
Substitution of Fermented Coffee Skin in Commercial Feed and Addition of Alkaline Water on The Growth of Super Local Chicken

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Abstract

This study aims to determine the effect of using fermented coffee husks as substitute feed and at what level it affects the growth of super-free-range chickens. The research method was carried out using a completely randomized design factorial pattern consisting of 2 factors. The first factor consisted of 3 treatments of fermented coffee skin substitution, namely: K0 = 100% commercial feed, K1 = 95% commercial feed + 5% substitute for fermented coffee skin, K2 = 90% commercial feed + 10% substitute for fermented coffee skin. The second factor consisted of 2 treatments of giving drinking water, namely: A0 = without giving alkaline water, A1 = giving alkaline water with a concentration of 20% in drinking water. The results showed that the substitution of fermented coffee skin on commercial feed had a significant effect on body weight gain in the fifth week. Meanwhile, weight gain at weeks 1, 2, 3, 4, 6, and final weight had no significant effect. Carcass weight and carcass composition had no significant effect but the K1 treatment always gave the highest average. The treatment with alkaline water had no significant effect, the average weight gain was always higher in treatment A1. Based on the results of the study, it can be concluded that the substitution of fermented coffee husks in commercial feed for free-range chicken had a significant effect on body weight gain in the fifth week, but on other variables such as final weight and composition of carcass parts had no significant effect. Meanwhile, the addition of alkaline water and without alkaline water had no significant effect, but the addition of alkaline water had a higher average value for both growth and carcass parts. Substitution of fermented coffee skin on commercial feed as much as 5% showed better results than without substitution and 10% substitution.

Keywords: *Fermented Coffee Skin, Alkaline Water, Super Local Chicken.*

1. Introduction

Super free-range chicken or superior local broiler chicken is the result of crosses between free-range chicken and purebred chicken, and has faster growth than local free-range chicken, so people call it super free-range chicken [1]. The chicken farming business has a pretty good prospect with increasing demand for meat due to increased income and knowledge about fulfilling family nutrition. Super native chicken meat is a good source of animal protein [2].

Maintenance of free-range chickens requires quality feed to fulfill their nutrition to get optimal results. However, the reality faced by breeders today is that the price of commercial feed in the market is very expensive. Feed ingredients that need to be used as alternative feed ingredients include agricultural or plantation waste, one of which is a fermented coffee waste as substitute feed for super free-range chickens. The results of research by [3] showed that coffee husk waste contained 6.67% crude protein, 18.28% crude fiber, 1.0% fat, 0.21% calcium, and 0.03% phosphorus. The availability of this amount of material in areas in Indonesia, and has not been utilized properly, so the fermentation process can increase crude protein [4]. Furthermore, from the quality test of fermented coffee skin using 4 types of probiotics, it was found that the use of Local Micro-Organisms (MOL) probiotics showed good results with a crude protein (CP) content

of 17.67%. The results of a study by [5] said that fermenting coffee pods could increase the crude protein content from 6.11% to 12.56% and reduce the crude fiber content from 18.69% to 11.05%. According to [6] that the use of coffee berry skin fermented with *Aspergillus niger* in rations had a significant effect ($P < 0.05$) on body weight gain, slaughter weight, and carcass weight of broiler chickens.

Alkaline water is water that has been treated so that it reaches acidity in a pH size of 8 to 9 or more than 9, pH is the degree of acidity or wettability of a solution, and the pH of healthy water to drink should be between 8.5 – 11.5. A high pH in drinking water can make the blood pH also alkaline or alkaline, which is believed to make the body healthier, alkaline water has a pH of more than 7 and is an antioxidant that can repair cell damage, alkaline water is water that shows a high pH compared to tap water [7]. The benefits of alkaline water in health according to [8] is that alkaline water has been recognized by the Korean and Japanese governments as a drink that is efficacious for improving abnormal intestinal fermentation, chronic diarrhea, hyperacidity in the stomach, and dyspepsia. [9] stated that intake of alkaline ionized water has various beneficial effects such as removal of reactive oxygen species, reducing constipation, restraining accumulation of fat in the body, reducing skin damage due to ultraviolet rays, modulating the immune system, and improving diabetes. Based on the background above, it is necessary to conduct research with the title of substitution of fermented coffee skin using Local Micro-Organisms (MOL) on commercial feed and provision of alkaline water on the growth of super-free-range chickens.

2. Materials and Methods

2.1. Place and Time Research

This research was conducted for 2 months from 16 October to 28 December 2022. This research was carried out at the Agro Learning Center (ALC) experimental garden, Gang Raya No. 5, Peguyangan Kangin, North Denpasar District, Denpasar City, Bali 80115.

2.2. Research Materials

The study was conducted using a completely randomized design (CRD) factorial pattern consisting of 2 factors. The first factor consisted of 3 treatments of giving or substituting fermented coffee skins, namely: K_0A_0 = 100% commercial feed (without the addition of alkaline water), K_1A_0 = The ratio of the addition of 5% coffee skin (without the addition of alkaline water), K_2A_0 = The ration of the addition of 10% coffee skin (without adding alkaline water), K_0A_1 = 100% commercial feed (+ 20% alkaline water), K_1A_1 = 5% coffee skin addition (+ 20% alkaline water), K_2A_1 = 10% coffee skin addition (+ 20% alkaline water) (%). The composition of the rations and the nutritional content of the treatment rations is shown in Table 1. Each treatment was repeated 3 times and each treatment experimental unit used 5 chickens, so the number of chickens used was $18 \times 5 = 90$ chickens.

Table 1. Rations Nutritional Content

Feed Type	Water Content	Dry Weight	Ash Content	Crude Fiber	Crude Protein	Organic Material	Energy (Kcal/kg)
Commercial Feeds	3.68	13.26	1.42	13.61	24.42		4.13
Substitution 5%	5.40	13.56	2.06	13.84	24.15	90.53	13.71
Substitution 10%	7.12	13.85	2.70	14.08	23.89	90.88	13.17

2.3. Research Variable and Data Analysis

The variables observed were: initial weight, weekly weight gain, final body weight, carcass percentage, and carcass part weight. The data obtained were analyzed by analysis of variance, if there were significantly different results ($P < 0.05$) then proceed with the smallest real distance test from Duncan.

3. Results and Discussion

3.1. Super Village Chicken Growth

Based on Table 2, it can be seen that the substitution of fermented coffee skin on commercial feed for growth from the first week to the sixth week had the highest significant body weight gain ($P < 0.05$). While the weight gain in the first, second, third, fourth, sixth week, and final weight had no significant effect ($P > 0.05$), 5% substitution always showed the highest average value of 242.92 g/head and was significant ($P > 0.01$) higher than without substitution 215.88 g/head and 10% substitution 210.21 g/head (Figure 1). 10% substitution the average value tends to decrease much lower than without substitution and 5% substitution, especially in the final weight. In Figure 1, it can be seen that the addition of fermented coffee skin increased growth every week.

Table 2. Substitution of Fermented Coffee Skin in Commercial Feed on the Growth of Super Free-range Chicken

Variable	Treatment		
	K ₀	K ₁	K ₂
Initial Weight (g)	127.88 ^{a1)}	124.25 ^a	128.11 ^a
The first week of weight gain (g)	170.43 ^a	176.16 ^a	168.30 ^a
The second week of weight gain (g)	173.76 ^a	181.64 ^a	175.51 ^a
Third week of weight gain (g)	178.31 ^a	189.51 ^a	183.46 ^a
Fourth-week weight gain (g)	199.71 ^a	207.74 ^a	198.59 ^a
The fifth week of weight gain (g)	215.88 ^b	242.92 ^a	210.21 ^b
Sixth-week weight gain (g)	216.64 ^a	253.29 ^a	217.85 ^a
Final Additional Weight (g)	1061.34 ^a	1092.68 ^a	1057.66 ^a

Information: Different letters behind the numbers on the same line show a significant effect ($P > 0.05$); K₀: Without fermented coffee skin substitution; K₁: 5% fermented coffee skin substitution; K₂: 10% fermented coffee skin substitute.

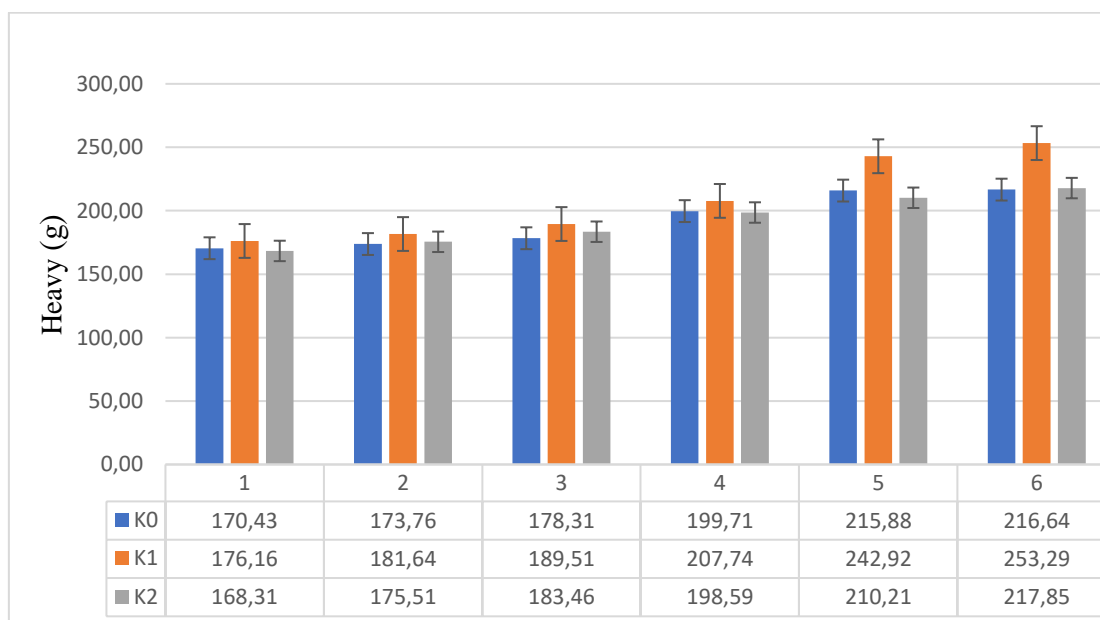


Figure 1. Effect of Coffee Skin Substitution on Weight Gain Every Week.

Substitution of fermented coffee skin and alkaline water on commercial feed on the growth of super free-range chickens. It was seen that the addition of 5% coffee skin had a significant effect ($P < 0.05$) on weight gain in the fifth week and tended to have the highest average value from the first week to the first week. end. This is closely related to the nutritional content of fermented coffee husks, especially the protein content in 5% substitute fermented coffee husks in the ration composition which is higher than that of commercial feed. With a fermented coffee skin protein content of 19.18%. Body weight gain is the difference between initial body weight and final body weight over a certain time [10] states body weight gain is a measurement of body weight in poultry which is done once a week. It is further explained that body weight gain is used to assess the growth of livestock responses to various types of feed, the environment, and the maintenance procedures applied. Some research results show that the growth and productivity of free-range chickens are affected by the balance of protein and metabolic energy in feed, [11]. A good ration must have quality and quantity and contain protein according to the needs of livestock [12]. Village chickens aged 10 weeks with a crude protein ration of 16% and metabolic energy of 2,900 kcal / kg can reach body weights of up to 770 ± 35 g [13].

Higher protein content in rations treated with 5% coffee skin substitution compared to 10% without substitution and 10% substitution, because coffee skin processing by fermentation can increase the crude protein content by 0.97% and reduce the crude fiber content by 1.36% [14]. The results of [15] stated that coffee pod fermentation increased the crude protein content from 6.11% to 12.56% and decreased the crude fiber content from 18.69% to 11.05%. Thus, if the fulfillment of protein and energy balance is fulfilled, then growth will be better, the results of research by [14] stated that in poultry that was given rations with a balanced nutritional content, growth in body weight would be more. The level of protein digestibility depends on the protein content of the feed ingredients and the amount of protein that enters the digestive tract. High protein consumption will be followed by high protein retention and body weight gain will occur if the energy in the ration is sufficient.

The alkaline water treatment showed no significant effect ($P > 0.05$), but the alkaline water treatment showed that the average weight gain was always higher (Table 3). From the research results, the weight gain from the first week to the fourth week did not seem to have a significant effect ($P > 0.05$). In Table 3 it is clear that the addition of alkaline water to drinking water by 20% from week 1 to week 6 and the final added weight shows an average value that is always higher.

Table 3. Adjustment of Alkaline Water in Drinking Water on the Growth of Super Kampung Chicken

Variable	Treatment	
	A ₀	A ₁
Initial Weight (g)	129.46 ^{a1)}	124.04 ^a
The first week of weight gain (g)	169.05 ^a	174.22 ^a
The second week of weight gain (g)	173.51 ^a	180.43 ^a
Third week of weight gain (g)	178.78 ^a	188.74 ^a
Fourth-week weight gain (g)	198.74 ^a	205.28 ^a
The fifth week of weight gain (g)	218.77 ^a	227.24 ^a
Sixth-week weight gain (g)	225.78 ^a	232.73 ^a
Final Additional Weight (g)	1065.41 ^a	1075.71 ^a

Information: The same letter behind the number on the same row shows no significant effect ($P > 0.05$)

A₀: Without adding alkaline water to drinking water; A₁: Adding alkaline water to drinking water

When viewed from the alkaline water treatment, the alkaline water treatment had no significant effect ($P > 0.05$), however, the A₁ treatment gave the highest average values for live weight, blood weight, offal weight, and carcass weight which were always higher (Table 3). Alkaline water is water that shows a high pH compared to tap water [7]. The health benefits of alkaline water

according to [16] is that alkaline water is reported that intake of water ionized by alkali has various beneficial effects such as the removal of reactive oxygen species, reducing constipation, restraining accumulation of fat in the body, maintaining the body's immune system, repairing diabetes, prevent disease.

3.2. Carcass Percentage

Substitution of fermented coffee husks on commercial feed had no significant effect on carcass weight and carcass percentage ($P>0.05$), however, 5% carcass weight substitution tended to be the highest at 970.50 g/head compared to no substitution and 10% substitution respectively 968.2 and 969.5 g/head respectively, but at a lower carcass percentage of 80.50% compared to 81.37% without substitution (Table 4). The lower carcass percentage was affected by the weight of offal and blood weight in the 5% coffee skin substitution treatment (Table 4).

Table 4. Substitution of Fermented Coffee Skin in Commercial Feed for the Percentage of Carcass Body Parts of Super Free-range Chicken

Variable	Treatment		
	K ₀	K ₁	K ₂
Live Weight (g)	1178.34 ^a	1216.83 ^a	1252.26 ^a
Blood Weight (g)	32.92 ^b	35.53 ^a	31.33 ^b
Offal Weight (g)	123.62 ^b	126.42 ^a	124.42 ^b
Carcass Weight (g)	968.20 ^a	970.50 ^a	969.50 ^a
Carcass Percentage	81.37 ^a	80.50 ^a	77.31 ^a

Information: The same letter behind the number on the same row shows no significant effect ($P>0.05$)

When viewed from the effect of giving alkaline water to carcass weight and carcass percentage, there was no significant effect ($P>0.05$), but the tendency of giving alkaline water to drinking water tended to reduce the percentage of carcass and non-carcass parts (Table 5). On average for all variables measured (live weight, non-carcass weight, and carcass percentage), the addition of alkaline water was always lower but not significantly different ($P>0.05$) (Table 5).

Table 5. Addition of Alkaline Water to Drinking Water on the Percentage of Carcass Body Parts of Super Free-range Chicken

Variable	Treatment	
	A ₀	A ₁
Live Weight (g)	1239.42 ^{a1)}	1192.19 ^a
Blood Weight (g)	34.66 ^a	31.87 ^a
Offal Weight (g)	126.29 ^a	123.34 ^a
Carcass Weight (g)	1003.67 ^a	913.02 ^a
Carcass Percentage (%)	82.42 ^a	68.84 ^a

Information: The same letter behind the number on the same row shows no significant effect ($P>0.05$).

The higher the coffee skin substitution, it can be seen that the growth of super-decreased free-range chickens, where giving 10% coffee skin substitution in commercial feed is lower than 5% substitution, even lower than without substitution. This is due to the very limited ability of chickens to digest crude fiber because the crude fiber content in the ration is higher than 5% substitution and no substitution. Coffee skin waste contains 6.67% crude protein, 18.28% crude fiber, 1.0% fat, 0.21% calcium, and 0.03% phosphorus [17]. Coffee skin has the disadvantage that it contains high crude fiber which can cause a decrease in digestibility, especially for poultry [18]. [19] using up to 10% level shows broiler chickens are still able to use fermented coffee skins efficiently because the crude fiber content of the ration is still at the tolerance limit, but at the

15% and 20% levels it is already inefficient because it contains Ration crude fiber has reached 5.55% and 6.64%. The high crude fiber in the ration will cause the rate of food ingredients in the digestive tract to be faster so that the opportunity for the small intestine to absorb nutrients is lower so that the livestock's needs are not met.

Judging from the final weight, carcass weight, and carcass percentage in 5% and 10% substitutions have the highest average value compared to no substitution. This is closely related to the weight of the offal and the weight of the blood where the coffee skin contains high crude fiber, with high crude fiber, the volume of feces in the innards is more in the coffee skin. These results are by the opinion of [6] that the use of fermented coffee pod skin still contains high crude fiber in the ration which affects body weight gain, slaughter weight, and carcass weight of super free-range chicken. The high crude fiber content in a substrate is a weakness. Crude fiber is a component of the cell wall that is difficult to digest. Crude fiber consists of cellulose, hemicellulose, and lignin, so the high amount of crude fiber digested by food will affect the composition of chicken carcasses [20].

The lower average live weight, carcass weight, and carcass percentage were caused by the dose of alkaline water in drinking water. Where giving high doses can reduce appetite in chickens resulting in decreased body weight, carcass weight, and carcass percentage. Alkaline water provides benefits for body health, preventing disease, and immune resistance. This will affect digestion in chickens, and the digestive system in the body, and will affect growth and productivity. This alkaline water can be used for external medicine, germ killer, or disinfectant. Alkaline water is water that is alkaline or has a pH above 7. Alkaline water has ingredients that are beneficial to the body, such as being rich in minerals and active hydrogen ions. These active hydrogen ions produce natural antioxidants that can generate energy and protect body cells optimally from the threat of free radicals [21]. Several studies of alkaline water have shown a positive effect on improving several disease states through modulating the body's immune cells, alkaline water is also useful in preventing disease in the body with appropriate doses [22].

3.3. Carcass Weight

Carcass weight in the treatment of fermented coffee skin substitution showed a significant difference ($P < 0.05$). The 5% fermented coffee peel substitution treatment (K_1) showed the highest results on carcass parts with a wing weight of 221.10 g/head, significantly higher than without substitution (K_0) 192.20 g/head. Meanwhile, for breast weight, giving 5% fermented coffee skin substitution was not significantly higher ($P < 0.05$) than without substitution, and giving fermented coffee skin substitution at 10% (K_2) had no significant effect ($P > 0.05$) with substitution 5%, even at chest weight tends to be lower (Table 6).

Table 6. Substitution of Fermented Coffee Skins in Commercial Feed for the Carcass Weight of Super Free-range Chicken

Variable	Treatment		
	K_0	K_1	K_2
Thigh Part Weight(g)	289.12 ^{a1)}	274.30 ^a	264.33 ^a
Wing Part Weight(g)	192.20 ^a	221.10 ^b	258.15 ^b
Chest Weight (g)	310.10 ^a	325.12 ^a	284.88 ^a
Head Section Weight(g)	55.52 ^a	51.15 ^a	55.10 ^a
Neck Section Weight (g)	65.75 ^a	54.12 ^a	54.08 ^a
Leg Part Weight (g)	62.32 ^a	52.20 ^a	53.02 ^a

Information: The same letter behind the number on the same row shows no significant effect ($P > 0.05$)

Judging from the effect of giving alkaline water (A_1), wing weight was significantly higher ($P < 0.05$) than without alkali (A_0), while other parts such as thighs, chest, head, and neck giving alkaline water had no effect (Table 7).

Table 7. Addition of Alkaline Water to Drinking Water on the Composition of Super Kampung Chicken Carcasses

Variable	Treatment	
	A ₀	A ₁
Thigh Part Weight(g)	264.30a ¹⁾	263.20 ^a
Wing Part Weight(g)	190.16 ^a	211.11 ^b
Chest Weight (g)	358.13 ^a	277.04 ^b
Head Section Weight(g)	48.84 ^a	59.02 ^b
Neck Section Weight (g)	64.08a	51.68 ^a
Leg Part Weight (g)	60.02a	51.07 ^a

Information: Different letters behind numbers in the same row show a significant effect ($P < 0.05$), while the same letters behind numbers in the same row show no significant difference ($P > 0.05$)

Giving coffee skin substitution as much as 5% had a significant effect ($P > 0.05$) on breast weight and thigh weight but had no significant effect ($P > 0.05$) on wing weight. Giving 10% coffee skin substitution gave average values on breast weight, thigh weight, and wing weight respectively 284.88 g / head, 264.33 g / head, and 258.15 g / head, without substitution it was lower but statistically showed no significant effect ($P > 0.05$) on 5% and 10% coffee skin substitution. The carcass is part of the poultry body without blood, feathers, neck, head, shank, and internal organs except for the lungs and kidneys, the carcass is composed of fat, skin tissue, bones, meat, and fat [23]. This is in line with research [24]. The ratio is one of the important factors to produce good quality and carcass weight. To provide good carcasses in terms of quantity and quality, it is necessary to improve the quality of the feed given. The percentage of carcasses in chickens can be affected by the feed. The percentage of native chicken carcasses aged 6-12 weeks is around 56.63% -58.7% [25]. According to [26] the higher the carcass weight produced, the higher the weight of the physical composition of the carcass produced.

The administration of alkaline water gave the highest average value in treatment A₁ on the wings of 211.11 g/head but there was no significant difference ($P > 0.05$) with the treatment without giving alkaline water 190.16 g/head. In the chest and thighs, the treatment without alkaline water treatment tended to be higher with an average value of 358.13 g/head and 264.30 g/head respectively but there was no significant difference ($P > 0.05$) with alkaline water 277.40 g/head, 263.20 g/head. In the treatment without adding alkaline water, the neck weight gave the highest value but was not significantly different ($P > 0.05$) from the weight of the legs, but the head weight tended to be the lowest, the treatment with alkaline water was not significantly different ($P > 0.05$). The high and low parts of the carcass were caused by the administration of high doses and the quality of drinking water resulting in a decrease in carcass weight. In terms of quality requirements, drinking water must comply with the provisions stipulated where there are two parameters, namely mandatory parameters and additional parameters which include chemical, microbiological, physical, and radioactivity requirements [27]. The quality of drinking water can determine the growth of super-native chickens to obtain optimal productivity.

4. Conclusion

Substitution of fermented coffee husks in commercial feed for free-range chickens affected body weight gain in the eighth week, but it did not affect other variables such as final weight and carcass composition. Meanwhile, the addition of alkaline water and without alkaline water had no effect, but the addition of alkaline water had a higher average value for both growth and carcass parts. Substitution of fermented coffee husks on commercial feed as much as 5% showed better results than without substitution and 10% substitution. There was no interaction between fermented coffee skin substitution and alkaline water administration on the growth of super free-

range chickens, but the 5% treatment with fermented coffee skin substitution and alkaline water administration with a concentration of 20% gave the highest average value.

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