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Performance of Balinese Pigs Fed with Banana Stem and Lamtoro (*Leucaena leucocephala*) Leaf-Based Diets Fermented for Different Durations in the Sukanadi Women Farmer Group

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ABSTRACT

Balinese pigs are one of the livestock commodities that the community has raised. However, their maintenance is still carried out traditionally by utilizing makeshift feed ingredients in the vicinity, so the appearance of Balinese pigs is not optimal with indicators, and their growth is still below the NRC standard. With simple maintenance, the weight gain of local pigs can only be achieved 180-260 gr/head/day, which is still below the NRC standard of 500-750 gr/head/day. Therefore, efforts must be made to increase weight gain by improving feed quality through fermentation. This study aims to improve the performance of local Balinese pigs by treating feed with various fermentation times from surrounding materials such as banana stems, forage, and complete feed mixtures (rice bran, fine corn, and concentrates). This study used a complete randomized design with fermented feed treatment with variations in fermentation time, namely feed without fermentation (F0), feed fermented for 14 days (F1), and feed fermented for 28 days (F2). Each treatment used 3 Balinese/local pigs of 2-3 months old weaning age with a weight range of 10-12 kg. The banana stem and lamtoro leaf-based feedstuffs fermented for 28 days showed significant results or the best on the performance of Balinese pigs.

Contribution to Sustainable Development Goals (SDGs):

SDG 1: No Poverty

SDG 2: Zero hunger

SDG 9: Industry, Innovation, and Infrastructure

SDG 12: Responsible Consumption and Production

SDG 13: Climate Action

SDG 15: Life on Land

1. INTRODUCTION

1.1 Research Background

The pig farming sector in Bali still occupies an important position in rural communities. Pigs are one of the livestock commodities the community keeps for a long time. The pig farming business

in Bali is primarily traditional farms that raise pigs on a small/household scale between 2 and 3 heads.

Many traditional farmers in rural areas still choose Balinese pigs to raise because they are very suitable for Balinese housewives as piggy banks or "tatakan banyu." After all, with simple feeding and utilization of kitchen waste (banyu and so on), Balinese pigs have been able to provide weight gain even though it is not optimal. Nevertheless, Balinese pigs are still widely kept in rural areas because they have a very important socio-cultural



status. Many ceremonial activities and *upacara* materials use pork, such as *babi guling*. In addition to meeting the needs for religious ceremonies, pork is also used in various social activities.

Along with the increasing market demand, it is not matched by efforts to improve the productivity and performance of Balinese pigs, especially in terms of weight gain, quality, and quantity of feed, because local pig farms in Bali still rely on local agricultural waste and surrounding forage as the main feed. They cannot afford to buy commercial feed because it is costly. The primary agricultural wastes are banana stems and rice bran, while the forage given according to the potential found in the study area is lamtoro leaves. Usually, the ingredients are mixed and then given after boiling.

Banana stems are one of the agricultural wastes produced from harvested banana plants that can be used as alternative feed ingredients. Banana stems have a low crude protein content ranging from 4.81 - 5.9% and high crude fiber ranging from 26.6 - 31.3%, so banana stems are classified as low-quality feed ingredients. The high oil fiber content in banana stems is due to the high lignin content that affects the work of microbial enzymes in digesting food substances [1]; the results of Ref. [2] showed a decrease in crude fiber content and an increase in crude protein content of banana stems fermented for 15, 18, and 21 days, while lamtoro leaves are leguminous that contain very high crude protein, which ranges from 25-30% and crude fiber around 15-23% and contains anti-nutritional substances myosin.

Efforts are made to increase crude protein content, reduce crude fiber content, and eliminate anti-nutritional substances, so it is necessary to carry out a fermentation process. Fermentation is a process of chemical changes in the substrate through the work of enzymes produced by microorganisms [3], which will increase crude protein content and reduce crude fiber. One of the factors affecting the increase in crude protein and decrease in oil fiber is the length of the fermentation process [2].

Based on the above, there is still no information about research on the length of fermentation time up to 28 days, so these results can add to the repertoire of science, especially in utilizing banana stem waste and lamtoro leaves to be of higher quality, which is used to improve the performance of Balinese pigs. Thus, the formulation of feed based on banana stems and lamtoro leaves with different fermentation times can be an appropriate technology for farmers in the Sukanadi Women Farmers Group and surrounding areas.

1.2 Research Objective

This research aims to evaluate the impact of different fermentation durations of banana stem and lamtoro (*Leucaena leucocephala*) leaves as feed ingredients on the performance of Balinese pigs

2. MATERIALS AND METHODS

2.1 Location and Duration of Research

This research was conducted at the Sukanadi Women Farmers Group in Pejarakan Village, Gerokgak Sub-district, Buleleng Regency, 125 km from the provincial capital. This research was conducted for 6 months.

2.2 Research Tools and Materials

This study used nine weaned Balinese pigs aged 2-3 months with an initial weight of 10-12 kg. The materials needed are feed ingredients (banana stalks, lamtoro leaves, and complete feed mixture), booster probiotics, molasses, and supplements. The tools required are livestock scales, feed scales, feeding and drinking places, and cage plots.

2.3 Research methods

This study used a completely randomized design (CRD) with three treatments, namely unfermented feed (F0), feed fermented for 14 days (F1), and feed fermented for 28 days (F2). Each treatment had three replicates, resulting in 9 pigs.

The feed consisted of 70% banana stems, 20% lamtoro leaves, and 10% complete feed (a mixture of 50A% % rice bran, 25% fine corn, and 25% concentrate). The feed ingredients were chopped, weighed according to the percentage of the mixture, and then stirred evenly. After that, the feed that has been mixed is not fermented, and some are fermented for 14 days (F1) and 28 days (F2). Feed was given as much as 10% of body weight every day and twice in the morning and evening. Drinking water is provided ad libitum.

The variables observed were initial weight, final weight, body weight gain, ration consumption, and Feed Conversion ratio (FCR). Direct weighing was done every 2 weeks for 4 months.

1. Initial body weight: pigs were weighed at the beginning of the study.
2. Final body weight: pigs were weighed at the end of the study.
3. Weight gain per day: final body weight minus initial body weight, then divided by the length of observation time.
4. Feed consumption per day: total feed consumption during observation divided by the length of observation time.
5. Feed conversion ratio: the amount of feed consumed divided by weight gain.

2.4 Data analysis

To determine whether there are differences between the treatments tried, the data obtained in this study were analyzed using analysis of variance. If there are significant differences ($P < 0.05$), then it will be continued with Duncan's Least Significant Difference test [4].

3. RESULT AND DISCUSSION

3.1 Results

The implementation of the study began with the preparation of fermented feed 28 days before the study for feed with code F2, 14 days before the study for feed with code F1, and then making unfermented feed with code F0 using plastic bags, each treatment (F0, F1, and F2) as many as 60 plastic bags for feeding during the study (60 days). In this study, the quality of fermented feed was tested according to the length of fermentation time with the results presented in Table 1.

Table 1. Quality Test of Nutritional Content of Banana Stem and Lamtoro Leaf-Based Feed Fermented with Different Times

Contents	Fermentation Time		
	0 days	14 days	28 days
Dry Matter (%)	37.27	30.16	20.33
Crude Protein (%)	7.89	10.86	17.82
Crude Fiber (%)	21.34	18.74	16.98
Crude Fat (%)	1.01	0.90	0.78
BETN	55.20	55.00	52.75

Description: Laboratory of Animal Food Nutrition, Faculty of Animal Husbandry, UNUD

The results of the Balinese pig performance study (initial body weight, final body weight, weight gain, ration consumption, and ration conversion) given banana stem and lamtoro leaf-based feed fermented for different times are presented in Table 2.

Table 2. Average Performance of Balinese Pigs Fed Banana Stem and Lamtoro Leaf-Based Feeds Fermented for Different Times

Variables	Treatment		
	F0	F1	F2
Initial Body Weight (kg/head)	14.03 ^a	13.70 ^a	14.40 ^a
Final Body Weight (kg/head)	22.38 ^a	23.07 ^b	25.48 ^b
Weight Gain (g/head/day)	139.47 ^a	56.17 ^a	184.67 ^a
Ration Consumption (g/head/day)	1480.12 ^a	1500.48 ^a	1560.95 ^a
Feed Conversion Ration	10.64 ^a	9.61 ^a	8.45 ^a

The result show that there is a significant difference in the final body weight variable ($P < 0.05$). In contrast, the ration consumption variable is not significantly different ($P > 0.05$). In the final, body weight between F1 and F2 treatments was significantly different ($P < 0.05$) with F0 treatment, while between F1 and F2 treatments were not significantly different ($P > 0.05$) (Table 2).

The highest final body weight was shown by treatment F2 whose feed ingredients were fermented for 28 days (25.48 kg), while F0 (22.38 kg) and F1 (23.07). Likewise, the highest final body weight gain was shown by treatment F2 (184.67 g/head/day) while F0 (139.17 g/head/day) and F1 (156.17 g/head/day). The high final body weight and Daily Weight Gain (PBBH) in the F2 treatment compared to the F0 and F1 treatments was due to the nutrient content in the F2 treatment, especially crude protein (PK) of 17.82% higher and crude fiber (SK) of 16.98% lower than in the F0 treatment (PK = 7.89% and SK = 21.34%) and F1 treatment (PK = 10.86% and SK 18.76%). The low final body weight and PBBH in the F0 and F1 treatments was due to the low content of PK nutrients in F0 7.89% and in F1 10.86% and the high content of SK in F0 = 21.34% and in F1 = 18.76%. This is following the opinion of Basuki [5] (2002) and Sihombing [6](2006) that pigs in the grower phase are a period that must be considered for their food substance needs and high-quality feed and meet the pig's standards. According to Ref. [7] NRC (1998) that the protein requirement for pigs weighing 10-50 kg in the grower phase is around 20% and the crude fiber is 7-8% so as to get PBBH between 500-700 gr/head/day, but if it is below the

standard then the PBBH is 180-260 g/head/day. This is also confirmed by the opinion of Ref. [8], who reported that the feed consumed by local pigs on Timor Island with a protein content of 14% and crude fiber of 17.5% resulted in very slow growth. Furthermore, it is said that pigs do not optimally digest rations containing high crude fiber because the pig digestive system is simple, so it is not allowed for pigs to be fed with high oil fiber.

The variable feed consumption in this study was not significantly different, this may be due to one of them being the content of nutrients. Following the opinion of Ref. [9] that the high and low feed consumption is generally influenced by palatability and energy in the ration. Furthermore, Ref.[10] stated that feed consumption increases when the energy content is low, and if feed consumption decreases, the energy content is high. Ref. [11] stated that one aspect that determines the high and low quality of feed is the protein and energy content. According to Ref. [12], the fermentation process can increase the content of nutrients and protein, increase digestibility and energy, and reduce the value of crude fiber.

In the feed conversion variable pigs given fermented feed for 28 days are 8.45, meaning that to increase 1 kg of body weight, Balinese pigs will consume 8.45 kg of feed. So giving longer fermented feed up to 28 days is more effective and efficient for the scale of the livestock business. Feed conversion in F2 is lower because ration consumption in each treatment is not significantly different (F0 = 1480.12 g/head/day, F1=1500.48 g/head/day, F2=1560.95 g/head/day). However, Balinese pigs with F2 treatment can provide a more optimal/higher final body weight or PBBH, so the ration conversion is the lowest.

4. CONCLUSION

Based on the results of this study, it can be concluded that banana stem-based feed ingredients and lamtoro leaves fermented at different times show real significance ($P < 0.05$) on the performance of Balinese pigs and feed ingredients fermented for 28 days show significant results or the best on the performance of Balinese pigs. Based on the results of this study with fermentation for 28 days with fermented feed ingredients based on 70% banana stems, 20% lamtoro leaves, and a mixture of bran, corn flour, and 10% concentrate which then the mixture is given as much as 10% of the body weight of Balinese pigs showed the highest and significantly different compared to those not fermented and those fermented for 14 days. However, with fermented feed for 28 days, although it gives the most optimal results, namely during the observation for 60 days, the highest weight gain is 11.08 kg, but judging from the feed conversion value, it is still very high at 8.45, meaning that to achieve a weight gain of 1 kg, the livestock eats as much as 8.45 kg so that in terms of livestock business it is still less efficient. So further research is needed to reduce the ration conversion value to be lower and more efficient. Therefore, further research needs to be carried out with 28-day fermented feed ingredients given to Balinese pigs at 5%, 10% and 15% of body weight. In this follow-up research, the target output is in the form of performance and economic business analysis so that the most profitable local pig business efficiency will be obtained.

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