MEAT BONE MEAL ORIGINATED FROM FAST-FOOD RESTAURANT WASTE TO IMPROVE BROILER CHICKEN GROWTH PERFORMANCE

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Abstract

This study aimed to explore the potential of meat and bone meal originated from fast-food restaurant waste (FFM) to the broiler chicken growth performance. We verified that fast-food restaurant waste consists of high protein content (approximately 63.36%) that having a high potential to plays a role as protein source in broiler chicken ration. This study was conducted by completely randomized design (CRD), involved a total of 100 birds in which each 20 birds randomly allocated to 1 of 5 treatments, namely: 0% FFM, 5% FFM, 10% FFM, 15% FFM, and 20% FFM that supplemented to chicken ration. The observed variables were the growth performance parameters, namely feed intake (FI), average daily gain (ADG), and feed conversion ratio (FCR). The results showed that there were increases of FI, ADG, and FCR in FFM supplemented ration, although the increases were not significantly different compared to control. In conclusion, the FFM supplementation up to 20% was neither harming nor giving adverse effects to the chicken performance.

Keywords: Fast-food restaurant waste, meat and bone meal, broiler chicken, performance

INTRODUCTION

There is an increasing awareness of environmental issues nowadays in Indonesia, especially in the treatment of food waste. Food waste processing model in Indonesia currently include the land fill, incineration, and recycling. These processes resulting in environmental issues since they are generating pollution and contamination. Besides, the cost of recycling process involving a very high cost [1], which is not efficient for most of Indonesians. Therefore, the need for an alternative processing method of food waste is now more important than before.

It has been known that feeding food waste is an important component of animal production that provides a competitive alternative to more traditional feed grain or protein sources [2]. To this endeavor, we explore one of the food wastes types that still having a good nutrition value, even when they not needed anymore by human. One of the sources of food waste is the fast food restaurant, which produces approximately of 12 kg of food waste daily (personal communication with a fast food operator, 2007). Fast-food restaurant waste is the leftover of food which can no longer used by the restaurant. This food waste is potential to be converted into meat and bone meal, since the fast food restaurant waste is consisting of bone and a little bit of incorporated meat. The conversion of food waste into animal feed might act as one of the alternatives to decrease waste accumulation which harms the environment.

Fast food restaurant waste origin meat and bone meal (FFM) might play a role as a protein and calcium source when they mixed with other feedstuffs to build up animal ration. We made a prototype of the FFM prior to this study, and analyzed them with proximate analysis method, which consist of 22.12%, 29.44%, and 21.45% of crude protein content, crude fat content, and ash, respectively (Laboratory of Food Technology, Pasundan University, 2005). Based on this prototype, we hypothesized that the inclusion of FFM into the complete

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ration can play a role as an alternative source of protein, which increases the broiler chicken productivity, with higher economic efficiency.

MATERIAL AND METHODS

Birds, Housing, and Treatments

A total of 100 Arbor Acres strain broiler chickens (Charoen Phokphand 707™, Jakarta, Indonesia) was allocated into 20 caged pens, resulting a group of 5 birds per pens. The size of caged pens was 100 cm × 50 cm × 60 cm, resulting a density of 10 birds/m2. The birds then kept producing meat for 35 days (5 weeks) with respective plane of nutrition.

The ration composition which given to the birds is presented in Table 1. Each 4 caged pens were allocated into one of five treatments, which is the 0% FFM (control), 5% FFM, 10% FFM, 15% FFM, and 20% FFM. The nutrient content of treatments is presented in Table 2. Prior to the study, the chickens were vaccinated with Newcastle Disease (ND) and Infectious Bursal Disease (IBD) vaccine to prevent the disease. Drinking water was provided ad libitum by using the hanging nipple drinker.

Table 1 Feedstuff composition of each treatments

Feedstuff[2]	Treatments[1]				
	0% FFM	5% FFM	10% FFM	15% FFM	20% FFM
Rice Bran	5.00	4.50	4.30	3.40	3.50
Corn Meal	55.00	55.00	55.00	55.00	55.00
Fish Meal	10.00	8.70	7.50	3.70	2.00
Coconut Oil	3.10	3.30	3.50	3.80	3.60
Coconut Kernel	6.00	6.00	5.80	5.00	5.00
Soy Kernel	20.00	16.60	13.00	13.20	10.00
Zeolit	0.63	0.63	0.63	0.63	0.63
DCP[3]	0.10	0.10	0.10	0.10	0.10
Salt	0.15	0.15	0.15	0.15	0.15
Premix	0.02	0.02	0.02	0.02	0.02
FFM[1]	0.00	5.00	10.00	15.00	20.00

[1]FFM: fast food restaurant waste origin meat and bone meal
[2]expressed in %
[3]dicalcium phosphate

Table 2 Nutrient content of each treatments

Nutrients[2]	Treatments[1]				
	0% FFM	5% FFM	10% FFM	15% FFM	20% FFM
Dry Matter	83.46	83.49	83.52	83.46	83.74
Crude Protein	22.14	22.16	22.14	22.16	22.16
Crude Fat	7.73	8.33	8.96	9.32	9.56
Crude Fibre	3.46	3.21	2.96	2.73	2.43
Calcium	0.74	1.16	1.56	1.87	2.27
Phospor	0.74	0.93	1.12	1.24	1.41
ME[3] (kkal)	3.090.32	3.094.97	3.098.69	3.091.36	3.091.98

[1]FFM: fast food restaurant waste origin meat and bone meal
[2]expressed in %, otherwise stated in different unit
[3]metabolizable energy

Preparation of FFM

The fast food restaurant waste was obtained from 15 outlets of fast-food restaurants which located in throughout the city of Bandung, West Java, Indonesia. The processing method was conducted in the same principle with the thermal processing by [3], except for some temperature and duration adjustments. In brief, the obtained food waste then boiled in the boiling water (± 100°C, 30 minutes), then dried in the sunlight till the water content is less than 10%. The dried (dehydrated) food waste then ground till it becomes powder and can be prepared as meat and bone meal. The FFM then mixed with respective ration according

to the treatment. To determine the protein content, FFM was analyzed with proximate analysis procedure [4], which resulting the raw protein content of 63.36%, and dry matter content of 93.91% (Laboratory of Animal Feed Chemistry, Faculty of Animal Husbandry, Padjadjaran University, 2007).

Statistical Analysis

The experimental design was the completely randomized design (CRD), which consist of five observed variables, namely feed intake (FI), average daily gain (ADG), and feed conversion ratio (FCR).Each observed variable data were statistically analyzed by using analysis of variance (Anova) procedure in SPSS Statistics to determine if there is a significant difference in the least squared means (LSM) of the treatments.

RESULTS AND DISCUSSION

The effects of the treatment to the LSM of FI, ADG, and FCR is presented in Table 3.

As Table 3 shows, the highest FI was observed in 15% FFM group (2564.75 g), followed by 20% FFM group, 5% FFM group, 0% FFM group, and 10% FFM group, which is 2514.31 g, 2496.65 g, 2470.40 g, and 2496.65 g, respectively. There was no significant difference found in the effects of treatment to FI. However, this trend indicates that the FI was increased as the increased of FFM content in the ration, suggesting better palatability in the higher content of FFM in ration. It was suggested that palatability was an important aspect of feed quality, because it is related to aroma and texture, which are important parameters for broiler chicken feed [5]. Moreover, the increase of FI in this study was similar to a study of kitchen waste inclusion of broiler chicken diet [6], in which higher feed intake was observed in the kitchen waste-included ration group.

Table 3 Effects of fast-food restaurant waste origin meat and bone meal supplementation to feed intake (FI), average daily gain (ADG), and feed conversion ratio (FCR)in broiler chickens. Data expressed as least squared means (LSM)

Variable	Treatments[1]				
	0% FFM	5% FFM	10% FFM	15% FFM	20% FFM
Feed Intake (g)	2470.4	2496.6	2306.1	2564.7	2514.3
Average Daily Gain (g/d)	40.4	42.1	42.4	43.7	40.7
Feed Conversion Ratio	1.76	1.7	1.57	1.68	1.78

[1]FFM: fast food restaurant waste origin meat and bone meal

In terms of ADG, the highest ADG was gained in 15% FFM group (43.7 g/d), followed by 10% FFM group, 5% FFM group, 20% FFM group, and 0% FFM group, which have the ADG of 42.4 g/d, 42.1 g/d, 40.7 g/d, and 40.4 g/d, respectively (Table 3). There was no significant difference found in the effects of treatment to ADG. However, this trend is in line with the trend of FI, which suggests that the more chicken eat the 15% FFM ration, the more ADG gained. This fact is in line with the previous study which reported that the ADG is highly correlated with FI [7]. The data suggests that the higher FFM consumed resulting in higher ADG, which likely related to the availability of protein and fat that utilized by chickens to develop more protein deposition (as muscle and fats) in their body.

Table 3 shows that the highest FCR was gained by 20% FFM group (1.78), which followed by 0% FFM, 5% FFM, 20% FFM, and 10% FFM, which have the FCR of 1.76, 1.70, 1.68, and 1.57, respectively. No significant difference found in all treatments. However, the trend suggests that the lowest FCR belong to the 10% FFM group compared to other treatments, indicating the higher feed efficiency compared to other treatments. It was reported that the FCR value is interrelated with either FI or ADG values, in which the lower FCR value indicates higher feed efficiency. The increase of feed efficiency was similar to a study of food waste inclusion in Pekin and Muscovy ducks ration, in which higher efficiency observed in agreement with increasing levels of food waste in the ration [8].

To achieve a safe product of food waste to be given to the animal as feed, there is a vital stage prior to administering food waste to the animal, namely the processing method. Food waste, anyhow, is a waste that is prone to microbial infection, having a high chance to cause foodborne diseases [2, 11]. Interestingly, processing methods of restaurant waste as animal feed might have a major impact to its quality. It has been reported that the chicken waste with thermal processing have the lowest number of bacteria so that decreasing chance of infection and contamination [3]. Other study suggests that thermal processing of restaurant food waste at 65°C for 20 minutes is sufficient to ensure microbiological quality [9]. In this study, the decreased number of bacteria in FFM might be related to the thermal processing (boiled in ± 100°C water for 60 minutes) which can eradicate bacterial growth and development.

Moisture content in the restaurant waste meal also appears to be an important aspect, in relation with pathogenic bacterial growth. Fresh food waste tends to have a high moisture content (about 80%), in which very supportive for pathogenic bacterial growth [10]. A dehydration process, therefore, is strongly recommended to be done prior to administering food waste to the animals [1, 10, 11, 12].

Other processing method, namely probiotic treatment is reported to have a better outcome to the food waste product [3]. Probiotics are microbial-biological source which can be used for food processing [13]. It was reported that one of the bacteria strains, such as Lactobacilli have antimicrobial effects and by producing some metabolites such as lactic acid, can inhibit growth of gram-positive and negative pathogens [14, 15]. Probiotics treatment, therefore, might potentially provide better outcome to the quality of food waste as an animal feed. Besides that, beneficial bacteria that incorporated within probiotics may act as an agent that promotes better nutritional availability of supplemented feedstuffs. A study reported that there are some positive effects of feed supplementation of *Lactobacillus spp*., namely: providing some nutrients such as vitamins, generating some digestive enzymes, abolishing pathogenic bacteria, and deactivating their toxins by producing organic acids and bacteriocins [16]. Probiotic processing methods and mechanisms in fast-food restaurant waste as animal feed might be an important aspect to be studied in future investigations.

CONCLUSION

In conclusion, the FFM might plays a role as an alternative of protein source for broiler chicken ration. Moreover, the FFM supplementation in broiler chicken ration was neither harmful nor giving negative effect to broiler chicken health and productivity. Furthermore, it might be important to study the different principles of fast-food restaurant waste processing methods. Based on the results of this study, thermal processing surely decreased the chance of bacterial infection and contamination. However, there might be a better outcome of fast-food restaurant waste nutritional value if the process were not eradicating all bacteria, but preserves beneficial bacteria and provides additional nutrients, such as probiotic processing method.

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