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Research Article
Feeding Substitution Using Fish Waste, Papaya Leaf and Banana Peel for Kampung Chicken Production

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Abstract

Background and Objective: Kampung chickens are native Indonesian chickens that have the ability to utilize the low quality of local feed. This research was aimed to study the responses of kampung chickens to local-based feedstuff. **Materials and Methods:** A total of 140 Tolaki strain kampung chickens (25 females and 5 males) were raised to obtain production performance. Chickens were divided into two equal groups (a group of 70 receiving local feed and a group of 70 receiving commercial feed). The local feedstuffs used in this research were yellow corn, rice bran, fish meal, banana peel meal and papaya leaf meal. The obtained data was analyzed using a t-test (Independent samples t-test). The research variables were indicators of production performance, including feed intake (FI), average daily weight gain (ADG) and feed conversion ratio (FCR). **Results:** Research results showed that there were highly significant correlation ($p<0.01$) between the body weight gain and feed consumption. However, the different feed treatments did not contribute differences ($p>0.05$) in FCR. **Conclusion:** The local feedstuff for kampung chickens could provide a benefit as a substitute for commercial feed because the local feed had a good impact on chicken production performance.

Key words: Kampung chicken, local feed, production performance

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Native chickens in Indonesia are commonly known as kampung chickens. These chickens have good potential in various farming system environments[1]. Native chickens vary genetically and their production potential is lower than that of commercial chickens, but it could be increased by implementing genetic (GH and Mx gene genotyping) and cross selection technology. One kind of native chicken that has good potential for higher production is Tolaki chicken, which has good prospect to be developed as for both meat and egg-laying[2-5].

Southeast Sulawesi is a region with considerable agriculture and livestock activity, thus providing the potential for agriculture, plantation and fisheries waste to serve as raw materials for quality feed or feed supplement. Field studies show that commercial feed for fulfilling Southeast Sulawesi local demand come from other regions, such as South Sulawesi dan Java. In addition, livestock, fisheries and the agricultural industry produce many types of waste that are commonly not well managed and tend to pollute the environment[6]. The agricultural and fisheries waste products, including banana peels from the banana processing industry, fish heads and other byproducts from the fish processing industry and liquid waste and feathers from chicken slaughtering houses, have good nutrient value. All of these waste products contain nutrients, such as banana peel as an energy source, fish heads and poultry feather as protein sources and waste liquid from chicken slaughtering as probiotics or feed additives.

There are various waste processing techniques to produce feed for poultry, including chemical (hydrolyzation), mechanical (steaming and milling) and biological (fermentation). These processing techniques render waste as suitable for feed stuff, increasing its utility, by increasing digestibility, decreasing toxic content and decreasing microorganism contamination. Banana peel fermentation using *Rhizopus* sp. could improve its utilization as broiler and quail feed[7], while steaming or heating fish waste could decrease microorganism contamination.

The ability of native chickens to utilize low-quality feedstuff processed from locally available wastes has the dual benefit of providing an alternative solution to overcome waste management problems and providing benefits to native chicken production. The possibility of using local waste-based feedstuff to maximize native chicken production was the goal of this research and it could become a reference for local waste utilization and nutrient standards for native chicken feed.

This study tries to utilize some raw materials from agricultural waste that have the potential to be used as alternative feed as a commercial feed for kampung chickens.

MATERIALS AND METHODS

Material and research tools: Research was conducted in the Nutrition Laboratory and Poultry Breeding House of Animal Science Faculty, Halu Oleo University. This research used 25 local hens aged 1-2 years old and 5 one-year old local rooster. The offspring numbered 140 chickens that were divided into two equal groups (70 chickens receiving local feed and 70 chickens receiving commercial feed). The local feed was produced from waste-based raw materials (fisheries waste, papaya leaf and banana peel). The commercial feed was B11S (for starter period) and B12S (finisher period) from PT Charoen Pokphand Feed mill Manufactur.

Research procedure: The banana peel processing method was modified[7-9]. The selected banana peel was ripe banana peel with a brownish yellow color, which was cleaned and then diced. Liquid from chicken slaughterhouses was added to comprise as much as 3% of the dry weight. The mixture was then put in plastic containers and closed tightly and fermented for two weeks. Then, the fermented banana peel was dried and milled into flour. The raw material of papaya leaves was separated from the stem and stalk and then sun dried for one to two days. Dry papaya leaves were then compressed to minimize the volume and then processed using a grinder. The nutrient content of the raw material includes crude protein, metabolic and crude energy, as presented in Table 1. The formulation of diet and the nutrient content of the rations are presented in Table 2.

Table 1: Content of nutrient raw materials research ration

	Nutrient composition		
Feed ingredients	Crude protein (%)	Metabolizable energy (kcal kg^{-1})	Crude fiber (%)
Banana peel meal	6	2600	12
Papaya leaf meal	20	2700	12
Fish meal	50	3000	4
Corn	8	3400	4
Rice brand	10	2200	12

Table 2: Feed formulation and nutrient content

		Nutrient composition		
Feed ingredients	Composition (%)	Crude protein (%)	Metabolizable energy (kcal kg^{-1})	Crude fiber (%)
Banana peel meal	15	1	390	1.80
Papaya leaf meal	9	2	243	1.08
Fish meal	15	8	450	0.60
Corn	50	4	1600	2.00
Rice brand	11	1.1	242	1.32
Total	100	16.1	2925	6.80

Experimental design: This study compared two feed regimes for two experimental populations of chickens and measured the production performance of each population.

Parameters measured and data analysis: The study parameters studied were indicators of production performance: feed intake (FI), average daily weight gain (ADG) and feed conversion ratio (FCR). The obtained data was analyzed using a t-test (Independent samples T-test).

RESULTS AND DISCUSSION

The performance of kampung chickens given different feed treatments: The performance of kampung chickens receiving different feed treatment is presented in Table 5.

Based on the data analyzed in Table 5, there were highly significant correlations ($p<0.01$) between body weight gain and feed consumption. However, the different feed treatments did not result in significant differences ($p>0.05$) in the feed conversion ratio (FCR). In either case, high feed consumption resulted in high body weight gain. This finding was related to the chicken's metabolizing either feed type for resultant growth and production. Providing commercial feed provision tended to result in a slightly higher body weight compared to local feed, although the feed conversion value of the two treatments did not have a significant effect.

Kampung chicken production: The data of kampung chicken responses to treatment rations, including weight gain, feed consumption and feed conversion for 14 weeks, are presented in Table 4.

Based on the data in Table 3 and Table 4, in the 14th week maintenance period, the average weekly weight gain of the chickens (chickens receiving local feed) was 72.95 g bird^{-1} week^{-1}, which was lower than the chickens receiving commercial feed (75.24 g bird^{-1} week^{-1}).

The increase in body weight can be affected by the weight, age, sex and genotype of the chicken, including the GH genotype and Mx genotype[3-5]. The body weight gain in this study indicates that the use of local waste ingredients in feed can utilize in chicken production. This conclusion is contrary to the opinion of Abel *et al.*[10] who stated that the use of banana peels in feed rations can lower the daily weight gain and reduce feed efficiency.

The ration consumption in this study was 342,91 g bird^{-1} week^{-1}. The average observed rate of feed consumption, which was 342,91 g bird^{-1} week^{-1} or 50 g bird^{-1} week^{-1}, was relatively lower than the average feed consumption of chickens, generally 60-80 g bird^{-1} week^{-1}. This difference may be explained by the kampung chicken having a leaner body type and lower body weight than chickens in general. The body type and body weight of the chicken correlated with the amount of ration consumed. Dewi *et al.*[11] stated that the chicken production performance is strongly influenced by the consumption of nutrients such as protein and energy, with lower protein and energy consumption resulting in lower performance.

Feed consumption levels decreased when more banana peel was added. This can be explained by the high crude fiber content in banana peel flour (18.01%)[12]. Bahri and Rusdi[13] stated that high crude fiber is not only difficult to digest but also causes some nutrients to be lost in the excreta. Has *et al.*[8,9] reported that the increase in crude fiber in the feed ration may decrease nutrient digestibility. Difficult and slow processing of feed by the chickens resulted in reduced consumption of rations.

Feed conversion is the ratio between the amount of rations consumed and weight gain in a week. Higher feed conversion ratio (FCR) indicates more feed is spent to achieve body weight gain. The FCR of chicken given banana peel flour in this study was 6.93, which approaches the FCR of chicken given commercial feed (6.73). This result is consistent with the findings of Hidayat and Asmarasari[14], who reported that village chicken feed conversion ratio ranged from 8.00-10.00 for semi-intensive farming and 4.90-6.40 for intensive farming. The rate of feed conversion observed in this study was still higher than that of Has *et al.*[8], who reported that the feed conversion ratio of domestic poultry using banana peel in

Table 3: Average weight gain, feed consumption and feed conversion of Kampung chicken (local feed treatment) during 14 weeks maintenance

Maintenance time	Weight gain (g bird^{-1} week^{-1})	Feed consumption (g bird^{-1} week^{-1})	Feed conversion
1st week	13.90	155.50	6.91
2nd week	24.90	170.40	7.82
3rd week	36.40	181.08	7.84
4th week	42.20	220.67	5.90
5th week	45.10	238.60	6.76
6th week	53.20	254.00	6.77
7th week	68.90	289.20	6.94
8th week	78.50	343.50	7.37
9th week	84.60	383.40	7.21
10th week	98.40	411.25	7.29
11th week	108.70	453.67	6.58
12th week	116.80	505.58	6.44
13th week	120.50	569.33	7.28
14th week	129.20	624.58	5.97
Total	1021.30	4800.76	97.08
Average	72.95	342.91	6.93

Table 4: Average weight gain, feed consumption and feed conversion of Kampung chicken (Commercial Feed Treatment) during 14 weeks maintenance

Maintenance time	Weight gain (g bird^{-1} week^{-1})	Feed consumption (g bird^{-1} week^{-1})	Feed conversion
1st week	14.51	161.20	7.32
2nd week	26.26	174.52	7.90
3rd week	39.48	185.06	7.93
4th week	42.00	226.60	6.34
5th week	47.10	240.54	6.93
6th week	54.26	258.23	6.89
7th week	70.93	295.30	6.86
8th week	80.62	345.40	6.37
9th week	87.54	387.78	6.36
10th week	102.66	415.65	7.67
11th week	111.28	457.57	5.67
12th week	119.38	509.35	6.20
13th week	124.59	576.80	6.58
14th week	132.84	628.43	5.26
Total	1053.45	4862.43	94.28
Average	75.24	347.32	6.73

Table 5: The performance of Kampung chicken with giving different feed treatment

	Average	
Variabel	Local feedstuff	Comercial feed
Feed consumption (g bird^{-1} week^{-1})	342.91**	347.32
Weight gain (g bird^{-1} week^{-1})	72.95**	75.24
FCR	6.93	6.73

**Significantly ($p<0.01$)

rations ranged from 4.4-5.7. Allegedly high conversion rates in this study were due to the high content of crude fiber in the ration[8].

The use of local waste ingredients proved to be suitable as feed ingredients for local poultry such as chicken. The research data showed the growth performance improvement over time and indicated that the rations used in this study can be utilized in chicken production. The use of local raw materials, especially from waste, is expected to help reduce the cost of feed used in the chicken livestock business. The use of native chicken as a local commodity is considered very appropriate which provide the opportunity to the native chickens to utilize locally produced nutrients.

CONCLUSION

Local feedstuff improved the growth performance of kampung chickens when compared with the commercial feed. Nutrient contents of feed formulation include crude protein (16.1%) with 2925 kcal kg^{-1} metabolic energy content and crude fiber (6.8%) in rations that contribute to suitable chicken production measured through weight gain, food consumption and food conversion ratio.

SIGNIFICANCE STATEMENT

This study highlights the production response of kampung chickens on a diet of local feed (fish waste, papaya

leaf and banana peel), which could be beneficial in enhancing the growth performance of native chickens. This study demonstrates the impact of local waste-based feedstuff on production performance of native Indonesian chicken, which many researchers were not able to explore. It was indicated that kampung chickens possess heightened adaptive tolerance to low-quality feed.

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