performance, particularly in terms of Feed Conversion Ratio (FCR) and the production index.

Keywords: garlic peel; shallot peel; onion peel; performance

Abstrak. Tujuan dari penelitian ini adalah untuk mengevaluasi pengaruh pemberian tepung kulit bawang putih, tepung kulit bawang merah, dan tepung kulit bawang bombay sebagai pakan aditif terhadap penampilan produksi. Materi yang digunakan adalah 189 DOC (*Day Old Chick*) ayam pedaging strain Lohmann (*unsexing*) terbagi menjadi 9 perlakuan dan 3 ulangan. P1: Pakan basal + 0,5% kulit bawang putih, P2: Pakan basal + 0,5% kulit bawang merah, P3: Pakan basal + 0,5% kulit bawang bombay, P4: Pakan basal + 0,25% kulit bawang putih dan 0,25% kulit bawang merah, P5: Pakan basal + 0,25% kulit bawang putih dan 0,25% kulit bawang bombay, P6: Pakan basal + 0,25% kulit bawang merah dan 0,25% kulit bawang bombay, P7: Pakan basal + 0,167% kulit bawang putih + 0,167% kulit bawang merah dan 0,167% kulit bawang bombay. Variabel yang diamati adalah konsumsi pakan, bobot badan, konversi pakan, mortalitas, indeks produksi dan *Income Over Feed Cost* (IOFC). Data dianalisis menggunakan *Analysis of Variance* (ANOVA). Hasil penelitian menunjukkan bahwa penambahan tiga jenis tepung kulit bawang memberikan perbedaan pengaruh tidak nyata (P>0.05) terhadap konsumsi pakan, bobot akhir, konversi pakan, mortalitas, indeks produksi dan IOFC. Kesimpulan dari penelitian ini menunjukkan bahwa tepung kulit bawang putih, bawang merah, dan bawang bombay dapat digunakan sebagai pakan aditif. Pemberian ini memberikan dampak positif pada penampilan produksi, khususnya konversi pakan dan indeks produksi.

Kata kunci: kulit bawang putih, kulit bawang merah, kulit bawang Bombay, penampilan produksi

Introduction

The growing population and increased public awareness of the significance of satisfying animal protein needs are driving up demand for poultry traders in Indonesia, which is growing annually. One of the efforts made by farmers to increase the productivity of chicken traders is the addition of growth promoters such as synthetic antibiotics. Antibiotic administration in feed must consider several factors, including high costs, disruption of intestinal microflora balance, resistance to microorganisms, and potential negative residual effects on chicken carcasses when used continuously (Abd El-Hack et al., 2022). But with advances in science and technology in various fields, including farming and animal health, new technologies are emerging that increase the efficiency of synthetic antibiotic replacements.

Increased chicken production and optimal feed utilization can be achieved by adding feed additives. Phytobiotics are feed supplements

derived from plant derivatives used in feed. They serve to balance the microorganisms in the digestive tract and enhance nutrition absorption and digestion. Potential feed additives made from local ingredients can utilize underexploited market waste that still has good nutritional content, such as garlic peel (*Allium sativum L.*), shallot peel (Allium ascalonicum L.), and onion peel (Allium cepa L.). Garlic peel (*Allium sativum L*) contains active compounds such as alkaloids, flavonoids, saponins, polyphenols and essential oils. These active compounds work synergistically as antibacterials by destroying cell walls and pollinating bacterial cells. Shallot peel extract contains the active compounds polyphenols, flavonoids, alkaloids, saponins, steroids and triterpenoids. Flavonoid compounds as antioxidants can prevent the growth of free radicals in the body as well as repair damaged body cells (Rahayu et al., 2015). Onion peel contains flavonoid compounds, glycosides, steroids, tannins and saponins. Onion peel contains quercetin, which is one of the flavonoids, part of the polyphenol group that has the potential to counter free radicals and heavy metals by inhibiting lipid peroxidation (Gawlik-Dziki et al., 2013). The active compounds found in shallot peel, garlic peel and onion peel added to livestock feed can act as an antibacterial agent that can balance bacteria in the digestive tract to improve broiler production.

Materials and Methods

Determination of onion peel powder

The procedure for producing onion peel powder involved included onion peels sorting in the flowing water. Subsequently, the onion peels were dried for 24 hours at 50°C in the oven to reduce the moisture content to less than 10%. After drying, the onion peels were ground using a grinder until they reached a powder texture. The onion peel powder was then filtered using a 100-micron mesh sieve to obtain a fine powder. Total flavonoid content and antioxidant activity index (AAI) were analysed using the Spectrophotometry method and presented in Table 2.

Total Flavonoid Compound

The total flavonoid appication of onion peel powder was carried out at the Plant Pest and Disease Laboratory, Faculty of Agriculture, Universitas Brawijaya. The quantity of flavonoids in onion peel powder was determined using the UV-Vis Spectrophotometry methods and the subsequent processes. A 2000 µg/ml concentration of onion peel powder was dissolved using methanol. The test sample, weighing 0.5 grams, was put into 1.5 millilitres of methanol. Add 0.1 ml of sodium acetate ($C_2H_3NO_3$) 1M, 2.8 ml of distilled water, and 0.1 ml of $AlCl_3$10%. UV-Vis spectrophotometry determined the mixture's absorbance at 510 nm after 30 minutes of incubation. The determination of the total flavonoid compound in the sample was conducted by quantifying it in milligrams of equivalents per gram of sample, utilizing the dry weight.

Antioxidant Activity Index

The antioxidant activity test of onion peel powder was carried out at the Plant Pest and Disease Laboratory, Faculty of Agriculture, Universitas Brawijaya. The DPPH (2,2-diphenyl-1-picrylhydrazyl) method in UV-Vis spectrophotometry was used to measure antioxidant activity, and the following procedure was followed: Materials and tools were prepared. 50 µg/ml of sample concentration was created by combining 0.5 grams of onion peel with 9.5 millilitres of distilled water. 50 mg of DPPH powder was combined with 100 ml of methanol to create a 50 ppm DPPH solution. To produce a comparison solution, 2 millilitres of methanol and 1 millilitre of 50 parts per million DPPH were combined. Two ml of the sample and two ml of the DPPH solution are needed to get the IC50 value. After 30 minutes of incubation at 27°C and the mixture turned yellow instead of purple, then the absorbance value was

determined using a UV-Vis spectrophotometer set to 517 nm. After that, the percentage of DPPH absorption inhibition was used to calculate the antioxidant activity of the sample based on the degree of DPPH radical absorption inhibition.

$$\%\ inhibition = \frac{A\ control - a\ sample}{A\ control} \times 100\%$$

The linear regression equation, y = a(x) + b, is displayed with the sample concentration and extract inhibition values on the x and y axes, respectively. The IC_{50} value (inhibitor concentration 50%) for each sample was determined using the following equation: the dependent variable (y) was set as 50 and solving for the corresponding independent variable (x), which represents the IC_{50} value. The IC_{50} value is the concentration of the sample solution necessary to achieve a 50% reduction in DPPH (Scherer & Godoy., 2009). The Antioxidant Activity Index (AAI) value may be calculated utilizing the formula provided below:

$$AAI\ value = \frac{DPPH\ concentration\ (ppm)}{IC50\ value\ (ppm)}$$

Experimental Design and Treatment

The unsexed Day-Old-Chick (DOC) of the Lohmann strain were the used in the study. The chickens were grouped in nine treatments of three replications, so there were 27 test cages. Each test cage had 7 chicks which were reared for up to 35 days. The basal feed used in this research was commercial feed with code 811K for starter period chickens (age 1–21 days) and commercial feed code JK630 for finisher period (age 21 – 35 days). Feed is produced by PT. New Hope East Java. The feed used is antibiotic-free, as stated on the feed label. Feed and drinking water were provided ad-libitum. The treatment feed content is shown in Table 1. The diet used is divided into nine treatments:

T0(-) : Negative control (Commercial feed)
T0(+) : Positive control (Commercial feed + antibiotic (zinc bacitracin 0.1%))
T1 : Commercial feed + 0.5% garlic peel
T2 : Commercial feed + 0.5% shallot peel
T3 : Commercial feed + 0.5% onion peel
T4 : Commercial feed + 0.25% garlic peel and 0.25% shallot peel
T5 : Commercial feed + 0.25%. garlic peel + 0.25% onion peel
T6 : Commercial feed + 0.25% shallot peel + 0.25% onion peel
T7 : Commercial feed + 0.167% garlic peel + 0.167% shallot peel + 0.167% onion peel

Table 1. feed content for the starter and finisher periods

Composition	Starter	Finisher
Water	Max 14%	Max 14%
Crude Protein	Min 22%	Min 19%
Crude Fat	Min 5%	Min 5%
Crude Fiber	Max 5%	Max 5%
Ash	Max 8%	Max 8%
Calcium	0.8 – 1.1%	0.8 – 1.1
Phosphorus	Min 0.50%	Min 0.50%
Amino Acid		
Lysine	Min 1.20%	Min 1.20%
Methionine	Min 0.45%	Min 0.45%
Methionine Cystine	Min 0.80%	Min 0.80%
Tryptophan		
Threonine	Min 0.19%	Min 0.19%
	Min 0.75%	Min 0.75%
Enzyme	Phytase	Phytase
Aflatoxin	Max 50 g/kg	Max 50 g/kg

Table 2. Total Flavonoid and Antioxidant of Garlic Peel, Shallot Peel and Onion Peel

Items	Parameters	
	Flavonoid (ppm)	AAI
Garlic peel	311.256	0.762
Shallot Peel	348.213	0.773
Onion Peel	351.223	0.723

AAI – antioxidant activity index; ppm – part per million

Results and Discussion

Feed Intake

The result showed that treatment has not significant effect on feed intake (P > 0.05). The feed intake data are shown in Table 3. The inability of the active ingredients in garlic powder to function at their best is the reason for the insignificant impact on feed intake. In this study, the garlic peel powder was treated with a concentration of 1% in 1 kg of feed. This was done to prevent the dominant presence of substances found in garment leather powder, such as flavonoids, saponins, alkaloids, and tannins, in the feed. The aim was to ensure that the active ingredients in the garlic peel flour could work optimally in the body. A negligible quantity of garlic flour has little impact on the nutritional composition of the provided feed, particularly in terms of protein and calorie content (Pradikta et al., 2018). According to Table 3, the administration of garlic peel flour, red garlic peel flour, and Bombay garlic has been observed. The intake of feed containing peel flour was shown to be higher when compared to the control feed. Incorporating garlic peel flour, which contains flavonoids, saponins, alkaloids, and tannins, can inhibit the growth of harmful bacteria. This allows the digestive system to optimize nutrient absorption and enhance feeding efficiency. The flavonoid molecule has the potential to function as an antioxidant and prevent damage from free radicals to chicken cells. It also has anti-inflammatory properties. Saponins have antibacterial properties, contributing to the equilibrium of bacterial populations within the digestive system (Kumar et al., 2022). Flavonoids have antibacterial properties by enhancing feed intake, namely by inhibiting the growth of harmful bacteria in the gastrointestinal system while promoting the growth of beneficial bacteria that aid in the absorption of nutrients. Additional variables influencing the fluctuation in chicken consumption are body mass, strain, age, gender, feed composition, and environmental conditions (Binowo et al., 2019).

Final Body Weight

The result showed that treatment has not significant effect on body weight (P > 0.05). The final body weight data are shown in Table 3. The final weight of the chickens in this study was lower than standard due to high environmental temperatures, which caused them to consume more water. The unrealistic influence observed in this investigation was attributed to variations in body weight resulting from changes in feed intake. According to Syafaat et al. (2021), the growth rate is mainly influenced by feed intake and the nutrient composition of the feed. Adding garlic peel flour to feed introduces active ingredients, particularly flavonoids, but not in sufficient amounts to noticeably alter the metabolic processes in the bodies of chickens, resulting in no change in body weight. Flavonoids have antibacterial capabilities that can effectively impede the proliferation of harmful microorganisms in the gastrointestinal tract. By protecting body cells from damage by free radicals, reducing the effects of oxidative stress on hens, and boosting the immune system of chicks, flavonoid chemicals serve as antioxidants (Bouhenni et al., 2021). Additional variables that affect weight gain among others are sex, breed, food intake, the chickens' health

status, environmental factors, and feed quality (Nuningtyas, 2014).

Feed Convertion Ratio (FCR)

The result showed that treatment has not significant effect on Feed Conversion Ratio (FCR) ($P > 0.05$). The observed discrepancies in the feed conversion ratio within the study may be attributed to the unrealistic differences between feed intake and the final weight of the poultry achieved during the research. Therefore, this would impact the conversion of feed that showed no substantial variation. The feed conversion ratio is the feed quantity required to achieve a weight increase per unit of weight. An optimal feed conversion ratio is characterized by a low value, indicating the ability to provide a high output. A lower feed conversion ratio indicates superior feed quality and increased feed efficiency (Binowo et al., 2019). The ineffectiveness of the active compound content in onion peel is indicated by its administration at a concentration of less than 1%. The study's findings indicated that the most efficient feed conversion occurred when 0.5% onion peel powder was provided, resulting in a consumption rate of 1.51 (Table 3.). Despite the low consumption, this feed supply led to the highest body weight gain and the lowest feed conversions. The feed conversion values observed in this study vary between 1.51 and 1.64. Similar to the study conducted by (Maharatih et al., 2017), it has been observed that feed conversion values vary across different periods of chicken breeding among dealers. Garlic waste flour can be used as a phytobiotic alternative without adversely affecting blood profiles, intestinal health, performance production, or the quality of poultry meat (Mozin, 2015)

Mortality

The result showed that treatment has not significant effect on mortality rate ($P > 0.05$). Whether administered separately or in combination, garlic, shallot, and onion peels may lower the death rate in this study, despite the fact that they had no discernible effect on mortality. Providing onion peel powders as a feed additive contains active compounds such as flavonoids, which act as antibacterials and antioxidants.

The flavonoid content in onion peel powders can act as an antioxidant and immunostimulant, improving health and preventing oxidation reactions in cells exposed to free radicals and activating cells that form cellular (non-specific) immunity so that broiler chickens are not susceptible to disease. The antioxidant activity of garlic peel, shallot peel and onion peel can be seen in Table 2. Antioxidants are compounds that can inhibit reactive oxygen and free radicals in the body by donating one or more electrons to free radicals so that they become normal molecules (Mahmood et al., 2021).

Production Index

The result showed that treatment has not significant effect on production index ($P > 0.05$). Feed intake, weight, and feed conversion are a few variables that affect the production index. However, these factors have little impact, resulting in a similar production index. Nevertheless, adding phytobiotic onion peel flour to the feed raises the value of the poultry production index. The production index value below 300 is classified as "minus." A production index range of 301–325 is classified as "sufficient." A production index range of 326–350 is classified as "good." Meanwhile, a production index range of 351–400 is classified as "very good." Moreover, a production index value above 400 in poultry breeding is classified as "special" (Gultom et al., 2022). Higher production index values suggest improved chicken performance and increased feeding efficiency. A higher production index can be attained through enhanced physical attributes like higher body weight, lower depletion, and a lower feed conversion ratio (FCR) (Amin et al.,

2023). In order to get a high production index, it is essential to consider several elements, including the quality of feed and drinking water, the duration of brooding, biosecurity measures, and maintenance management. It is advisable to evaluate the maintenance management system if the production index value is below the required level. (Anggitasari et al., 2016).

Income Over Feed Cost (IOFC)

The result showed that treatment has not significant effect on Income Over Feed Cost (IOFC) ($P > 0.05$). The IOFC of the poultry trader is determined by two primary factors: the average final body weight achieved and the total feed cost. This measurement is indicative of the success of the trader's chicken farm business. (Gultom et al., 2022). Adding 0.5% garlic peel at P3 treatment yields the highest result on IOFC, which amounts to Rp 11,743.00/live weight (Table 3). This outcome is primarily impacted by the high final weight ratio and good feed efficiency, leading to a relatively cheap total feed cost. According to the study, the flavonoid concentration of onion peel powder was significantly higher than that of red and white peel powder. Since feed accounts for more than 70% of production costs, IOFC value must be calculated to ascertain whether the feed being utilized is economically viable. (Rahmawati and Irawan, 2020).

Conclusion

The results of this study indicate that powdered garlic, shallot, and onion peels can be added to feed. The production index and the feed conversion ratio (FCR), in particular, benefit from this decision in terms of production performance.

Table 3. Effect of feed additive from three garlic peels on performance broiler

Treatments	Variables					
	Feed intake (g/bird)	Final BW (g/bird)	FCR	Mortality (%)	Production Index	IOFC (Rp/live bird)
T0 (-)	2947.18 ± 48.60	1890.08 ± 81.24	1.56 ± 0.05	0.05±0.08	320.54 ± 40.32	10948.71 ± 1191.58
T0 (+)	3050.33 ± 74.41	1978.00 ± 31.60	1.54 ± 0.02	0.14±0.00	285.08 ± 30.14	11508.23 ± 148.87
T1	3082.00 ± 66.67	1887.18 ± 59.99	1.64 ± 0.08	0.05±0.08	306.76 ± 45.36	9278.67 ± 1565.31
T2	2982.85 ± 115.50	1912.62 ± 64.11	1.56 ± 0.03	0.00±0.00	341.98 ± 8.10	10537.05 ± 496.42
T3	2965.40 ± 27.82	1968.33 ± 104.63	1.51 ± 0.07	0.00±0.00	367.19 ± 37.49	11597.47 ± 1659.89
T4	3060.52 ± 51.68	1892.86 ± 65.95	1.62 ± 0.05	0.05±0.08	294.45 ± 46.40	9600.94 ± 1091.41
T5	3106.55 ± 30.82	1940.00 ± 114.69	1.61 ± 0.11	0.00±0.00	339.98 ± 41.23	10034.44 ± 2329.99
T6	3008.59 ± 76.78	1907.38 ± 86.77	1.58 ± 0.06	0.05±0.08	323.55 ± 52.35	10190.75 ± 1299.51
T7	3067.71 ± 37.37	1989.52 ± 83.91	1.54 ± 0.08	0.00±0.00	358.59 ± 26.69	11222.59 ± 1621.54

BW – Body Weight; g – gram

T0(-): basal diet + free antibiotic; T0(+): basal diet + antibiotic (zinc bacitracin 0.1%); T1: basal diet+ 0.5% garlic peel; T2: basal diet + 0.5% shallot peel; T3: basal diet + 0.5% onion peel; T4: basal diet + 0.25% garlic peel + 0.25% shallot peel; T5: basal diet + 0.25%. garlic peel + 0.25% onion peel; T6: basal diet + 0.25% shallot peel + 0.25% onion peel; T7: basal diet + 0.167% garlic peel + 0.167% shallot peel + 0.167% onion peel.

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