EFFECTIVENESS OF MARINE FUNGI AS FEED ADDITIVE ON NATIVE CHICKEN PERFORMANCE

[1*]Nurhayati Nurhayati [1]Nelwida Nelwida [2]Lisna Lisna [2]Fauzan Ramadan [3,4,*]Kustiariyah Tarman
Prof. Assoc. Prof. Assist. Prof. Assist. Prof. Assoc. Prof.
[1]Dept. Anim. Sci. Fac. Anim. Sci. Univ. Jambi [2]Dept. Fish. Fac. Anim. Sci. Univ. Jambi
[3]Dept. Aqu. Prod. Tech. Fac. Fish. Mar. Sci. IPB Univ. [4]Mar. Biot. Div. Coa. Mar. Res. IPB Univ. Indonesia
Email: nurhayati_agus@unja.ac.id; kustiaz@apps.ipb.ac.id

ABSTRACT

This study was conducted to determine the effectiveness of marine fungi as a feed additive on the performance of native chickens. One hundred and eighty unsex one-day-old native chickens were used in this study. Chickens were kept for ten weeks and given a treatment supplemented with the dietary marine fungi (1, 2, 3, and 4 ml/kg) in a ration consisting of yellow corn, rice bran, fish meal, soybean meal, coconut meal, L-lysine, methionine, and CaCO3. The data collected were feed consumption, body weight gain, carcass percentage, mortality rate, and feed efficiency. The results showed significant ($P<0.05$) decreased feed consumption and increased mortality with adding marine fungi. They did not affect the body weight, carcass percentage, and feed efficiency. The highest mortality occurred in a group of chickens supplemented with marine fungi as much as 3 ml/kg. It was concluded that marine fungi could be added to the ration as much as 1 ml/kg from the beginning of keeping to improve the performance of native chickens effectively and increase the chicken's immunity. It is suggested to mix marine fungi extract into the drinking water. Thus, its active compounds might be absorbed more effectively to improve the performance and produce healthy poultry products.

Keywords: Body weight, Chicken feed additive, Feed efficiency, Marine fungi, Native chicken

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فعالية الفطريات البحرية كمُضافات علفية في تحسين أداء الدجاج المحلي

نورحياتي نورحياتي نيلويدا نيلويدا ليسنا ليسنا فوزان رمضان كوستيارياه تارمان
قسم علوم الحيوان، كلية علوم الحيوان، جامعة جامبي
قسم المصايد، كلية علوم الحيوان، جامعة جامبي
قسم تقانة الإنتاج المائي، كلية علوم المصايد والعلوم البحرية، جامعة IPB
شعبة التكنولوجيا الحيوية البحرية، مركز البحوث الساحلية والبحرية، جامعة IPB، إندونيسيا

المستخلص

أُجريت هذه الدراسة لتحديد فعالية الفطريات البحرية كمُضاف علفي في تحسين أداء الدجاج المحلي. استخدم في التجربة مئة وثمانون فرخًا محليًا غير مميز الجنس بعمر يوم واحد. تم تربية الدجاج لمدة عشرة أسابيع، وجرى معاملته بإضافة الفطريات البحرية إلى العليقة بمستويات (1، 2، 3، و4 مل/كغم)، وكانت مكونات العليقة الأساسية تتألف من الذرة الصفراء، نخالة الأرز، مسحوق السمك، كسب فول الصويا، كسب جوز الهند، ليسين، ميثيونين، وكربونات الكالسيوم، شملت البيانات المجمعة كلا من استهلاك العلف، والزيادة الوزنية، ونسبة الذبيحة، ومعدل النفوق، وكفاءة التحويل الغذائي. أظهرت النتائج وجود تأثير معنوي ($P<0.05$) في انخفاض استهلاك العلف وارتفاع معدل النفوق عند إضافة الفطريات البحرية، في حين لم تُظهر أي تأثير معنوي في الزيادة الوزنية أو نسبة الذبيحة أو كفاءة التحويل الغذائي. وسُجل أعلى معدل نفوق في مجموعة الدجاج التي أضيفت إليها الفطريات البحرية بمستوى 3 مل/كغم، نستنتج من هذه الدراسة إمكانية إضافة الفطريات البحرية إلى العليقة بمعدل 1 مل/كغم منذ بداية التربية لتحسين أداء الدجاج المحلي ورفع مناعته بشكل فعال. كما يُوصى بإضافة مستخلص الفطريات البحرية إلى مياه الشرب لضمان امتصاص المركبات الفعالة بصورة أفضل، مما يُسهم في تحسين الأداء وإنتاج دواجن صحية.

الكلمات المفتاحية: الوزن الحي، مُضافات علف الدجاج، كفاءة التحويل الغذائي، الفطريات البحرية، الدجاج المحلي.

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INTRODUCTION

Native chickens have slow growth and low egg production due to their genetics as dual purposes chickens because they produce meat and eggs simultaneously. The meat production of native chickens is lower than broiler chickens, and egg production is lower than laying hens (22). BPS-Statistics Indonesia (5) reported that the demand for native chicken products continues to increase. This is because, in Indonesia, native chicken meat and eggs are trusted and believed by the community as traditional medicine, used in a mixture of herbal medicines or other ingredients. After all, chickens are raised in the free-range system and not offered commercial feed. Commercial feed is produced with nutritional content under the nutritional needs of chicken. However, the products of chicken consumed in commercial feed have been detected with antibiotic residues (3; 16; 29; 33) even though the Indonesia government has banned the use of antibiotics in feed to ensure the safety of livestock products since 2014 with the issuance of Law Number 18 of 2009 Juncto number 41 of 2014 concerning Animal Husbandry and Health and Minister of Agriculture Regulation No. 14 of 2017 concerning Classification of Effective Animal Medicines Prohibition per 1 January 2018. The detection of antibiotic residues in livestock products allegedly might be due to synthetic additives (antibiotics). Tantina (26) stated that long-term administration of synthetic antibiotics to animals resulted in its residues in animal products. Therefore, antibiotics in animal feed should be kept to a minimum because feeding animals excessive amounts of synthetic antibiotics might lead to microbial resistance that could harm the people's health who eat the livestock products. Alternative antibiotics made from natural ingredients are required to satisfy consumer demand for livestock products free of antibiotic residues (2). Besides, using commercial feed in the native chicken business also reduces public trust in the chicken product as a traditional medicine. To overcome the problems of chicken productivity, public trust, feed price, and product safety, it becomes crucial to formulate feed from native and organic feedstuffs such as marine fungi as additives. Marine fungi are prolific sources of bioactive compounds that are potential organisms as a source of antimicrobials because they can create structurally and functionally bioactive chemicals (4). In Indonesia, various endophytic fungi have been isolated from coastal plants and marine life, such as mangroves, seaweed, and seagrass (10) for therapeutic ingredients (7). Marine fungi contain cytotoxic, antimicrobial, anti-parasites, and antioxidants (1; 34). Wahjuningum et al (31) stated that applying marine fungi in feed could improve growth performance and prevent vibrio harveyi infection in Vaname shrimp (*Litopenaeus vannamei*). In line with Hai and Fotedar (9), who reported that β-glucan given in feed could increase shrimp intestinal microvilli that allow the absorption of higher feed nutrients so that the growth rate of shrimp is higher than those that are not given β-glucan treatment. However, the utilization of marine fungi as a feed additive for poultry is still lacking, so the current study becomes important to determine the effectiveness of marine fungi extract as a feed additive in improving native chicken performance.

MATERIALS AND METHODS

Chicken and feeding management

This study was conducted at the Laboratory of Animal Science and Forage Production, Faculty of Animal Husbandry, Jambi University, under the supervision of the Animal Health Department, the Animal Science Faculty, Jambi University, related to livestock welfare. The nutrient composition of feedstuffs was analyzed in the Laboratory of Feed Science and Technology, Faculty of Animal Science, IPB University. One hundred and eighty unsex one-day-old native chickens were used currently. Chicken fed a basal ration containing yellow maize, rice bran, soybean meal, fish meal, coconut meal, L-lysine, methionine, and $CaCO_3$ as shown in Table 1, and added marine fungi extract as a treatment. Marine fungi extract was obtained through isolation, purification of marine fungi isolates, and marine fungi cultivation which was reported by Wahjuningum et al. (30).

T0= basal ration without any addition of marine fungi extract (control)

T1= basal ration + 1 ml marine fungi/kg ration

T2= basal ration + 2 ml marine fungi/kg ration
T3= basal ration + 3 ml marine fungi/kg ration
T4= basal ration + 4 ml marine fungi/kg ration
Chickens were not vaccinated during the feeding trial period (10 weeks) and were kept in 20 colony cages, 50 x 100 x 100 centimeters each, and nine chickens in each cage unit. Disinfected cages were equipped with feeders, drinking water bottles, and lights with 25 watts for two weeks (14 days) that functioned as lighting and heating tools. After that, they were lighted with 5 watts of lighting lamp. The main cage temperature was maintained at 27-30°C. The experimental chickens had free access to treatment feed and drinking water for ten weeks. Every two weeks, the ration, the remaining feed, and the chicken's body weight were weighed to obtain data on feed consumption and weight gain.

Studied parameters :The measured parameters in this study were feed consumption, body weight gain, feed conversion ratio, carcass percentage, and mortality. Feed consumption was estimated by calculating the difference between the offered and remaining ration, expressed by g/head/day (13). Body weight gain was obtained by calculating the difference between the final and initial body weight and expressed by g/head/day (6). Live weight was obtained by weighing the chicken at the end of the study after the introduction of the treatment ration (13) The feed conversion ratio was obtained by simultaneously dividing feed consumption and body weight gain (25). The carcass percentage was calculated by dividing carcass weight and live weight (35). The mortality rate was obtained from the percentage of dead chickens from all chickens used in the study (15).

Table 1. The feedstuffs and nutrient composition of basal ration

Feedstuff	Percentage
Yellow maize	40
Rice bran	21
Fish meal	15
Soybean meal	10
Vegetable oil	2
Coconut meal	10
L-Lysine	0,5
Methionine	0,5
CaCo3	1
Total	100
Nutrients (%)	
Dry matter	85.45
Organic matter	72.88
Crude protein	26.32
Crude fiber	9.78
Crude fat	11.05
Nitrogen free extract	27.73
Gross energy (Kcal/kg)	3598.29

Statistical analysis: Collected data were statistically analyzed using One way ANOVA procedures of Analyse-it® (https://analyse-it.com/) integrated with Microsoft Excel 2010 for Windows. Identifying any significant effect on the parameter was tested by Orthogonal Contrast with a Confidence level of 95% (α = 0.05) (21).

RESULTS AND DISCUSSION

The effect of treated rations on the measured parameters is shown in Table (2). The results revealed significant differences ($P<0.05$) in feed consumption. However, they had a tendency numerically to decrease body weight gain, carcass percentage, and feed conversion ratio by increasing the level of marine fungi extract added to the ration. The basal ration, which added 1% of marine fungi extracts offered to the native chicken, had a similar effect on all measured parameters.

Table 2. Effect of adding marine fungi extract into the rations on native chicken performance (mean±SD)

Parameters	Treatment				
	T0	T1	T2	T3	T4
Initial weight (g/head)	26.92±0.38	26.53±0.71	26.44±1.28	26.33±0.74	25.94±1.36
Feed consumption (g/head/day)	51.71±2.13[a]	49.08±0.77[ab]	46.92±1.85[b]	47.35±1.92[b]	47.66±2.36[b]
Body weight gain (g/head/day)	10.30±0.82	10.26±0.67	9.94±0.71	9.33±0.60	9.82±0.49
Live weight (g/head)	668.75±62.10	727.50±43.49	733.75±74.76	725.00±74.27	657.50±73.99
Feed conversion	5.04±0.38	4.8±0.23	4.96±0.42	5.05±0.41	4.83±0.26
Carcass (%)	60.19±3.84	61.93±2.38	65.32±1.13	64.52±5.25	64.80±3.03
Mortality (%)	2.78±2.27	1.39±1.60	2.08±1.39	4.17±2.78	2.78+0.00

Different superscripts on the same row showed significantly different (P<0.05)
T0: basal ration without any addition of marine fungi extract (control), T1: basal ration + 1 ml marine fungi/kg ration, T2: basal ration + 2 ml marine fungi/kg ration, T3: basal ration + 3 ml marine fungi/kg ration, T4: basal ration + 4 ml marine fungi/kg ration

Feed consumption: Analysis of variance showed that the feed consumption of chickens fed a ration supplemented with marine fungi extract (T1, T2, T3, and T4) was significantly lower ($P<0.05$) than that of fed basal ration (T0) without any marine fungi added. The feed consumption among chicken groups offered the treated ration was not significantly different. It indicates that the active compounds in marine fungi, such as β-glucan, alkaloids, terpenoids, peptide derivatives, phytosterols, polyphenols, saponins, and polysaccharides (8, 27), play an important and significant role in nutrient digestion in chicken. These active compounds could increase the growth of good bacteria in the digestive tract so that digestive health could be maintained and feed intake might be reduced (31). Besides, they have bulky properties that will slow the digestion of carbohydrates and the rate of nutrients in the digestive tract. Thus, the chicken will be easily full and temporarily stop consuming feed. The chicken will re-consume when it is hungry (19). Table (2) observed that the feed consumption of native chicken for ten weeks was around 46 – 51 g/head /day. This amount was lower than that reported by previous authors. Rajulani et al. (19) found that native chicken consumed a ration of 50-51 g/head/day for eight weeks. Syamsuddin et al. (25) reported that superior native chickens consumed around 58,47-58.47 g/head/day after feeding a ration containing chicory flour for seven weeks. A decrease in consumption would increase feed efficiency and reduce production costs when it did not cause a decrease in body weight. Figure 1 shows increased feed consumption significantly after keeping the chickens for eight weeks. The average consumption in weeks 2, 4, 6, 8, and 10 were 16.87, 24.84, 34.68, 55.87, and 110.83 g/head/day, respectively. It indicates that after eight weeks, native chickens need more feed to grow and develop their body, organs, tissue, Etc. In other words, the developer phase of native chickens will reach after eight weeks of age, and they need more nutrients. Thus, they will increase their consumption. The achievement of this developer phase was earlier than what was stated by Suprijatna (23) who reported that the native chicken reared extensively was divided into 4 phases, namely the starter phase (aged 0-6 weeks), the grower phase (aged 6-12 weeks), developer phase (aged 12-20 weeks), and the layer phase (aged 20-60 weeks). This division is due to the feed quality and the rearing system applied.

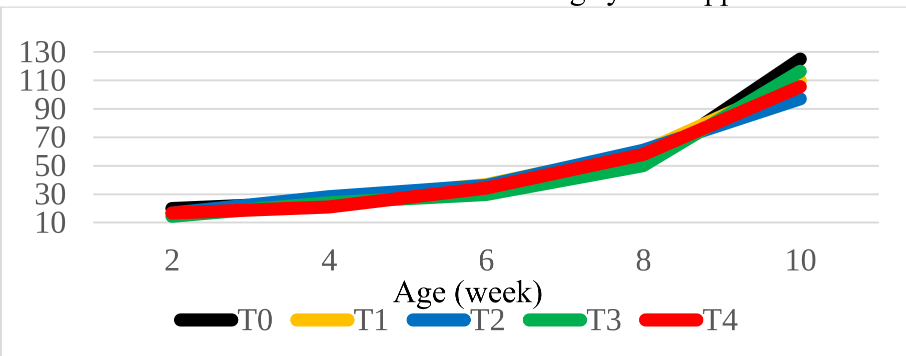

Figure 1. Feed consumption of native chicken consumed ration containing marine fungi extract (g/head/day)

Body weight gain

Analysis of the variance of body weight gain among native chickens fed treated diets did not significantly differ even though it tended to decrease by increasing the level of marine fungi extract in the diet. This study differed from feed consumption which significantly decreased among the treated groups. This study shows that the offered feed had good quality, although feed consumption decreases did not decrease the body weight. This might be due to the active compound contained in marine fungi, namely polyphenol (27) which can help maintain the chicken's weight so that the chicken does not lose weight. Besides that, it also might be due to the feed quality given (Table 1), containing energy and protein that exceeds the needs of native chickens. Lisnahan et al. (12) who stated that required crude protein and metabolizable energy for native chickens' starter and grower phases were 22.47 and 52.11 g/head/week and 2965.3 and, 2990.55 kcal/kg, respectively. The body weight of the native chickens fed with a ration containing marine fungi extract (Table 2) was higher than those reported by Putri et al. (18) who noticed that the body weight of the 8-week-old native chicken was 605.53 ± 80.01 g. This finding is due to the differences in the genetics of chickens and feed quality. Surbakti et al. (24) reported that incorporating marine fungi extract into the diet of native chickens at a concentration of up to 4 ml per kilogram did not produce any statistically significant changes in their daily weight gain over a period of eight weeks. This study suggests that while marine fungi may offer potential nutritional benefits, their impact on the growth performance of native chickens might be negligible at this specific dosage. Further research could explore alternative concentrations or investigate additional factors that might influence growth rates. Figure 2 showed the increases in native chicken body weight every two weeks. It showed that the group of chickens that consumed feed containing 2 ml/kg of marine fungi (T2, 18.24 g/head/day) tended to be higher than that of chicken groups that consumed other treatments (17 g/head/day) after being maintained for ten weeks despite the increase in body weight not significant. This result was in line with what was reported by Syamsuddin et al. (25) who noticed that the increases in superior native chicken body weight maintained for ten weeks ranged from 17.70 - 18.62 g/head/day. The results of this study were higher than those reported by Munira et al. (14) who stated that the increase in the body weight of the 10-week-old native chicken ranges from 10-11 g/head/day. This difference might be because the quality of the offered rations in the current study was better than what Munira et al (14), which fed chicken a basal ration supplemented with fermented rice bran.

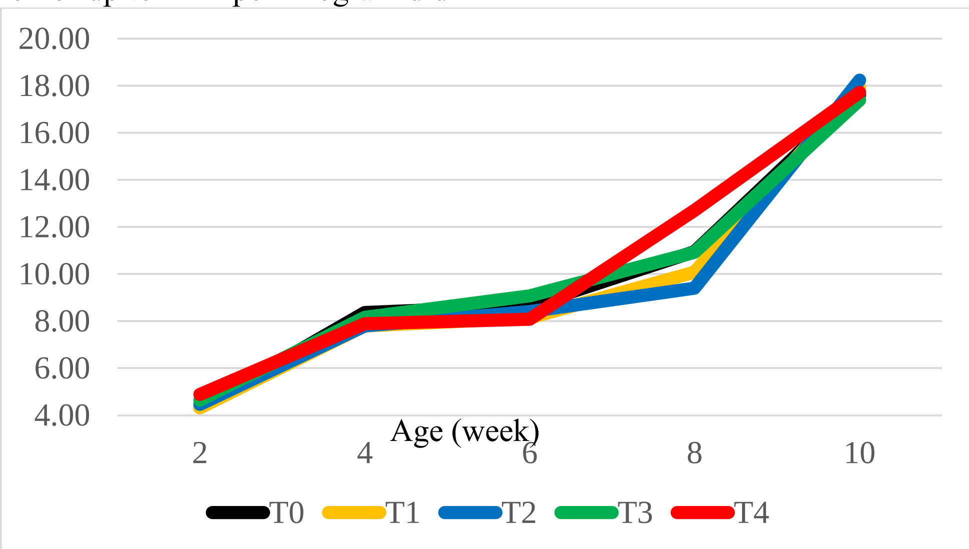

Figure 2. Average daily gain of native chicken consumed ration containing marine fungi extract during the study (g/head/day)

Feed conversion ratio: The feed conversion ratio showed that the treated groups were not significantly different. This could be understood, considering that the increased body weight also was not significantly affected. However, there was a tendency for the increase in the addition of marine fungi in the ratio of more than 2 ml/kg of rations to increase the feed conversion ratio. This means that the Effectiveness of rations decreases with the addition of more than 2 ml/kg of marine fungi. The results indicated that marine fungi extract was not added to the ration more than 2 ml/kg of rations to produce good chicken performance. The feed conversion ratio in the current study was 4.8 – 5.05 and was higher than previous researchers (12; 17; 25) who reported the feed conversion ratio in native chickens around 4,091-4,997, and superior native chickens were 2.7-3.3. However, this study found a better result than that reported by Wicaksono et al. (32) who stated that super native chickens were kept for ten weeks and given *ad libitum* rations and had a feed conversion value of 5.0-5.5. The better feed conversion ratio in the current study indicated that marine fungi could be added to the ration to improve feed efficiency, reduce production costs, and shorten the length of time for maintaining chicken. Generally, native chickens can be sold in the market after 20 weeks old with around 800 - 1000 grams of live weight. However, at that time, the meat was not soft, not flexible, and hard due to the enlarged meat muscle tissue increasing the age of the chicken. Hermanianto et al. (11) stated that the body weight of native chicken was around 1050 grams at 20 weeks old. Results of this study, after keeping the chickens for ten weeks, their body weight reached around 700 grams.

Carcass percentage

The carcass is the main result of slaughtered chickens after blood, feathers, head, shanks, and internal organs, except lungs and kidneys, have been removed. The carcass percentage is the comparison of carcass weight with the live weight of the chicken (12; 20).The carcass percentage showed that adding marine fungi extract up to 4 ml/kg ration did not significantly affect the percentage of carcass produced, and there is a tendency to increase the weight of the carcass produced. This showed that sea fungi positively influenced the increase in carcass component weight. This was in line with the increase in body weight produced (20). Although the impact had not yet been substantial, there was a noticeable trend indicating that chickens that consumed marine fungi tended to gain more weight compared to those that did not receive the marine fungi in their diet. This study found that carcasses of native chicken were around 60 – 65% of live weight. These results were lower than Sari et al. (20), who found that native chicken carcasses ranged from 71-79% at seven weeks, with a slaughtered weight reaching 402-529 grams. However, they were similar to Nurmi et al. (15) who stated that the carcass percentage of native chicken fed with unfermented and fermented arenga waste was 60%.

Mortality rate

The current study revealed that the mortality rate among the treated group of chickens was not significantly influenced by consuming dietary marine fungi extract. However, there was a tendency to increase the mortality rate by providing marine fungi extracts of more than 1 ml/kg of rations. This means that the immune system in native chickens had been formed well when given rations containing 1 ml/kg of marine fungi extract. This might be because polyphenols that act as antioxidants have met the requirement of native chicken to increase their immune in the administration of 1 ml/kg of ration. Increased levels of dietary marine fungi resulted in an increase in polyphenol levels that would be consumed to interfere with the work of the kidneys; in this study, the kidneys looked enlarged, and the color turned pale.

Although there was a tendency to increase the mortality rate of native chickens that are fed rations containing marine fungi extract, the mortality rate in this study was lower than those reported by (18; 28), which gave rations supplemented nanoencapsulation of red fruit oil as additives. The current study found that the mortality rate of the native chicken after being raised for ten weeks was 1.39-4.17%, whereas Timur et al. (28) found that the mortality rate was 1-7%.

CONCLUSIONS

It was concluded that marine fungi could be added to the ration as much as 1 ml/kg from the beginning of keeping to improve the performance of native chickens effectively and increase the chicken's immunity. It is suggested to mix marine fungi extract into the drinking water. Thus, its active compounds might be absorbed more effectively to improve the performance and produce healthy products.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

DECLARATION OF FUND

The authors declare that they have not received a fund.

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