



## Integration of Feed Nutrient Analysis and Predictive Model in Assessing the Performance of Native Chickens fed with *Rhizopus* sp. Fermented Rice Bran

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### ABSTRACT

The study aimed to determine the effect of giving fermented rice bran with *Rhizopus* sp on the performance of free-range chickens. This study used a non-factorial Complete Random Design (RAL) method with 4 treatments and 5 replicates. The treatment used was as follows: P0 = control, P1 = ration + 10% DPF, P2 = ration + 15% DPF and P3 = ration + 20% DPF. The study results showed that the administration of fermented rice bran can affect the performance of free-range chickens, namely ration consumption, body weight gain, and ration conversion. The results of the fingerprint analysis showed that the P2 treatment (ration + 15% DPF) had a conversion of 3.64 and the highest body weight gain of 63.81 g.

#### Keywords:

Additional feed, Rice bran, fermentation, *Rhizopus* sp., Native chicken

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## 1. INTRODUCTION

Native chickens or commonly called free-range chickens (non-breeds) are local chickens that originate from Indonesia. The existence of free-range chickens has long coexisted with people's lives. Maintenance is relatively easy and more resistant to disease when compared to purebred chickens makes free-range chickens easy to find anywhere, especially in rural areas. Free-range chickens or known as free-range chickens have characteristics compared to other types of chickens, namely the variety of patterns and feather colors both male and female are characteristic of free-range chickens [1].

Most of the free-range chickens that live in Indonesia have a compact body morphology with relatively good body growth, perfect feather growth and a lot of feather color variations. Rice bran is waste from rice milling, rice bran is the inner shell of rice and can be used as feed. It is used as a source of energy in feed from its potential seen from its nutritional content and availability. Rice bran is a by-product/waste from the rice milling process. According to the results of the study, approximately 8-8.5% of the weight of rice is rice bran. With this number, we can predict the potential of an area to produce rice bran. For example, an area for one harvest period produces 1000 tons of rice, then it can be estimated that the area is able to produce 80-85 tons of rice bran [2]. Rice bran has a nutritional content of 10.43% water (BK), crude protein 13.70% (BK), crude fat 13.06% (BK), ash 9.55% (BK), crude fiber 18.93% (BK), BETN 54.75% (BK) and metabolic energy 2612.36 kka/kg [3]. The nutritional content of rice bran consists of water 11.28%; ash 10.44%; crude fiber 22.17%; crude protein 8.43%; crude fat 18.47%; organic ingredients 85.93% and BETN 34.97% [3].

As an ingredient for animal feed, the use of large amounts of rice bran in rations is not possible and needs to be limited. The amount of rice bran that can be used in poultry rations is limited to 10-20%. Use in poultry feed can be used up to 15% [5]. One of the considerations for limiting the amount of rice bran use is the content of crude fiber and phytic acid contained in it. The amount of phytic acid in rice bran is 6.9% [6]. The crude fiber content of rice bran ranges from 14-26% [7]. Rice bran can be improved in nutrients through the fermentation process so that it can be used as a feed ingredient for poultry up to 30% [8] [5]. In an effort to increase the biological value of rice bran, it can be done by reducing the high content of crude fiber. Reducing the level of crude fiber in poultry feed is necessary, because if crude fiber is found in high amounts in the ration it can interfere with the digestibility of poultry feed [2] One way that can be done to improve the nutritional content of bran is to ferment. Fermentation is one of the biologically food technologies that involves the activity of microorganisms to improve the nutrition of low-quality ingredients [2].

Fermentation is one of the biological material technologies that involves the activity of microorganisms to improve the nutrition of low-quality materials. Fermentation can improve the quality of a feed ingredient, because in the fermentation process there are chemical changes in organic compounds, namely carbohydrates, fats, proteins, crude fibers and other organic materials, both in aerobic and anaerobic states through enzymes produced by microbes [9].

Fermentation of feed ingredients can improve nutritional value such as increased protein and soluble protein levels in water and can break down proteins into simpler compounds such as peptides and amino acids [10]. One of the fermentation products that is widely known to the Indonesian people is tempeh. *Rhizopus sp* It is known to have its benefits in fermenting soybeans into tempeh. This mold belongs to the Genus *Rhizopus*, Order Mucorals, class Zygomycetes, Family Mucoraceae, and Species *Rhizopus oryzae*, *Rhizopus sp* is a mold that can produce protease enzymes [11].

## 2. RESEARCH METHODOLOGY

### 2.1 Research Stages

This study used 100 2-week-old free-range chickens with a diversity coefficient of 9.8%. The cage used is 1 M2 in size as many as 20 cage plots. Each drum plot is equipped with a feeding place, a drinking place and lights. The rice bran used is rice bran purchased at a rice mill in the Binjai area, then fermented using tempeh yeast (*Rhizopus sp.*). The ingredients for the ration consist of several feed ingredients in the form of corn, rice bran, bran, soybean meal, fermented bran, fishmeal and premix.

Table 1. Composition of starter phase free-range chicken ration (1-4 weeks of age)

Feed ingredients	Composition of the ration (%)			
	P0	P1	P2	P3
Corn	60	50	45	40
Fermented bran	0	10	15	20
Soybean meal	17	17	17	17
Fishmeal	11	11	11	11
Squirt	10	10	10	10
Premix	2	2	2	2
Sum	100	100	100	100
Energy (kcal)	3143,2	3113,2	3098,2	3083,2
Crude protein (%)	19,024	19,264	19,384	19,504
Crude Fiber (%)	5,638	6,751	7,6125	7,874

Crude fat (%)	4,133	4,857	5,219	5,581
Calcium (%)	0,461	0,523	0,509	1,372
Phosphorus (%)	0,464	0,515	0,5405	0,566

Table 2. Composition of free-range chicken ration in the grower phase (age 5 – 8 weeks)

Feed ingredients	Composition of the ration (%)			
	P0	P1	P2	P3
Corn	65	60	55	51
Fermented bran	0	10	15	20
Soybean meal	10	10	10	10
Fishmeal	8	6	6	5
Squirt	15	12	12	12
Premix	2	2	2	2
Sum	100	100	100	100
Metabolic energy (kcal)	3066,05	3008,16	2993,16	2960,96
Crude protein (%)	14, 545	14,326	14, 446	14,101
Crude Fiber (%)	5,0095	5,7906	7,3521	6,9186
Crude fat (%)	3,807	4,5196	4,8816	5,4516
Calcium (%)	0,393	0,38	0,396	0,3892
Phosphorus (%)	0,4	0,006	0,006	0,4723

The method used in this study is an experimental method designed using a Complete Random Design (RAL) design with 4 treatments and 5 replicas, each replica containing 5 free-range chickens. The treatment feed given is basal feed that is mixed and added rice bran contaminated with *Rhizopus sp.* according to the treatment. The frequency of feeding 2 times a day and drinking water *ad libitum*. The treatment given was P0 (0% control feed), P1 (10% DPF in rations), P2 (15% DPF in rations), P3 (20% DPF in rations).

Data collection was carried out every week until the end of the study. The data obtained is then processed using the help of Microsoft Excel software. After the average data is obtained, it is then continued with statistical analysis using ANOVA.

## 2.2 research implementation

### Enclosure Preparation

The cage measures 100 cm long x 100 cm wide x 100 cm high which is equipped with a feed and drinking place. Before use, the drums and equipment to be used are washed and sterilized first.

### Livestock Preparation

This study used 100 DOC free-range chickens obtained from the Tavip market in Binjai city. The newly arrived DOC is given sugar water to replace the lost DOC energy, then the DOC is put into the brood cage first to prepare before entering the research drum. At the age of 2 weeks, free-range chickens are then weighed to find out their initial body weight before entering the research drum.

### Vaccination

Vaccination is carried out when the chicken is 1 day old (DOC), the vaccine given is the ND vaccine. Vaccination aims to prevent ND disease (Newcastle Disease) or tetelo/plague disease by dripping in the eye with a dose of one drop. Vitachick administration, the way it is given is by adding it to drinking water.

### Fermentation Rice Bran Manufacturing

Rice bran before fermentation, bran must go through the steaming stage for a few minutes, after steaming is complete, then the rice bran is cooled first, after it cools then rice bran is mixed with tempeh yeast, mixed until homogeneous so that the fermentation process runs well. The fermentation process is carried out for 3 days.

### Maintenance

The free-range chickens that will be raised in the cage are 14 days old, after being put into the research cage they are kept for 12 weeks. Feeding is carried out twice a day, at 08.00 WIB and 17.00 WIB. Each feed given will be weighed first, as well as the rest of the feed.

### Data Collection Stage

The data observed included weight gain, ration consumption and ration conversion. Data on body weight gain and ration consumption were taken every week until the 12th week. Meanwhile, the data on the conversion of the ration will be taken at the end of the study.

#### 1. Weight gain

Body weight gain data is taken every week starting from the third week. Every weekend the chicken is weighed and the weighing results are subtracted by the previous week's live weight, so the result of the reduction is called the weekly life weight growth.

$$UN : BB_t - BB_{t-1} \quad (1)$$

Information:

- United Nations = Weight gain (grams/head)
- BBt = Final body weight (grams/tail)
- BBt-1 = Initial body weight (grams/tail)
- t = In chicken farms it is usually within the same period of time.

#### 2. Ration consumption

The consumption of rations is calculated every week by weighing the rations given in one minggu minus the rations left at the end of the last week divided by seven to obtain consumption per day.

$$\text{Consumption of rations} = \text{ransum yang diberikan(gram)} - \text{ransum yang tersisa(gram)}$$

#### 3. Ration conversion

Ration conversion is a comparison between the amount of rations given and the increase in body weight.

$$\text{Ration conversion} = \frac{\text{Konsumsi Ransum}}{\text{Pertambahan Bobot Badan}} \quad (2)$$

## 3. RESULT AND DISCUSSION

The effect of applying fermented rice bran with *Rhizopus sp* on the performance of free-range chickens can be seen in table 1. The data in Table 1 show the administration of fermented rice bran *Rhizopus sp*. In the ration of the unreal effect ( $P > 0.05$ ) on body weight gain, feed consumption, and FCR (Feed Conversion Ratio).

**Table 3.** Recapitulation of the study's results on body weight gain, ration consumption, and ration conversion in free-range chickens by giving fermented bran with *Rhizopus sp*.

Treatment	Parameter Flattening		
	Body Weight Gain (g/week)	Consumption of Rations (g/week)	Conversion of Rations
P0 (0%)	61.22 <sup>tn</sup>	230.70 <sup>tn</sup>	3.77 <sup>tn</sup>
P1 (10%)	61.41 <sup>tn</sup>	230.61 <sup>tn</sup>	3.78 <sup>tn</sup>
P2 (15%)	63.81 <sup>tn</sup>	231.30 <sup>tn</sup>	3.64 <sup>tn</sup>
P3 (20%)	59.90 <sup>tn</sup>	232.38 <sup>tn</sup>	3.88 <sup>tn</sup>

Remarks: tn = Different is not real at the level ( $P > 0.05$ )

The results of the study conducted for 12 weeks, the rearing of free-range chickens that were given rations with fermented bran using *Rhizopus sp* had a different average from each treatment given. However, after testing by statistical analysis using a computer and presented in the fingerprint analysis table, it showed intangible differences ( $p > 0.05$ ). which means the provision of rations containing fermented rice bran *Rhizopus sp*. It affects the performance of free-range chickens up to 20%.

### 3.1 Body Weight Gain

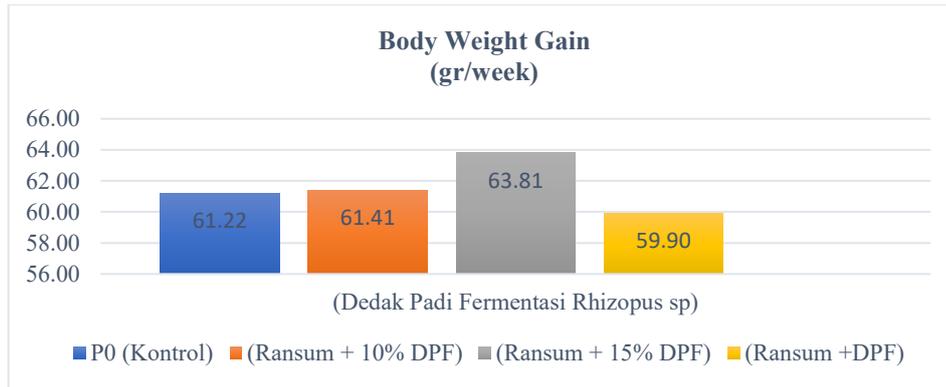


Figure 1. Body Weight Gain

Body weight gain is the difference between the final weight and the initial weight divided by the length of the study time (grams/head). The use of fermented rice bran *Rhizopus sp.* Up to 20% in this study resulted in weight gain that was almost equal to the control (P1).

Treatment of giving *Rhizopus* fermented rice bran *Sp.* have an average of each body weight gain at P0, P1, P2, and P3 respectively, namely P0 (61.22 g/week), P1 (61.41 g/week), P2 (63.81 g/week), and P3 (59.90 g/week). The highest body weight gain was found in the P2 treatment (15% fermented bran in rations) which was 63.81 g/week and the lowest body weight gain was found in the P3 treatment (20% fermented bran in rations) which was 59.90 g/week. These results are still much lower when compared to the study (Aryanti et al., 2013) Where the results of research on intensively raised free-range chickens can reach an average weight of 900 grams within 10 week.

This can be suspected due to several other factors, the low final body weight in this study can also be influenced by weather factors and disease. The physiological characteristics of chickens that can be observed as a result of this disease attack are the sound of snoring, swollen and watery eyes and mucus coming out of the nose. The impact caused by this disease is a decrease in appetite which has an impact on decreasing ration consumption, stunted growth and even losing body weight.

Although the results of the fingerprint analysis showed that the addition of fermented bran with *Rhizopus sp* on free-range chicken rations does not have a real effect on body weight gain, but there is a tendency that treatment with bran in rations has a higher body weight gain than P0 (0% tempeh bran) as a control. These results are also in line with the research (Munira et al., 1991) which states that the administration of bran tempeh tends to increase body weight gain in super free-range chickens.

This is due to the decrease in antinutrient substances contained in bran, the increased availability of proteins, minerals, vitamins, and other nutrients that are the result of the bran fermentation process. Fermented bran can lower phytic acid, improve ash, protein and amino acid digestibility (Oliveira et al., 2010).

### 3.2 Consumption of Rations

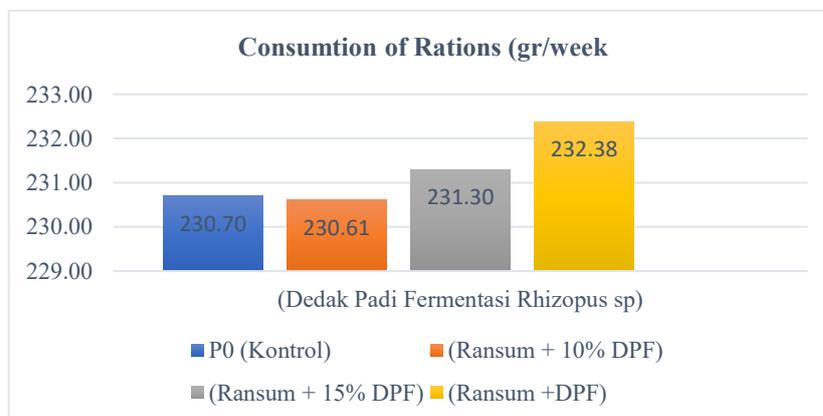


Figure 2. Consumption of Rations

Based on the results of the variety, it was shown that the administration of fermented bran using tempeh yeast (*Rhizopus sp*) in free-range chicken rations at different levels produced an unreal effect ( $P>0.05$ ) on the consumption of free-range chicken rations. The results of each treatment had an average of ration consumption in the P0 (0%), P1 (10%), P2 (15%), and P3 (20%) treatments, showing average results in free-range chickens of P0 (230.70 g/week), P1 (230.61 g/week), P2 (231.30 g/week), and P3 (232.38 g/week). The average results showed that free-range chickens fed fermented bran using tempeh yeast (*Rhizopus sp*) P3 (20% fermented bran in rations) had the highest ration consumption (232.8 g/week) and in the P1 treatment (10% fermented bran in rations) had the lowest ration consumption (230.61 g/week).

From the data, it can be seen that the ration with the addition of tempeh bran as much as 20% in the ration has the highest level of ration consumption. This is thought to be because fermented rice bran has a smell and taste that is preferred by livestock, a softer texture and a slightly yellowish color so that livestock prefer it. (Munira et al., 1991) In his research, it was stated that the addition of bran tempeh tends to increase the consumption of super free-range chicken rations. As the chicken ages, the higher the rate of ration consumption. This is the same as the opinion (Zulfanita, Roisu Eny, M, 2011) which states that the older the chicken, the higher the consumption of rations to meet the needs of the chickens.

It is different that the treatment of giving fermented rice bran up to the level of 20% ( $P>0.5$ ) on ration consumption is due to rice bran fermented with *Rhizopus sp*. What is given has increased its palatability because fermented products usually produce a distinctive flavor and the ration is preferred by chickens. This is in accordance with research [11] which states that fermented products have a preferable flavor and produce several vitamins such as B1, B2 and B12 so they are preferred over unfermented ingredients.

### 3.3 Conversion of Rations

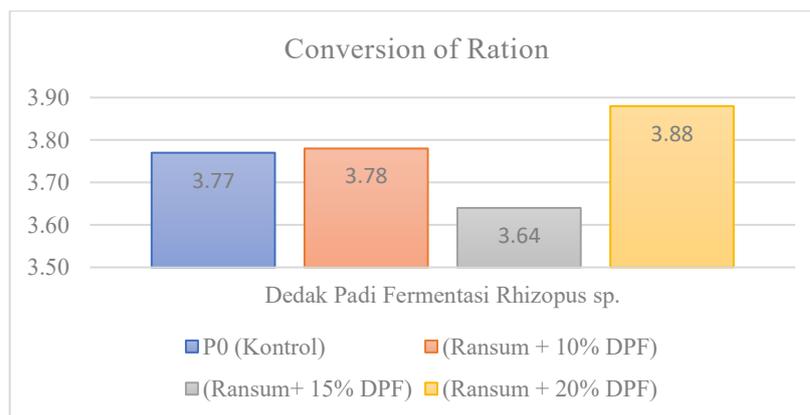


Figure 3. Conversion of Ration

Ration conversion (FCR) is used to see the efficiency of the use of rations by livestock or it can also be said to be the efficiency of converting the rations eaten into the final product of livestock, namely meat. The results of the variety-based analysis showed that the application of fermented bran using tempeh yeast (*Rhizopus sp*) in free-range chicken rations at different levels produced an unreal effect ( $P>0.05$ ) on the conversion of free-range chicken rations.

The results of each treatment had an average of each ration conversion in the P0 (0%), P1 (10%), P2 (15%), and P3 (20%) treatments, resulting in average results in free-range chickens of P0 3.77, P1 3.78, P2 3.64, and P3 3.88. The average results showed that free-range chickens fed fermented bran using tempeh yeast (*Rhizopus sp*) P2 (15% fermented bran in rations) had the lowest ration conversion (3.64) and in the P3 treatment (20% fermented bran in rations) had the highest ration conversion value (3.88).

The unreal effect of the use of fermented rice bran on ration conversion, this is in line with the previous discussion about the consumption of rations and different body weight gains. Statistically, the best ration conversion value at P2 was with the addition of fermented rice bran *Rhizopus sp*. 15% is 3.64. [12] stated that the factors that affect feed conversion are sufficient energy content, sufficiency of nutrients in the ration, environmental temperature and health conditions of chickens.

Although the results of the fingerprint showed an unreal effect, it was seen that the P2 treatment (15% fermented bran in rations) had a lower ration conversion value (3.64) than P0 (0% fermented bran in rations) which had a ration conversion value of 3.77. One of the compounds in rice bran that can reduce the conversion value of the ration is octacosanol. (Zulfanita, Roisu Eny, M, 2011) It was found that octacosanol extracted from rice bran tended to lower the conversion of rations. It is suspected that the fermentation process is able to increase the availability of octacosanol so

that it can contribute to a decrease in ration conversion. (Suhenda et al., 1995) It was also found that the fermentation process in bran can improve protein retention. Next (Oliveira et al., 2010) explained that the digestibility of amino acids will contribute to reducing ration conversion. Tendency to decrease in ration conversion with bran fermented with bran *Rhizopus sp* This will be advantageous for farmers if offset by relatively equal costs.

#### 4. CONCLUSIONS

A study on the use of rice bran fermented with tempeh yeast (*Rhizopus sp.*) in the rations of free-range chickens showed that up to 20% of fermented rice bran could be included without negatively affecting the chickens' performance. The best results in terms of feed conversion ratio were obtained from the P2 treatment, which included 15% fermented rice bran in the feed. This indicates that the optimal inclusion level of fermented rice bran in the rations for free-range chickens is 15%. Fermenting rice bran with *Rhizopus sp.* enhances its nutritional content, such as proteins and amino acids, making them more digestible for chickens. Additionally, the fermentation process can reduce the levels of anti-nutritional factors found in rice bran, thereby improving its overall feed quality. With the inclusion of 15% fermented rice bran, the chickens continued to perform well in terms of growth and feed conversion. In conclusion, rice bran fermented with *Rhizopus sp.* can be effectively utilized as an alternative feed ingredient for free-range chickens, with a recommended inclusion rate of up to 15%. This approach not only offers economic benefits but also helps reduce agricultural waste, while maintaining the health and productivity of the chickens. Therefore, the use of fermented rice bran in poultry feed is a viable, environmentally friendly, and efficient solution.

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