AJARCDE
ASIAN JOURNAL OF APPLIED RESEARCH FOR COMMUNITY DEVELOPMENT AND EMPOWERMENT

Journal home page: http://ajarcde-safe-network.org ISSN 2581-0405

Substitution of fermented coffee skin in commercial feed on the growth of pigs aged 1-3 months

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ARTICLE INFO

Article History:
Received: 31 March 2023
Final Revision: 11 May 2023
Accepted: 14 May 2023
Online Publication: 15 May 2023

KEYWORDS

Feed substitution, fermented coffee skin, growth of pigs.

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A B S T R A C T

Catur Kintamani Village is one of the village areas in Kintamani-Bangli District, besides its cool climate as an Arabica coffee producing area and has received a Geographical Indication Certificate (GIS). Several coffee processing companies have developed, one of which is UPP. Catur Paramita is a business unit of Subak Abian Kenjung Sari. The problem is that coffee skin waste has not been utilized which can disrupt the environment. One alternative solution to the problem is processing coffee husk waste through fermentation using local microorganism (LMO) probiotics from coffee husks for animal feed. The purpose of this study was to determine the extent to which the appearance response of sows given fermented coffee husk waste as a substitute for commercial feed can affect the appearance of sows in the growth phase. The method used to achieve this goal is the experimental design method and the design used in this study was a completely randomized design (CRD) with 3 treatments, namely: Po (without coffee husk waste), P1 (5% substitution of coffee husk waste), and P2 (substitution of 10% coffee husk waste). Each treatment was repeated 3 times. The results showed a significant effect ($P<0.05$) substitution of fermented coffee husk waste in commercial feed on the growth of pigs aged 1-3 months. The greater the number of substitutions for coffee skin waste up to 10% (P2) had a significant effect ($P<0.05$) with an increase in body weight of 12.76 kg compared to without substitution (Po) only 7.89 kg and substitution of coffee skin waste 5% (P1) of 10.98 kg. Still, between P1 and Po the difference was not significantly ($P>0.05$). It can be concluded that substituting commercial feed with fermented coffee husk waste using local microorganisms (LMO) coffee skin as much as 10% significantly improves body weight gain at 1-3 months.

1. INTRODUCTION

Administratively, Catur Village is located in Kintamani District, Bangli Regency, with an area of 366.59 km2 and a population of 7,863 [1]. In Bali, Robusta coffee is widely cultivated in the Tabanan area. In contrast, Arabica coffee is widely grown in the Bangli area, especially in Kintamani, which has a Geographical Indication Specification (GIS) certificate because of its excellent taste and is well known abroad. In agro-climate, Bangli Regency is very suitable for the growth of Arabica coffee plants which requires an area with an altitude between 900 m above sea level - 1700 m above sea level and a temperature between 160C - 200C people. Arabica coffee production in 2020 in Bangli Regency reached 2,249 tons (53.68%) of the total arabica coffee production in Bali Province [2]. With cool geographical conditions, Catur Kintamani Village is estimated to produce 250 tons of coffee annually for wet processing and 25 tons for dry processing (natural). The wet process of coffee (wet process) with fermentation produces better quality than other methods without fermentation.

Agricultural waste fermentation technology has been widely developed, and one of the potential fermentation processes can be carried out on coffee skin waste as animal feed. The coffee rind contains nutrients including 6.6% crude protein, 18.28% crude fiber, 1.0% fat, 0.21% calcium, and 0.03% phosphorus [3]. According to [4] unfermented coffee skin contains dry matter 88.92, crude protein 8.76, energy (Kcal/kg) 3892, crude fat 1.29, organic matter 91.85, ash 8.15, 29.65 crude fiber, 0.53 calcium, and 0.10 phosphorus. In addition to the nutrients in the coffee skin, there are anti-nutritional substances, namely tannin, caffeine, lignin, and high crude fiber so it is very influential on livestock if given in unfermented conditions. In addition to the nutrients contained in the coffee skin, there are anti-nutritional

substances, namely tannin, caffeine, lignin, and high crude fiber it is very influential on livestock if given in unfermented conditions so that fermentation needs to be carried out to increase the nutritional value by converting complex raw materials into raw materials simple with the help of microbes. Coffee skin contains cellulose, hemicellulose, and lignin as plant constituent bonds that comprise the structure and plant cells as much as 52.59%, as inhibitors of metabolic processes in livestock [5], [6]. Through the fermentation process, coffee skin can be used as feed ingredients because they contain a fairly high crude protein, namely 11.18%, and crude fiber 21.74% so it can be used as a limiting factor [5], [7]. The calcium and phosphorus content in coffee skins is needed by livestock, especially in growth [8].

From community service activities by the Matching Fund Team in 2021 at UPP Catur Paramita, experiments have been carried out to ferment coffee skin waste using several types of probiotics, namely EM-4, Bio-Bali Tani, Aspergillus niger, and local microorganisms (LMO) coffee skin. After a laboratory analysis test, it turns out that the fermentation of coffee husk waste can significantly improve the quality of coffee skin waste, especially the crude protein (CP) content. The best results were crude protein content by fermentation using probiotic LMO coffee skin of 17.67%, which was significantly higher (P<0.05) than other probiotics, namely EM-4 (12.54%), Bio-Bali Tani (13.83%) and *Aspergillus niger* (11.56%) (Table 1).

Therefore, in this study, we wanted to determine how the response and appearance of sows given fermented coffee husk waste using LMO coffee skin as a substitute for commercial feed on the appearance of pigs.

2. MATERIALS AND METHODS

2.1 Place and time research

This research was conducted in the UPP Catur Paramita pig pen in Catur Village, Kintamani, Bangli Regency. The research activity was carried out for 3 months from May to July 2022.

2.2 Desain experimental

The design used in this experiment was a Completely Randomized Design (CRD) with 3 levels of substitution treatment of fermented coffee husk waste, namely: Po (control without coffee skin), P1 (giving 5 % coffee husk), and P2 (giving 10% coffee husk). Each treatment was repeated 3 times, so the number of experimental units used was 12 pigs. Each experimental unit animal was placed in an experimental cage plot of 1.5 m x 2 m. The laboratory analysis results of coffee husk waste fermentation using several types of probiotics on nutrient content, as shown in Table 1 [9].

Table 1. The Effect of Probiotics on the Quality of Fermented Coffee Skin Waste

No	Parameter	Jenis Probiotik			
		P1	P2	P3	P4
1	Water content (%)	37.09[a]	36.24[a]	42.65[a]	37.90[a]
2	Dry matter (DM) content (%)	62.87[a]	62.00[a]	51.42[a]	51.44[a]
3	Ash (%)	12.76[a]	12.71[a]	12.44[a]	10.24[a]
4	Crude Fiber (CF) content (%)	19.44[a]	19.28[a]	19.24[a]	19.18[a]
5	Crude Protein (CP) content (%	12.54[a]	13.83[a]	17.67[b]	11.56[a]

Description: P1: EM-4 probiotic, P2: Bio Bali Tani probiotic, P3: LMO coffe waste probiotic, P4: *Aspergilus niger* probiotic

Each cage unit is automatically equipped with a feed and drinking water installation on the cage wall. The coffee skin fermentation process uses local microorganisms (LMO) from coffee husks and molasses, with a ratio of 100 kg of coffee skin: 1 liter of LOM, 1 liter of molasses, and the fermentation time is carried out for 2 weeks. The results of laboratory analysis of commercial feed on nutrient content are as shown in Table 2.

Table 2. Results of Laboratory Analysis of Pig Livestock Commercial Feed Growth Phase

No	Parameter	P-0	P-1
1	Water content (%)	11.68	11.29
2	Dry matter (DM) content (%)	88.32	88.71
3	Ash (%)	8.14	9.81
4	Crude Fiber (CF) content (%)	4.73	7.60
5	Crude Protein (CP) content (%)	17.84	14.61

2.3. Research variable

The variables measured to determine the effect of substitution of fermented coffee husk waste on commercial feed on the growth of pigs were: initial body weight, body weight at 2 months of age, body weight at 3 months of age, additional weight at 2 months of age, and additional body weight at 3 months of age.

2.4. Statistical analysis

The data were statistically analyzed using analysis of variance (ANOVA) according to the design used. If the treatment has a significant effect, proceed with the 5% BNT test. Data processing was carried out with the help of Microsoft Excel, Minitab, and SPSS Software Programs.

3. RESULT AND DISCUSSION

3.1. Results

The results showed a significant (P<0.05) substitution of fermented coffee husk waste in commercial feed on the growth of pigs aged 1-3 months. The greater the number of substitutions for coffee skin waste up to 10% (P2) had a significant effect (P<0.05) with an increase in body weight of 12.76 kg compared to without substitution (Po) only 7.89 kg and substitution of coffee skin waste 5%. (P1) of 10.98 kg, but between P1 and Po the difference was not significant (P>0.05) (Table 3).

Table 3. Growth of Pigs aged 1-3 months given the substitution of fermented coffee husk waste with LMO coffee husk

Variable	Substitution of coffee skin waste		
	P0 (0%)	P1 (5%)	P2 (10%)
Initial weight at 1 month (kg)	9.07a	8.27a	8.93a
Weight 2 months (kg)	0.16b*)	11.65a	12.90a
Additional body weight (kg)	1.09b	3.38a	3.97a
Weight 3 months old (kg)	16.96b	19.25b	21.69a
Additional body weight (kg)	6.86b	7.60b	8.79a
Additional body weight aged 1-3 Months (kg)	7.89b	10.98b	12.76a

3.2. Discussion

Growth is one of the changes that occur in livestock, including changes in body length, volume, and mass [10], and growth as an increase in the weight of organs or body tissues, bones, and fat in an animal [11]. The initial body weight of the research pigs aged

https://doi.org/10.29165/ajarcde.v7i2.259

1 month was the same, statistically not significantly different (P>0.05) in the 8.27-9.07 kg range. The weaning weight of 1-month-old pigs in this study was still higher than the statement of [12] of 7.14 kg, and the statement of [13] of 7.54 kg which was influenced by the environment and maintenance management and the feed provided. At the age of 2 months, the substitution of fermented coffee husk waste in commercial feed obtained body weight and body weight gain was higher at the level of 5% (P1) and 10% (P2) statistically significantly different (P<0.05),, but between P1 and P2 were not significantly different (P>0.05). The highest body weight was shown in treatment P2 (10% substitution) at 12.90 kg and body weight gain of 3.97 kg. This indicates that with the addition of coffee husk waste for pigs and meeting protein needs, fermented coffee skin waste using MOL contains a fairly high protein in the range of 17.4% [9], and the completeness of nutrients from other elements is sufficient. From the results of laboratory tests on the nutritional content of commercial feed given to pigs growing phase (P-0), the crude protein content is almost the same as that of fermented coffee husk waste, as much as 17.8380 % (Table 2). Based on the laboratory analysis results, the fulfilment of crude protein from substituting fermented coffee skin waste and other nutritional requirements has been fulfilled. This is to the statement of [14] that the increase in pigs' body weight gain is largely determined by the completeness of nutrients in the feed. Research by [8] found that fermented coffee rind, besides the high N content, also contains many macro-mineral elements, especially potassium. This element is needed by livestock as a component of cell formation so that the increase in the body weight of animals is higher. Although coffee rind contains several anti-nutritional substances such as caffeine, tannin, lignin, and polyphenols [15], after the fermentation process, these elements can be reduced so that they become beneficial for the growth of pigs. Pigs as monogastric livestock, and the ability to digest crude fiber and lignin is very limited. Still, after fermentation, the bonds that make up the crude fiber and lignin can be broken down to make them easier to digest. According to [16], coffee husk waste has a dry matter digestibility of 44.51% and an organic matter digestibility of 42.16%, so fermentation can be increased. From the research [17] giving fermented coffee husk using, Aspergillus niger to broiler chicken feed can significantly increase ration consumption and increase body weight. [18] stated that giving coffee husks at the level of 25% as a substitute for corn in chickens can give good results. Meanwhile, giving fermented coffee skin using probiotics to local chickens up to 73.29% positively affected carcass composition. Giving fermented coffee skin as much as 30% and giving legumes as Gamal and calliandra gave the best growth for Etawah crossbreed goats [19].

At the age of 3 months, fermented coffee husk waste substitution on commercial feed resulted in higher body weight with increasing substitution level of coffee husk in commercial feed. The substitution of coffee husk waste at 10% was very significantly the highest (P <0.05) with a body weight of 21.69 kg compared to without substituting fermented coffee skin of only 16.96 kg. Based on the body weight, the increase in body weight of prospective sows aged 1-3 months is very significant for the 10% treatment of coffee husk substitution, the highest is 12.76 kg compared to only 7.89 kg without coffee skin. This confirms the statement of [8], [5]; and [20] that the use of fermented coffee rind in feed for livestock in addition to being able to meet the nutritional needs needed, with mineral content, can increase metabolic processes. Feeding fermented coffee skin, okara, and beef bones significantly affects broiler chicken feed consumption, daily body weight gain, and feed conversion [21]. From the research of [22] and [23] supplementation of energy and protein sources in the basal feed of corn tempi and coffee husks gave weight gain of easy rams 90 g/head/day. According to [24], coffee husk waste fermented with local microorganisms positively affects feed consumption, body weight gain, and feed conversion. It can be used as an alternative feed ingredient of up to 30% in buffalo concentrate.

4. CONCLUSION

The use of fermented coffee rind waste using MOL from the coffee rind as a substitute for commercial feed significantly increased the growth of pigs aged 1-3 months. Substitution of fermented coffee husk for commercial feed as much as 10% had a significant effect on the highest body weight gain of pigs aged 1-3 months

ACKNOWLEDGMENT

The authors would like to thank the Research Institute of Warmadewa University and the research team and students who have helped and supported the implementation of this research.

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