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Original Article

Nutritional quality of fermented feed for local chicken containing banana tree waste in Sidolego Village, Tabir Lintas District, Merangin Regency

Nurhayati Nurhayati*, Berliana Berliana, Nelwida Nelwida, Depison Depison, Endri Musnandar, Heru Handoko, Yun Alwi, Raden Abdul Muthalib, Abdul Azis

Faculty of Animal Science, Universitas Jambi, Jambi, 36361
*Correspondence: nurhayati_agus@unja.ac.id

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Abstrak

Tujuan: Penelitian ini bertujuan untuk mengetahui kualitas gizi pakan fermentasi yang mengandung limbah tanaman pisang yang akan diberikan pada ayam kampung di Desa Sidolego guna percepatan pencapaian Desa Sidolego sebagai desa sentra ayam.
Metode: Bahan-bahan yang digunakan untuk membuat pakan fermentasi adalah limbah pohon pisang, bawang hitam, temulawak, jagung, dedak, tepung ikan, dan bungkil kelapa. Semua bahan digiling menjadi tepung, diaduk rata, difermentasi menggunakan larutan Effective Microorganisms 4 (6ml EM4: 6gram gula: 1 liter air). Penelitian ini dirancang dengan rancangan acak lengkap dengan 4 perlakuan yaitu lama fermentasi (1, 2, 3, dan 4 hari) dan 5 ulangan. Parameter yang diamati adalah kandungan nutrisi (bahan kering, bahan organik, protein kasar, serat kasar, dan lemak kasar) dan energi metabolis.
Hasil: Hasil penelitian menunjukkan bahwa lama fermentasi nyata mempengaruhi (P<0.05) kandungan zat makanan pakan yang dihasilkan. Fermentasi selama 3 hari nyata menurunkan kandungan bahan kering, serat kasar, bahan ekstrak tanpa Nitrogen dan energi metabolis. Lama fermentasi tidak nyata mempengaruhi kandungan bahan organik dan lemak kasar, tetapi nyata meningkatkan kandungan protein kasar.
Kesimpulan: Disimpulkan bahwa pakan yang mengandung limbah batang pisang yang difermentasi menggunakan EM4 selama 3 hari memiliki kandungan zat makanan yang cukup terutama protein (20%) dan memungkinkan untuk diberikan kepada ayam lokal fase pertumbuhan di Desa Sidolego guna memenuhi kebutuhan zat makanannya. Disarankan agar hasil penelitian ini ditindaklanjuti pada pemberian pakan pada ayam lokal yang dipelihara di Desa Sidolego untuk mengetahui pengaruhnya terhadap performa ayam tersebut.

Kata Kunci: Ayam kampung; Desa Sidolego; Kualitas gizi; Limbah tanaman pisang; Pakan fermentasi

Abstract

Objective: This study aims to determine the nutritional quality of fermented feed containing banana plant waste that will be given to native chickens in Sidolego Village to accelerate the achievement of Sidolego Village as a chicken center village.

Methods: The ingredients used to make fermented feed were banana tree waste, black garlic, curcuma, maize, rice bran, fish meal, and coconut meal. All ingredients were ground into flour, mixed thoroughly, and fermented using a solution of Effective Microorganisms 4 (6ml EM4: 6gram sugar: 1-liter water). The study was designed into a completely randomized design with 4 treatments; length of fermentation (1, 2, 3, and 4 days) and 5 replications. The parameters were the nutrient content (dry matter, organic matter, crude protein, crude fiber, and crude fat) and metabolizable energy.
Results: The results showed that the fermentation time significantly affected ($P<0.05$) the nutrient content and energy of fermented feed. Fermentation for 3 days significantly decreased dry matter, crude fiber, nitrogen-free extract, and metabolizable energy. The fermentation period did not significantly affect organic matter and crude fat content, but it significantly increased crude protein content.
Conclusions: It was concluded that feed containing banana tree waste fermented using EM4 for 3 days had sufficient nutrients especially crude protein content (20%) and might be offered to the growing local chickens in Sidolego Village and meet their nutrient requirement. It is recommended that the results of this study be followed up on feeding to local chickens kept in Sidolego Village to know its effect on local chicken performance.

Keywords: Kampung chicken; Sidolego Village; Nutritional quality; Banana tree waste; Fermented feed

INTRODUCTION

Local chickens kept by the community in Sidolego Village are still carried out semi-intensively and the feed provided has not met the livestock needs as shown in Table 1 that the feed contained very low protein (8%), energy (1670 kcal/kg), and high crude fiber (22%), so it could not meet the needs of chickens and becomes a limitation in its use. The farmers do not feed commercial feed due to the fluctuating prices and tend to be expensive. Besides, in the commercial feed is still the presence of antibiotics. Untari *et al.* [1] reported that the commercial feed circulating in the chicken farms in Sleman was still detected to contain antibiotics growth promoter with the detection of antibiotics in the digestive tract of chickens. The use of antibiotics in feed might lead to antibiotic resistance [2], the detection of antibiotic residues in poultry products [3], and could compromise human and animal health.

Low protein content in the diet will cause chicken growth slow, low energy will cause chickens to eat continuously to meet energy needs so that feed costs will highly increase. High crude fiber will cause the feed cannot be digested so that it cannot be utilized by chicken. Therefore, it is necessary to assist villagers in producing fermented feed which is containing banana tree waste for local chickens so that the resulting fermented feed has good quality, can replace commercial feed whose prices tend to rise and fluctuate, reducing production costs, speeding up time, ultimately increasing family income.

Banana Tree waste is a lot of waste not only in villages, suburbs but also in cities, including in Sidolego Village. The Central Statistics Agency of Jambi Province [4] reported that the production of bananas in Jambi in 2019 was 4,233,500 tons. This means that many banana trees are planted in Jambi Province so that banana tree waste is easy to obtain.

Several previous researchers reported that banana stems contain several phytochemical compounds, namely saponins [5], glycosides, and terpenoids as well as tannins [6]. According to Raharjo and Andaka [5] and Ashok and Upadhyaya [7], saponins, flavonoids, and tannins in banana stems had antibacterial effects. Wenas *et al.* [8] reported that the presence of antibacterial substances in the banana tree might inhibit the growth or kill pathogenic bacteria such as *Staphylococcus aureus* and *Pseudomonas aeuroginosa.* The content of active compounds in bananas such as phenolics, biogenic amines carotenoids, phytosterols [9], and banana stems [10] indicates that banana trees have the opportunity to be used as antimicrobials for poultry feed ingredients, especially free-range

Table 1. Nutrient composition of fermented feed containing banana tree waste

Nutrient	Value
Dry matter (%)	90.96
Organic matter (%)	60.52
Crude protein (%)	8.35
Crude fibre (%)	22.04
Crude fat (%)	11.51
Nitrogen free extract (%)	18.62
Metabolizable energy (Kcal/kg)	1670.04

Integrated Laboratory Faculty of Animal Science, Universitas Jambi (2020)

chickens. However, the high content of crude fiber causes this waste could not be utilized optimally. According to Kusmiyati *et al.* [11], banana stems contained 44.6% cellulose, 36.0% hemicellulose, and 19.4% lignin. Therefore, it was needed to increase the nutritional value of banana tree waste such as through the fermentation [12-14] using Effective Microorganisms 4 (EM4).

EM4 is a mixed culture of various microorganisms including photosynthetic bacteria, lactic acid bacteria, actinomycetes, and yeast that can be used as inoculum [15]. Azizah *et al.* [16] stated that the bacteria Lactobacillus sp. has the main function of degrading protein which are lactic acid bacteria have a proteolytic system capable of hydrolyzing proteins into peptides and amino acids. The addition of EM4 could reduce the fiber content of the feedstuff [17]. According to Saini *et al.* [18], actinomycetes can produce enzymes that can hydrolyze lignocellulose and hemicellulose so that it will reduce the fiber content of the substrate. The addition of EM4 in the fermentation process of dry solid organic sludge served to increase the growth of microorganisms so that they can work optimally in breaking down unsplit cells and increasing the crude protein content. The crude protein content of dry solid organic sludge fermented using EM4 for 3 days (72 hours) was higher than that of fermentation for 1 and 2 days, the protein content increased with the longer fermentation process [19]. Suryani *et al.* [20] stated that the length of fermentation time affects the protein and crude fiber content. In line with the opinion of Wu *et al.* [21] who state that one of the factors that can affect the nutritional value of fermented products is the length of fermentation time. Based on those reasons, a study was conducted to determine the effect of fermentation time using EM4 on the nutritional quality of fermented feed containing banana plant waste that will be given to native chickens in Sidolego Village to accelerate the achievement of Sidolego Village as a chicken center village.

MATERIALS AND METHODS

Preparation of feed fermentation

This study was conducted in Sidolego Village and Integrated Laboratory Faculty of Animal Science, Universitas Jambi. The materials used in this study were banana tree waste (stem, leaf, and stalk), rice bran, maize, coconut meal, fish meal, curcuma, black garlic (Table 2). The solution of EM4 was made of 6 g granulated sugar, 1000 ml water, and 6 ml EM4 (effective microorganisms 4) for livestock produced by PT. Songgolangit Persada which is containing *Lactobacillus casei, Saccharomyces cerevisiae* and *Rhodopseudomonas palustris*. The equipment used was silo, stirrer, mixer, miller, measuring glass, scale, and apparatus for proximate analysis. All the ingredients were ground to flour and kept in the silo. Thereafter, it was mixed with EM4 solution with comparison 20 kg ingredients mixed with 2 liters EM4 solution and fermented for 1–4 days according to the treatments.

Table 2. The ingredients of fermented feed contained banana tree waste

Feedstuff	Percentage (%)
Maize	40
Rice bran	17
Coconut meal	15
Fish meal	15
Banana tree waste (stem, leaf, and stalk)	10
Black garlic	2
Curcuma	1
Total	100

Table 3. Nutrient composition of feed before fermentation

Nutrient Content	Value
Dry matter (%)	85.93
Organic matter (%)	76.04
Crude fiber (%)	8.93
Crude fat (%)	4.91
Crude protein (%)	16.73
Nitrogen free extract (%)	45.47
Metabolizable energy (Kcal/kg)	2508.60

Research design and data analysis

The study was designed into a Randomized Completely designed with 4 treatments and each was replicated 5 times. The treatments were fermentation time; 1, 2, 3, and 4 days, respectively. They were:

- T1 = fermentation time for 1 day,
- T2 = fermentation time for 2 days,
- T3 = fermentation time for 3 days,
- T4 = fermentation time for 4 days.

The measured parameters were the nutrition content of feed fermented such as dry matter, organic matter, crude protein, crude fiber, and crude fat. Metabolizable energy was calculated based on Janssen [22]. For the comparison, the feed without mixing with EM4 solution was also analyzed the nutritive content and metabolizable energy. Proximate analysis was carried out based on AOAC [23]. Analysis of variance was used to analyze data and the significant effect between treatment means was analyzed by Duncan's Multiple Range Test [24].

RESULTS

Nutrient composition and metabolizable energy of fermented feed

The nutrient content of feed containing banana tree waste (stem, leaf, stalk), rice bran, maize, coconut meal, fish meal, Curcuma, black garlic before fermentation is listed in Table 3. Effect of fermentation time on the nutrient composition and metabolizable energy of fermented feed as shown in Table 4. Fermented feed was higher in nutrient content and metabolizable energy than before fermentation. However, among treatment groups, a longer fermentation time resulted in decreasing energy content. Fermentation time until 4 days significantly ($P<0.05$) affected nutrient content (dry matter, crude fiber, crude protein, and nitrogen-free extract) and metabolizable energy of fermented feed among the treatment group. The fermentation period did not significantly ($P>0.05$) affect the organic matter and fat content

Table 4. Nutrient composition and metabolizable energy of feed fermentation contained banana tree waste

Parameter (%)	Treatment			
	T1	T2	T3	T4
Dry matter	90.01±1.89^{b}	88.80±1.68^{b}	85.45±4.21^{a}	84.74±3.43^{a}
Organic matter	81.88±2.03	80.73±2.46	77.32±4.52	76.28±3.74
Crude fiber	8.66±1.88^{a}	8.83±2.18^{a}	5.94±1.40^{b}	6.35±1.37^{b}
Crude fat	2.30±1.25	2.59±1.19	2.09±1.25	2.91±0.65
Crude protein	17.90±1.33^{b}	18.40±2.36^{b}	20.81±1.68^{a}	20.47±1.64^{a}
Nitrogen free extract	53.02±3.33^{a}	50.91±2.72^{ac}	48.48±3.53^{bc}	46.55±5.80^{b}
Metabolizable energy (Kcal/kg)	2655.95±128.78^{a}	2616.46±81.44^{a}	2582.63±207.95^{b}	2553.05±157.58^{b}

Means±SD. Different superscrifts in the same row show significant differences (P<0.05). T1 = fermentation time for 1 day, T2 = fermentation time for 2 days, T3 = fermentation time for 3 days, and T4 = fermentation time for 4 days

of the fermented feed. The content of crude fiber of fermented feed decreased up to 3 days of fermentation and the protein content increased. Extending the fermentation time until 4 days resulted in a decrease in protein content but increased crude fiber content. The dry matter content, nitrogen-free extract, and metabolizable energy significantly decreased (P<0.05) when the time of fermentation extended.

DISCUSSION

Changes in the content of nutrients and energy in fermented feed using microbes such as those contained in EM4 namely photosynthetic bacteria, lactic acid bacteria (*Lactobacillus sp*), actinomycetes, and yeasts [25] might be due to the development and the microbial activity were influenced by the level of inoculant and fermentation time [26]. The levels of inoculant were related to the number of microbial populations to determine whether or not they developed quickly on the substrate, while microbial growth was characterized by the length of time it took. It was reported that the protein content of coffee peel fermented for 5 days using 5% probiotic resulted in higher protein content than the lower dose. While to reduce crude fiber of coffee peel needed a longer time, namely 7 days of fermentation. It was similar to Neha *et al.* [27] and Wardah and Tatang [28] who found that microbial activities especially photosynthetic bacteria and *Lactobacillus sp.* needed more time and conditions to grow. Mirzah and Muis [29] reported that microbe's reproduction and growth required energy and it could come from the substrate used to produce water and CO2. As a result, the water content in the fermented product increases so that the dry matter content decreases. Besides, during the fermentation process, microbes in the EM4 secreted protease enzymes, and microbes themselves were a source of single-cell protein, thus, protein content might increase. The increasing crude protein content of fermented feed might also be due to the large number and types of microbes in EM4, thus, more microbes can break down the complex's feed ingredients such as banana tree waste and rice bran become simpler. Then, the microbes might be used to multiply themselves. Moreover, in the process of fermentation, there was the addition of sugar as a source of energy for the microbes to grow and their activities. A similar statement was stated by Rahmatullah *et al.* [30] who found that Banana kepok's peel fermented by EM4 at a dose of 5% and 5 day fermentation time had water and crude protein content higher, dry matter and crude fiber lower than that of other doses (1 and 3%) and fermentation time (3 and 7 days). The higher the dose of EM4 and the longer the fermentation time resulted in more microbial growth, so, the more microbes worked producing single-cell protein and metabolized carbohydrates. These activities

would produce water, steam and increase protein content. The decreasing crude fiber might be caused by EM4 consisting of cellulolytic bacteria which produce cellulose enzymes.

CONCLUSION

It was concluded that feed containing banana tree waste fermented using EM4 for 3 days had sufficient nutrients especially crude protein content (20%) and might be offered to the growing local chickens in Sidolego Village and meet their nutrient requirement.

It is recommended that the results of this study be followed up on feeding to local chickens kept in Sidolego Village to know its effect on local chicken performance.

CONFLICT OF INTEREST

The authors of this manuscript declare that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript. The funder (Universitas Jambi) had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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