Evaluation of the Addition of Curcuma zedoaria and Elephant Ginger (Zingiber officinale var. officinale) in Encapsulated and Non-Encapsulated Forms on the Performance of Broiler Production

Laila Nur Rohma[1], Desna Ayu Wijayanti[2]
[1]Livestock and Fisheries Service, Blitar Regency, East Java, Indonesia
[2]Faculty of Science and Technology, Karanganyar Muhammadiyah University, Karanganyar, Central Java, Indonesia
Corresponding author : Desna Ayu Wijayanti
Email : desnawijayanti@gmail.com

Abstract

This study aimed to evaluate and examine the content of the essential oils of white turmeric and giant ginger, how the effect of phytobiotic forms (encapsulation and non-encapsulation), and the usage level influence broiler production. The research material in the phase included 196 DOC of broiler, basal feed, and phytobiotic encapsulation and non-encapsulation. The in vivo study was divided into seven treatments with four replications, the experimental design used was a completely randomized design (CRD), and the statistical analysis used was variance analysis (ANOVA), which, if the data showed significant differences, then continued with Orthogonal Contrast Test and Duncan's Multiple Range Test. The treatments given were basal feed (P0), basal feed plus white turmeric and giant ginger in the form of non-encapsulation 0.6 (P1), 0. 8 (P2), 1% (P3), and basal feed plus white turmeric and giant ginger in the form of encapsulation 0.6 (P4), 0.8 (P5) and 1% (P6). The results showed that the treatment also significantly affected ($P<0.05$) feed consumption, body weight gain, Income Over Feed Cost, and crypt depth. However, the treatment did not significantly affect feed conversion ($P> 0.05$). Overall, the treatment of P6, a mixture of white turmeric and giant ginger in encapsulation with a level of 1%, is the best. The treatment did not significantly affect feed conversion ($P> 0.05$). Overall, the treatment of P6, a mixture of white turmeric and giant ginger in encapsulation with a level of 1%, is the best. The treatment did not significantly affect feed conversion ($P> 0.05$). Overall, the treatment of P6, which is a mixture of white turmeric and giant ginger in the form of encapsulation with a level of 1% is the best treatment.

Keywords : broiler, encapsulation, giant ginger, phytobiotic and performance, white turmeric

Introduction

The government has banned antibiotic growth promoters (AGP), so it is necessary to develop other feed additives that do not cause adverse effects, such as antibiotics. Many studies have been carried out to replace AGP feed additives, including probiotics, prebiotics, acidifiers, and probiotics. Among these feed additives, probiotics are an option because they are easy to obtain, and the price is relatively affordable. Herbal plants have been known for a long time as natural medicines by the wider community. Phytobiotics are feed additives derived from herbal plants which are utilized by the active substances contained therein to increase livestock growth. Several sources of probiotics can come from the leaves, stems, rhizomes, seeds, and fruit of a plant.

Various types of probiotics are derived from plant rhizomes, such as temu putih and elephant ginger. Temu putih (Curcuma zedoaria) contains active curcuminoids and essential oils components. These substances help to increase appetite and have pharmacological activities, namely antibacterial, antioxidant, antifungal, anticancer, and hepatoprotective (Saefudin, Syarif, and Chairul, 2014). Elephant ginger (Zingiber officinale var officinale) has active substances in gingerols and essential oils. The pharmacological activities of elephant ginger include antioxidant, antibacterial, immunomodulatory, neuroprotective, and anti-inflammatory (Adnyana & Suciati, 2016). Phytobiotic research using white turmeric and elephant ginger is still limited because their active substances are not as large as other rhizomes. Therefore, combining these two rhizomes will complement each other's active substance content. Using white turmeric and elephant ginger will produce probiotics containing essential oils with various compositions, and curcuminoids and gingerols, which can increase appetite and improve the taste. Previous research reported that the use of rhizomes as a feed additive was able to improve production in poultry and did not cause adverse effects. Based on some of these positive impacts, the rhizomes of herbal plants can be used as an alternative to antibiotics in poultry feed. Using white turmeric and elephant ginger will produce probiotics containing essential oils with various compositions, and curcuminoids and gingerols, which can increase appetite and improve the taste. Previous research reported that the use of rhizomes as a feed additive was able to improve production in poultry and did not cause adverse effects. Based on some of these positive impacts, the rhizomes of herbal plants can be used as an alternative to antibiotics in poultry feed. Using white turmeric and elephant ginger will produce probiotics containing essential oils with various compositions, and curcuminoids and gingerols, which can increase appetite and improve the taste. Previous research reported that the use of rhizomes as a feed additive was able to improve production in poultry and did not cause adverse effects. Based on some of these positive impacts, the rhizomes of herbal plants can be used as an alternative to antibiotics in poultry feed.

Based on the results of research conducted by Natsir et al. (2016), probiotics in the form of turmeric and ginger gave to broilers in the form of encapsulation with an administration level of 0.8% produced the best end result for total intestinal microflora and intestinal characteristics of chickens. The active substances in the

rhizome of temu putih and elephant ginger are generally volatile or easily evaporated. The benefits of various active rhizome substances can be optimized by protecting them from evaporating in the air through micro-encapsulation technology. The micro-encapsulation process needs to be carried out to protect the active substance of the rhizomes from evaporation and protect the taste of the rhizomes so that later they can be released to the intended digestive organs, such as the small intestine.

Based on the description above, it is necessary to carry out research and deeper studies regarding the use of feed additives derived from the rhizomes of herbal plants such as temu putih and elephant ginger in encapsulated and non-encapsulated forms on broiler production performance.

Materials and Methods

The materials used in this research are: 196 Day Old Chick broilers produced by Japfa MB 202 with an average weight of 42.80 ± 3.22 g and a coefficient of variance of 7.53%.Litter cage with a plot size of 1m2. For commercial feed for broilers, the results of the proximate analysis can be seen in Table Rhizome phytobiotics (encapsulated and non-encapsulated in the form of flour).

Research methods

The method used in this study was a field experiment using a completely randomized design (CRD). If the results are significantly different between treatments, it will be followed by an orthogonal contrast test. The study consisted of 7 kinds of treatment and four replications. Each replicate consisted of 7 broilers. The treatment used is:

P0: basal feed + 0% phytobiotics
P1: basal feed + 0.6% white turmeric and elephant ginger phytobiotic (non-encapsulated)
P2: basal feed + 0.8% white turmeric and elephant ginger phytobiotic (non-encapsulated)
P3: basal feed + 1% white turmeric and elephant ginger phytobiotic (non-encapsulated)
P4: basal feed + 0.6% white turmeric and elephant ginger phytobiotic (encapsulated)
P5: basal feed + 0.8% white turmeric and elephant ginger phytobiotic (encapsulated)
P6: basal feed + 1% phytobiotic combination of temu putih and elephant ginger (encapsulated)

Table 1. Results of proximate analysis of basal feed.

Food substance	Starter feed	Finisher feed
Dry matter (%)	89.58	89,27
Crude protein (%)	21,22	20,13
Crude fat (%)	5.65	5,52
Crude fiber (%)	4.67	4.82
Ash (%)	5.86	5,16
Calcium (%)	1.01	1.32
Phosphorus (%)	0.65	0.67
Metabolic energy (Kcal/kg)*	2981.30	3029,60

Source: Animal Feed Laboratory analysis results, District Livestock and Fisheries Service. Blitar.
(*) Based on 70% Gross Energy.

Research variable

Feed consumption. Broiler feed consumption is calculated daily by reducing the feed given with the remaining feed (in g). Body Weight Gain Broiler body weight gain can be calculated by calculating DOC's difference in body weight to harvest chickens and then dividing it by the number of days of rearing, which is 35 days. Calculation of chicken weight is done every week to find out the increase. Feed Conversion Ratio(FCR), Income Over Feed Cost (IOFC), IOFC is calculated based on the income or selling price of chickens minus expenses for feed costs.

Results and Discussion

The results of in vivo research on the effect of adding the phytobiotics turmeric and elephant ginger in non-encapsulated and encapsulated forms on the performance of broiler production can be seen in Table 2.

Table 2. Performance of broiler production with the administration of white turmeric and elephant ginger phytobiotics in non-encapsulated and encapsulated forms.

Treatment	Feed Consumption (g/head)	Body Weight Gain (g/head)	*Feed Conversion Ratio*	*Income Over Feed Cost*(Rp/head)
P0	3345.66±44.54ab	1999,83±54,37ab	1.64±0.02	15567.51±749.31b
P1	3291.95±73.28a	1973,73±77,16a	1.63±0.04	13502.81±1042.90ab
P2	3336.53±36.45ab	2005.54±126.49ab	1.63±0.10	13122.33±2428.37ab
P3	3408.00±71.65b	2004,32±30,34ab	1.67±0.05	11857.69±918.09a
P4	3448.34±100.05b	2094.15±63.78b	1.61±0.05	14068.74±1136.67ab
P5	3292.51±93.19a	2026,10±51,56ab	1.59±0.01	13154.70±388.08ab
P6	3443.09±85.38b	2133.57±58.52b	1.58±0.02	13174.01±586.23ab

Note: Different superscripts (ab) in the same column indicate a significant difference (P<0.05).
Different superscripts (ad) in the same column indicate a significant difference (P<0.01).

Table 3. Orthogonal contrast test results on the performance of broiler production.

No.	Contrast	Feed consumption	Body weight gain	*Income Over Feed Cost*
1.	P0 vs. P1-P6	P>0.05	P>0.05	P<0.01*
2.	P1-P3 vs. P4-P6	P>0.05	P<0.01*	P>0.05
3.	P1 vs P2-P3	P>0.05	P>0.05	P>0.05
4.	P2 vs P3	P>0.05	P>0.05	P>0.05
5.	P4 vs. P5-P6	P>0.05	P>0.05	P>0.05
6.	P5 vs P6	P<0.05**	P<0.05**	P>0.05

Note: Columns marked (*) indicate that the contrast is highly significant.
Columns marked (**) indicate that the contrast is significantly different.

Feed Consumption

Adding turmeric and elephant ginger to non-encapsulated and encapsulated forms to feed had a significant (P<0.05) effect on broiler feed consumption. The highest feed consumption was shown by the P4 treatment, namely 3448.34 ± 100.05 g. In comparison, the lowest consumption was shown by treatment P1, with a consumption of 3291.95 ± 73.28 g. Based on the results of the orthogonal contrast further test, it was found that the control treatment (P0) compared to the P1-P6 treatment (contrast 1) showed no statistically significant difference (P>0.05). This may be because adding these probiotics has not been able to affect the amount of broiler feed consumption. After all, the kept broilers have relatively the same feed requirements.

The sixth contrast, the P5 vs. P6 encapsulated phytobiotic treatment, showed a significant difference (P<0.05) in feed consumption. In the P5 treatment, the encapsulated phytobiotic level used was 0.8%, while in the P6, the encapsulated phytobiotic level was 1%. Consumption of feed P6 is higher than P5; this may be due to the number of probiotics consumed which can increase the appetite of chickens. According to Setyanto, Atmomarsono, and Muryani (2012), essential oils can help digestive enzymes work so that the rate of feed in the digestive tract increases and increases appetite. The same thing was conveyed by Ulfah (2006), that sensory function greatly affects feed consumption.

Body Weight Gain

The highest body weight gain value was shown by the P6 treatment, which achieved2133.57± 58.52 g, and the lowest body weight gain was shown by treatment P1, namely 1973.73 ± 77.16 g. Adding turmeric and elephant ginger in the non-encapsulated and encapsulated form to feed significantly affected broiler body weight gain (P<0.05). In the first contrast, the control treatment (P0) compared to the P1-P6 treatment did not show any statistically significant difference (P>0.05) in the body weight gain of the chickens. The second contrast showed a highly significant difference (P<0.01) between the flour treatment (non-encapsulated) and encapsulated treatment groups on broiler body weight gain.

The results of this study align with research conducted by Natsir et al. (2013) that broiler body weight gain can be increased by adding a mixture of garlic and meniran in the form of flour and encapsulation. According to Sjofjan (2003), non-pathogenic bacteria can produce enzymes that digest protein, fiber, and fat. So this helps the digestive process of feed by livestock to support better body weight gain. The third and fourth contrasts compare psychobiotic treatments in flour with three different levels (P1, P2, and P3). Based on the results of the contrast test, it was concluded that the levels of the powder form of probiotics had no significant effect ($P>0.05$) on broiler body weight gain.

Feed Conversion Ratio

The addition of turmeric and elephant ginger in non-encapsulated and encapsulated forms to feed at various levels did not significantly affect feed conversion ($P>0.05$). This may be because the phytobiotic treatment could not improve feed efficiency. The impact of herbal probiotics is slower and more accurate than antibiotic growth promoters in increasing feed efficiency. The results of this study are in line with Natsir et al. (2013) that the psychobiotic mixture of meniran and garlic in encapsulated and non-encapsulated forms could not have a significant effect ($P>0.05$) on the feed conversion ratio of broilers.

Feed conversion shows the level of efficiency of the feed consumed by livestock to increase the body weight of the livestock. The smaller the feed conversion value, the better the feed. The best (smallest) feed conversion was shown by the P6 treatment with a conversion of 1.58 ± 0.02. The highest feed conversion results were shown by the P3 treatment with a conversion of 1.67 ± 0.05; in this study, the best treatment was shown by the P6 treatment in which the feed was given additional probiotics mixed with white turmeric and elephant ginger in the form of encapsulation with a level of 1%. The 1% level of encapsulated probiotics can help the digestive process so that the feed is efficient.

IOFC (Income over feed cost)

The highest IOFC value was obtained from the control treatment, which reached IDR 15567.51 ± 749.31/head, while the lowest IOFC was shown by the P3 treatment, which was IDR 11857.69 ± 918.09/head. Based on statistical analysis, it was found that there was a significant difference ($P<0.05$) from the treatment given to IOFC. The presence of feed additives added to the feed will increase the production costs incurred; this is to the statement by Nuningtyas (2014), namely, the higher the level of psychobiotic administration, the lower the IOFC.

The orthogonal contrast follow-up test showed several comparisons of the IOFC treatments. The first contrast, the comparison between the control and treatment with the addition of probiotics, showed a significant difference ($P<0.01$) between the two treatment groups. This is because there is no additional cost for probiotics in the control treatment, so the IOFC obtained is high. Non-encapsulated and encapsulated probiotics added to feed add to production costs, thereby reducing the IOFC value. The presence of feed additives added to the feed will increase the production costs incurred; this follows the statement of Nuningtyas (2014), namely, the higher the level of psychobiotic administration, the lower the IOFC.

Conclusion

The rhizome of white turmeric and elephant ginger in encapsulated form can improve the appearance of production. Using phytobiotic rhizome of turmeric and elephant ginger as encapsulation at a 1% level gave the best results in this study.

References

Adnyana, IK and SW Suciyati. Footsteps of Elephant Ginger (Zingiber officinale Roscoe var officinalum) and Red Ginger (Zingiber officinale var rubrum). Galenika Pharmacy Journal. 3(1): 1-7. 2016.

Natsir, MH, Hartutik, O. Sjofjan and E. Widodo. Effect of Either Powder or Encapsulated Form of Garlic and Phyllanthus niuri L. Mixture on Broiler Performances, Intestinal Characteristics and Intestinal Microflora. int. Journal of Poultry Science. 12(11): 676-680. 2013.

Natsir, MH, E. Widodo and Muharlien. Combination Use of Turmeric Flour (Curcuma domestica) and Ginger (Zingiber officinale) in Encapsulated and Non-Encapsulated Forms on Intestinal Characteristics and Intestinal Microflora of Broiler Chickens. Livestock Newsletter. 40(1):1-10. 2016.

Natsir, MH, O. Sjofjan and Muharlien. Technology Innovation for Black Grass Jelly (Mesona palustris BL) and Green Grass Jelly (Cyclea barbata L. Miers) Leaf Processing as Poultry Feed Additives. College Research Excellence. Brawijaya University. Poor. 2015.

Nuningtyas, YF. The Effect of Adding Garlic Powder (Allium sativum) as an Additive on the Performance of Broiler Production. Journal of Tropical Livestock. 15(1):21-30. 2014.

Saefudin, F. Syarif, and Chairul. Antioxidant Potential and Antiproliferative Activity of White Turmeric (Curcuma zedoaria Rosc.) Extract on Hela Cells. Widyariset. 17(3): 381-390. 2014.

Setyanto, A., U. Atmomarsono and R. Muryani. The Effect of Emprit Ginger Flour (Zingiber officinale var Amarum) in Rations on Feed Rate and Feed Digestibility of 12 Weeks Old Village Chickens. J. Animal Agriculture. 1(1):711-720. 2012.

Sjofjan, O. Isolation and Identification of Bacillus sp from the intestines of laying hens as a source of probiotics. Competitive Grant Research Proposal XII. Faculty of Animal Husbandry, Padjadjaran University. Bandung. 2003.

Ulfah, M. The Potential of Medicinal Plants as Multi-Functional Phytobiotics to Improve the Appearance and Health of Animals in Captivity. Conservation Media. 3:109-114. 2006.