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The Effect of Fermented Coffee Husk on The Growth Performance of Biromaru Kampung Chicken

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ABSTRACT

This study aimed to determine the effect of providing fermented coffee husk waste on the growth performance of Biromaru Kampung chickens. The high price of conventional feed has led to the exploration of more economical alternatives, one of which is the utilisation of agricultural waste, such as coffee waste. The nutritional value of coffee husk waste can be increased and its antinutrient content reduced through fermentation using microorganisms. The study was carried out for six weeks in Palu, Central Sulawesi, using a Completely Randomized Design (CRD) consisting of four treatments and five replications: P0 (basal feed), P1 (90% P0 + 10% non-fermented coffee waste), P2 (90% P0 + 10% fermented coffee waste with *Saccharomyces cerevisiae*), and P3 (90% P0 + 10% fermented coffee waste with Effective Microorganisms 4). Feed consumption, body weight gain, and feed conversion ratio were measured as the variables of interest. The results indicated that feed consumption was significantly increased in treatments P1 and P3, while body weight gain and feed conversion ratio were not significantly affected. Providing fermented coffee waste as an alternative feed for Biromaru Kampung chickens resulted in a significant increase in feed consumption, particularly in treatments P1 (10% non-fermented coffee waste) and P3 (10% fermented coffee waste with Effective Microorganisms 4). Although body weight gain did not differ significantly between treatments, there was a tendency for an increase in P1 and P3. Additionally, treatment P3 demonstrated the best feed conversion efficiency compared to the other treatments. Overall, fermented coffee husk waste has the potential to increase feed consumption and efficiency. However, its impact on body weight gain still needs further research to understand the mechanism of its influence in more depth.

Keywords: Kampung chicken, coffee husk, feed consumption, body weight gain, feed conversion ratio.

INTRODUCTION

The high cost of conventional feed is a significant challenge in the livestock industry. This situation has prompted farmers to seek more economical alternative feed sources (Akhiriani & Nurhayati, 2015). One widely considered solution is the utilisation of agricultural waste as an alternative feed, which not only reduces production costs but also helps address environmental issues (Husin *et al.,* 2020).

Sigi Regency, located in Central Sulawesi, is one of Indonesia's major coffee-producing regions. Coffee plantations in this area are primarily managed by smallholder farmers, with coffee serving as the primary commodity. (Borman *et al.,* 2023). The coffee processing industry in the region generates large quantities of waste, including coffee waste (husk), which is often left unused and allowed to accumulate, posing environmental concerns.

Coffee husk waste has potential as a feed ingredient due to its abundance and nutrient content. However, its utilisation is limited by its high crude fibre content and the presence of anti-nutritional compounds such as tannins and caffeine. Aswanto *et al.*, (2023). These factors reduce digestibility and limit its effectiveness as a feed for animals. Fermentation has been identified as a promising method to overcome these limitations. Previous studies have shown that fermentation can reduce crude fibre content. (Nuraya et al., 2016), Increase nutritional value (Daning & Karunia, 2018), and enhance protein content while reducing anti-nutrients Yanuarianto *et al.,* (2024) The use of microorganisms such as *Effective Microorganisms 4* and *Saccharomyces cerevisiae* during fermentation can further improve the quality of coffee husk waste by breaking down complex compounds into simpler, more digestible forms. (Christo & Sutedja, 2024).

Biromaru Kampung chicken is a local breed widely raised in the area for its adaptability and meat quality. The inclusion of fermented coffee husk waste in the diet of these chickens is expected to support growth performance and

provide a sustainable feed alternative. Although some studies have investigated the use of fermented coffee waste in poultry diets, research specifically targeting Biromaru Kampung chickens remains limited.

Therefore, this study aims to evaluate the effect of fermented coffee husk waste on the growth performance of Biromaru Kampung chickens. The findings are expected to provide scientific insights into the potential use of agricultural waste as an alternative feed ingredient, supporting both economic and environmental sustainability in local poultry production.

MATERIALS AND METHODS

Time and Research Site

This research was conducted over a six-week period in Palu City, Central Sulawesi. Research sample data was maintained and collected in Loru Village, Sigi Biromaru District, Sigi Regency. Meanwhile, coffee husk waste was fermented in the Animal Nutrition and Feed Lab, Faculty of Animal Husbandry and Fisheries, Tadulako University.

Research Design

This study used an experimental method with a Completely Randomised Design (CRD). The study consisted of four treatments, including basal feed and feed from coffee husk waste, with different fermentors, and each treatment was repeated four times. The treatments in this study were:

P0: Basal feed

P1: 10% feed from non-fermented coffee husk waste + 90% basal feed

P2: 10% feed from fermented coffee husk waste Saccharomyces cerevisiae + 90% basal feed

P3: 10% feed from fermented coffee husk waste, Effective Microorganisms 4 + 90% basal feed

Fermentation Process

The fermentation of coffee husk waste using Effective Microorganisms 4 and *Saccharomyces cerevisiae* was carried out under aerobic conditions. Coffee husk waste was mixed with water until a moisture content of 50–60% was achieved. Effective Microorganisms 4 R and *Saccharomyces cerevisiae* were then added at 0.5–1% of the dry weight of each mixture. The mixture was stirred thoroughly and left in an open container or in a container with good air circulation to support the activity of aerobic microorganisms. Fermentation was conducted for 14 days at a room temperature of 25–30°C. After the fermentation process, the materials were ground and used as components in Kampung chicken rations.

Nutrient Content of Fermented Coffee Husk Waste

Table 1. Proximate analysis of fermented coffee husk waste

Sample type	Water content (%)	Crude fat (%)	Crude protein (%)	Crude fibre (%)	Ash content (%)
Effective Microorganisms 4	10.39	15.06	19.76	7.47	6.01
Saccharomyces cerevisiae	11.31	16.41	17.23	8.34	6.89

Description: Proximate analysis results of the Animal Nutrition and Feed Laboratory, Faculty of Animal Husbandry and Fisheries, Tadulako University 2024.

Kampung Chicken Maintenance

In this study, 28 Kampung chickens were used during the grower phase and were housed in 14 battery cages. Each cage was occupied by two chickens (duplo) and was equipped with feed and a drinking water source. Before the study commenced, the treatment feed was given to the Kampung chickens for adaptation. After the adaptation process, the initial weights of the chickens were measured again for further analysis.

Ration Distribution

The rations were prepared as basal feed and provided to Kampung chickens twice daily, at 08:00 AM and 5:00 PM. The feed was placed in a feeder, allowing the chickens to eat independently. The basal feed was formulated as a mixture of feed ingredients designed to meet the nutritional requirements of Kampung chickens during the growth phase. Corn was used as the primary source of carbohydrates and nutrients. Bran was included to supply fibre and additional nutrients. Soybean meal was added as a source of vegetable protein to support muscle development,

and fish meal was incorporated as a source of animal protein rich in essential amino acids. Additionally, vegetable oil was included as a fat source to provide extra energy and facilitate the absorption of vitamins. These ingredients were mixed in specific proportions to produce rations that aligned with the nutritional needs of Kampung chickens. The composition of the feed ingredients and the nutrient content of the rations are presented in the following table.

Table 2. Nutrient content of research rations

Feed ingredients	P0	P1	P2	P3
Yellow corn	46	42	42	42
Rice bran	38	33	33	33
Coffee husk waste	0	10	10	10
Soybean meal	9	8	8	8
Fish meal	5	5	5	5
Oil	1	1	1	1
CaCo3	1	1	1	1
Total	100	100	100	100
Feed nutrient content				
Crude protein (%)	14.77	14.67	15.2	15.55
Crude fibre (%)	3.94	5.67	4.30	4.25
Crude fat (%)	3.53	4.91	4.91	4.82

Table 3. Nutritional requirements of native chickens according to SNI 2013

Nutrition Feed	Age Chicken (Sunday)		
	0- 3 Starter Phase	4- 6 Grower Phase	7-10 Finisher Phase
Energy (kcal/kg)	2,900.00	2,800.00	2,600.00
Protein (%)	18-19.00	15- 17.00	12- 14.00
Fat rough (%)	4-6.00	4- 6.00	4- 6.00
Crude Fibre (%)	4.00	4- 6.00	4- 6.00
Calcium (%)	0.90	0.90	1- 1.20
Methionine (%)	0.45	0.30	0.30
Lysine (%)	0.90	0.90	0.65

Observed Variables

The variables observed in this study are:

Rations Consumption

Ration consumption is the ability of livestock to consume rations used in their body metabolism. Rations are measured by subtracting the amount of ration given (grams) from the remaining amount (grams).

According to Razak et al., (2016) The formula that states ration consumption is as follows:

$$RC = RG - RR$$

With the caption:
RC = Ration consumption (grams)
RG = Ration given (grams)
RR = Remaining ration (grams)

Body weight gain

Kampung chicken body weight gain refers to the increase in chicken body weight over a specific period, measured in grams per bird or week. (Tajudin *et al.,* 2021) . It is calculated by subtracting the body weight at the end of the second week (in grams/head) from the body weight at the beginning of the first week (in grams/head) (Pakaya & Zainudin, 2019).

According to Razak *et al.* (2016) The formula for body weight gain is as follows:

$$BWG = FBW - IBW$$

With the caption:
BWG = Body Weight Gain (grams)
FBW = Final Body Weight (grams)
IBW = Initial Body Weight (grams)

Feed conversion ratio

Feed conversion ratio obtained from the division between the number of rations consumed and the weight gain in the same weight units and time. (Utami & Pantaya, 2016).

According to Razak *et al.* , (2016) The formula for body weight gain is as follows:

$$FCR = \frac{\text{Feed consumption (gram)}}{\text{Body Weight Gain (gram}}$$

With Description:
Ration Conversion = Efficiency of ration use
Ration Consumption (grams) = Amount of rations consumed
Body Weight Gain = Increase in animal weight

Data analysis

Data were analysed using analysis of variance (ANOVA). If there is a significant effect, further tests of Duncan's Real Distance (JNTD), Least Real Difference (LSD), or Honestly Real Difference (HSD) are carried out, according to the value of the Coefficient of variation (CV).

RESULTS AND DISCUSSION

Table 4 presents the study's results on body weight gain, feed consumption, and feed conversion of Biromaru Kampung chickens during the growing phase, along with the results of the analysis of variance (ANOVA).

Feed Consumption

The results of the study showed that the addition of coffee husk waste without fermentation and with fermentation had a significant effect ($p<0.05$) on ration consumption. The average obtained in this study was 683.5375 grams/bird/week. This phenomenon may be attributed to the palatability or the degree of preference for the ration. Several factors, including the aroma, taste, texture, and colour of the feed, influence palatability. It represents a functional characteristic of feed ingredients, determined by their inherent physical and chemical properties. (Septian *et al.*, 2022) .

Coffee husk waste, especially that which has been fermented, undergoes changes in its chemical structure, such as the degradation of antinutrient compounds or an increase in volatile components, which can enhance the sensory appeal of the feed. Syariah *et al.* (2024)It was stated that the fermentation process can produce compounds, such as organic acids or aromas, that are preferred by livestock, thereby stimulating appetite and increasing feed consumption. This suggests that changes in the chemical and physical structure of coffee husk waste play a crucial role in enhancing palatability, which in turn significantly impacts increasing feed intake.

Body weight gain

The results indicated that the addition of coffee husk waste, whether fermented or non-fermented, did not significantly affect the body weight gain of Kampung chickens ($p > 0.05$). The average weekly weight gain across treatments was 83.20 grams per bird, suggesting that the inclusion of coffee waste meal, regardless of fermentation status, yielded comparable growth performance. In treatment P2, a decrease in body weight gain was observed, corresponding with lower feed consumption. Conversely, treatments P1 and P3 demonstrated increased body weight gain, which aligned with higher feed intake levels. These patterns suggest that variations in feed consumption may account for the differences in growth performance among treatments.

Previous studies have established a strong association between feed intake and body weight gain, emphasising the role of both quantity and nutritional quality of feed. Razak *et al*., (2016). Reported that weight gain is generally influenced by feed consumption and its nutrient composition, while Lantowa *et al*., (2021).

Table 4. Weight gain, ration consumption, and ration conversion of Biromaru Kampung chickens in the grower phase and the results of analysis of variance (ANOVA)

Observed variables	Treatment				Average	p-value
	P0	P1	P2	P3		
Feed consumption (grams/bird/week)	613.35 [b]	698.46 [a]	664.18 [a]	683.53 [a]	664.38	$p < 0.05$
Body weight gain (grams/bird/week)	82.9	90.57	66.00	93.42	83.72	$p > 0.05$ (ns)
Feed Conversion Ratio	7.81	8.18	11.35	7.37	8.68	$p > 0.05$ (ns)

Description: P0 basal feed, P1 10% unfermented coffee husk waste, P2 10% coffee + fermented *Saccharomyces cerevisiae*, P3 10% coffee + fermented Effective Microorganisms 4.

healthHighlighted the positive correlation between feed intake and growth in broiler chickens. Furthermore, diets containing high-quality protein contribute to improved weight gain by supporting optimal metabolic function and overall health. From a practical perspective, these findings suggest that coffee husk waste, when incorporated at a 10% ratio, whether fermented or not, does not adversely impact growth performance and can serve as a sustainable alternative feed ingredient. However, its effectiveness appears to depend on factors influencing feed intake, underscoring the importance of palatability and nutrient bioavailability in ration formulation. (Teguh *et al.*, 2023)

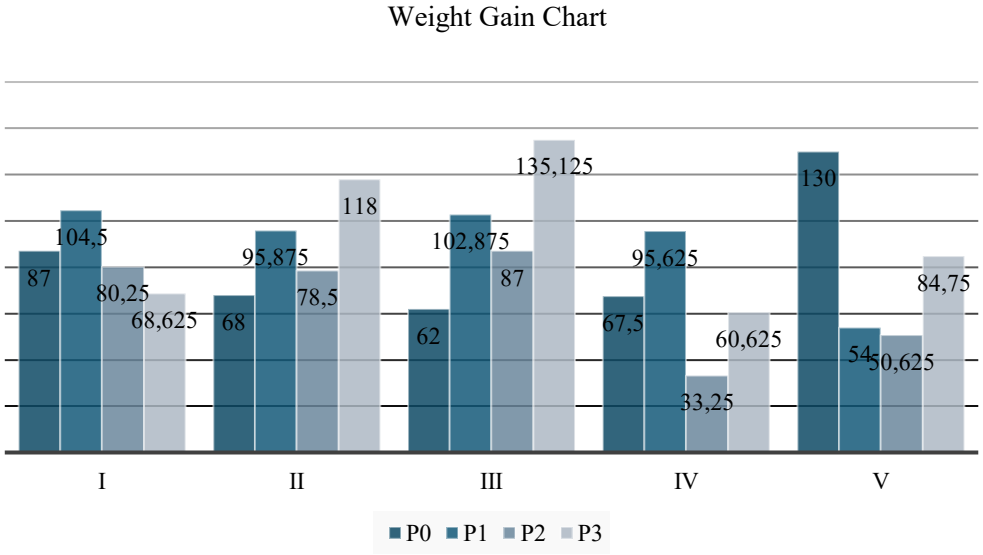

Figure 1. Body Weight Gain Chart

Feed conversion ratio (FCR)

The results of the study demonstrated that the inclusion of coffee husk waste, both fermented and non-fermented, in the ration did not significantly affect the feed conversion ratio (FCR) ($p > 0.05$). The average FCR recorded across treatments was 8.68. FCR is a key indicator of feed efficiency, where lower values signify more effective conversion of feed into body mass, and thus, more economical feed utilisation (Setiyono *et al.,* 2015).

Among the treatments, P3, supplemented with 10% fermented coffee husk waste using Effective Microorganisms 4, achieved the lowest FCR value of 7.37, suggesting a relatively higher feed utilisation efficiency compared to the other groups. This improved efficiency may be attributed to enhanced nutrient availability and digestibility resulting from the fermentation process. The fermentation likely reduced anti-nutritional factors and improved the palatability of the ration, supporting better feed intake and utilisation.

According to Dharmawati & Widaningsih (2022), FCR serves as a measure of livestock productivity, defined as the ratio between feed intake and weight gain over a given period. These findings indicate that the use of 10% fermented coffee husk waste, particularly when processed with Effective Microorganisms 4, has the potential to maintain or even improve feed efficiency in Kampung chickens without compromising growth performance.

CONCLUSION

Providing fermented coffee waste as an alternative feed for Biromaru Kampung chickens resulted in a significant increase in feed consumption, particularly in treatments P1 (10% non-fermented coffee waste) and P3 (10% fermented coffee waste with Effective Microorganisms 4). Although body weight gain did not differ significantly between treatments, there was a tendency for an increase in P1 and P3. Additionally, treatment P3 demonstrated the best feed conversion efficiency compared to the other treatments. Overall, fermented coffee husk waste has the potential to increase feed consumption and efficiency. However, its impact on body weight

gain still needs further research to understand the mechanism of its influence in more depth.

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