CHICKEN SLAUGHTERHOUSE WASTE UTILIZATION (CHICKEN FEATHER MEAL TREATED) AS A SOURCE OF PROTEIN ANIMAL FEED INGREDIENTS IN BROILER CHICKENS

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Abstract

Waste of chicken slaughterhouse industries is one of the areas of live stock waste. The waste from this the industries contributes to environment damage. This problem is a consequence of the process of decomposition by bacterial. Decay by bacterial easily occur due to the high organic content of the waste, such as protein content. Research on Utilization of Waste Chicken Slaughterhouse (Chicken Feather Meal treated) as Feed Ingredients Protein Source in Broiler Chickens. This studies to explore the best type of treatment for chicken feathers seen on the digestibility of dry matter, organic matter, protein, nitrogen retention, and the value of energy metabolic. Types of processing, namely: 1. processed chicken feather meal cooked by steam pressure 2.5 kgf/cm^2, temperature of 140^{0}C for 50 minutes; 2. processed chicken feather meal which soaked 0.5% NaOH, followed by 2.5 kgf/cm^2 cooking vapor pressure, temperature 140^{0}C for 50 minutes; 3. processed chicken feather meal fermented by Bacillus licheniformis. S followed by a vapor pressure of 2.5 kgf/cm^{2}cooking, the temperature of 140^{0}C for 50 minutes. The dates in this result showed that treatment with chicken feathers by soaking in 0.5% NaOH solution for 24 hours, followed by 2.5 kgf/cm^2 pressure cooking, with a temperature of 140^{0}C for 50 minutes produces chicken feather meal processed mostbest of digestibility, N retention and metabolizable energy value.

Key words: chicken feathers processed, source of protein, broiler chickens

INTRODUCTION

Waste of chicken slaughterhouse industries is one of theare as of livestock waste. The waste from this the industries contributes to environment damage. This problem is a consequence of the process of decomposition by bacterial. Decay by bacterial easily occur due to the high organic content of the waste, such as protein content.

Feather of chicken contains high protein, similar with blood of about 80%, but it has a complex structure of keratin which digest by microorganisms difficult. It condition is the cause of a big problem.

The alternative to handle these two problems can be done by utilizing chicken feed ingredients, given the high protein content. Fur can be used as an alternative source of protein feed ingredients as a replacement or substitute for other sources of protein feed ingredients. The use of waste chicken slaughterhouse in addition to addressing environmental problems can also reduce the cost of the ration.

Feather meal has a high protein content 85% (Scott et al., 1982). However, the use of singly feed ingredients may not be able to substitute other sources of feed ingredients, it is a consequence of chicken feather given the deficiency of some amino acids. Feather meal deficient in methionine and lysine but has amino acids isoleucine well enough that when combined with the use of feather meal other feed ingredients then some amino acids derived complementarity and amino acid content is good.

Another obstacle of feather meal has a lower digestibility values because of the presence of keratin. Keratin is a fibrous protein

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consisting of typical long-chain peptides, are insoluble in water and difficult to digest (Van der Poelo et al., 1990) so that the amino acids they contain can not be used either.

Broiler chickens reared with the aim for producing good meat in a relatively short time and gained a high body weight and efficient in the use of feed into meat. According Kartasudjana Ruhyat and E. Suprijatna (2006), broiler chickens are young males and females are generally harvested at 5-6 weeks of age for the purpose of producing meat. As the animal grows rapidly, requires broiler feed quality, because broiler chickens sensitive to the availability of nutrients in the feed. Low-quality feed resulted in the growth of broiler chickens to be blocked.

Broilers included in monogastric animals (single gastric). Previous study showed that gastro intestinal of broiler chicken consists of esophagus, crop (cache), proventriculus, gizzard, small intestine, caecum, colon, and cloaca (Edjeng et al., 2005) and liver for inducing metabolism activities (Andi Mushawwir and D. Latipudin, 2013).

MATERIALANDMETHODS

Materials

This study was performed on Cobb broiler strain and 6 weeks old. Chickens were randomly assigned to 18 units of cages 35 x 25 x 40 cm^3, so that each unit consisting of one broiler. During the study used vitamin to prevent stress and drugs to keep chickens for health research.Various products processed chicken feathers to be tested digestibility and metabolic energy value, is as follows :

P_1= processed chicken feather meal cooked by steam pressure 2.5 kgf/cm^2, temperature of 140^0C for 50 minutes.

P_2= flour processed chicken marinated 0.5% NaOH, followed ripening with a vapor pressure of 2.5 kgf/cm^2, temperature of 140^0C for 50 minutes.

P_3= processed chicken feather meal fermented by *Bacillus licheniformis. s,* continue cooking with a pressure of 2.5 kgf/cm^2 vapor, the temperature of 140^0C for 50 minutes.

Experiment Procedures

Chickens were fasted for 24 hours, aiming to eliminate the previous ration in the digestive tract. Chickens were given rations of experiments are given in the form of pastes are force feeding through the esophagus as much as 100 g were given two stages.

The first stage did force feeding 50 g, than excreta collected. Twelve hours later conducted a second force feeding, four hours later the chickens were slaughtered and removed his colon excreta samples to be taken. The method used to obtain samples of excreta using methods Sklanand Hurwitz (1980) in Wiradisastra (1986). In the experiment used an external indicator crome oksida (Cr_2O_3), amounting to 0.5% (Del Almo, 2008). Feed samples, excreta, and excreta were analyzed in the laboratory. The components were analyzed : dry matter of feed and excreta, feed organic matter and crude protein feed and excreta, nitrogen feed and excreta, gross energy of feed and excreta, and indicators (Cr_2O_3) feed and excreta.

Parameters

Dry Matter Digestibility

$$= 100\% - \left\{100 \left[\frac{\%\ Feed\ indicator\ (Cr_2O_3)}{\%\ Excreta\ indicator\ (Cr_2O_3)} x \frac{\%\ Dry\ Matter\ in\ Excreta}{\%\ Dry\ Matter\ in\ Feed}\right]\right\}$$

Organic matter digestibility

$$= 100\% - \left\{100 \left[\frac{\%\ Feed\ indicator\ (Cr_2O_3)}{\%\ Excreta\ indicator\ (Cr_2O_3)} x \frac{\%\ Organic\ Matter\ in\ Excreta}{\%\ Organic\ Matter\ in\ Feed}\right]\right\}$$

Protein Digestibility

$$= 100\% - \left\{100 \left[\frac{\%\ Feed\ indicator\ (Cr_2O_3)}{\%\ Excreta\ indicator\ (Cr_2O_3)} x \frac{\%\ Protein\ in\ Excreta}{\%\ Protein\ in\ Feed}\right]\right\}$$

Nitrogen Retention

$$= \left\{1 - 100 \left[\frac{\%\ Feed\ indicator\ (Cr_2O_3)}{\%\ Excreta\ indicator\ (Cr_2O_3)} x \frac{\%\ N\ in\ Excreta}{\%\ N\ in\ Feed}\right]\right\} \text{X } 100$$

Energy Metabolism (kkal/kg)

$$= \text{GE kkal/kg (feed)} - \left\{GE\ \frac{kkal}{kg}\ (excreta)x\ \frac{\%\ Feed\ indicator\ (Cr_2O_3)}{\%\ Excreta\ indicator\ (Cr_2O_3)}\right\}$$

Nitrogen corrected energy metabolism (EMn kkal/kg)

$$= \text{GE kkal/kg (feed)} - \left\{GE\ \frac{kkal}{kg}\ (excreta)x\ \frac{\%\ Feed\ indicator\ (Cr_2O_3)}{\%\ Excreta\ indicator\ (Cr_2O_3)}\right\}\ x$$

$$\left\{\%\ N\ (feed) - \left[\%\ N\ (excreta\ x\ \frac{\%\ Feed\ indicator\ (Cr_2O_3)}{\%\ Excreta\ indicator\ (Cr_2O_3)}\right]\right\}$$

Experiment Method

This study used a completely randomized design. Data were analyzed by analysis of variance (ANOVA) using the Stat 8, Differences between treatments were analyzed by different test average of Duncan with a significant level of 0.05 (Steel and Torrie, 1998).

RESULTS AND DISCUSSION

Protein content of products from feather meal processed showed a different value for each type of processing. The highest protein content of chicken feather meal results of high-pressure cooking is by 2.5 kgf/cm^2 pressure, at a temperature of 140^{0}C for 50 minutes (P_1). Followed by chicken feather meal fermented by *Bacillus licheniformis*, followed by 2.5 kgf/cm^2 pressure cooking temperature 140^{0}C for 50 minutes (P_3). Lowest protein content achieved by feather meal preparations before cooking soaked in a solution of 0.5% NaOH followed by 2.5 kgf/cm^2 pressure cooking at 140^{0}C temperature for 50 minutes (P_2). The big difference in the protein content of the three types of processing stages as a result of hydrolysis.

Feather meal processed was soaking bay NaOH (P_2) and fermented (P_3) has done to stages of hydrolysis. For this type of treatment P_3 hydrolyzed chicken feathers fermentation by *Bacillus licheniformis*, On the type of chemical processing of P_2 hydrolyzed by NaOH.

Both the feather meal processing creates deproteinasi, namely there lease of the protein from chicken feather keratin bond.

Keratin bond consist of cysteine residues that can be provided a high disulfide bridges between adjacent polypeptide chain (Lehninger, 1995). Cystine consists of two molecules of cysteine.

Table 1 The content of nutrients, nutrient and energy metabolic processed products Chicken feather meal

Variable	P_1	P_2	P_3
Crude Protein (%)	92.01	**85.50**	88.27
Dry matter digestibility (%)	30.13 b	**58.52 a**	42.83 b
Digestibility Organic Mattter (%)	35.29 b	**59.71 a**	46.01 b
Protein digestibility (%)	34.91 b	**58.60 a**	45.05 b
Nitrogen Retention (%)	32.23 b	**53.55 a**	38.68 b
Metabolic Energy(kkal/kg)	965.05 c	**2307.57 a**	1671.90 b
Corrected Energy Metabolic Nitrogen(kkal/kg)	925.07 c	**2248.15 a**	1627.00 b

Upper case different in the lines same showed differences significantly (in level α0.05)

P_1= processed chicken feather meal cooked by steam pressure 2.5 kgf/cm^2, temperature14 C for 50 minutes

P_2= Soaking chicken feather meal of 0.5% NaOH, followed by vapor pressure of 2.5 kgf/cm^2 cooking, temperature140^0 C for 50 minutes.

P_3= processed chicken feather meal fermented by *Bacillus licheniformis, s*, continued with a vapor pressure of 2.5 kgf/cm^2 cooking, temperature 140^0 C for 50 minutes

Proteins contained in chicken feathers can be physically and covalently bind. Covalently bound proteincan be degraded by chemical treatment that is dissolving in strong alkaline solutions or with biological treatment (Lee and Tan, 2002). Deproteinasi biologically by using the enzyme proteinase, an enzyme which is able to hydrolyze peptide bonds in proteins. Protease enzyme can be obtained from the results of the cultivation of microbial secondary metabolites the bacteria *Bacillus licheniformis* (Bisping et al., 2005). The consequences of the two stages of hydrolysis of the two kinds of treatment (treatment type P_2 and P_3), a process of growing deproteinasi that ultimately will lower protein content.

The hydrolysis stage of immersion with the type of processing chemicals (P_2) and fermentation (P_3) produces a low protein, but both resulted highest in value of digestibility of dry matter, organic matter, protein, nitrogen retention and metabolizable energy. Values of dry matter digestibility, organic matter and protein, nitrogen retention and metabolizable energy on the type of processing that is experienced by 0.5% NaOH immersion significantly ($P<0.05$) higher compared to the type of processing that is cooked (P_1) or fermented (P_3) .

Chicken feather was soaking in NaOH solution was more effective in remodel and keratin disulfide bonds than the the other treatment. Disulfide bonds in keratin leads to low digestibility of feather meal. Keratin is a fibrous protein that is typical, consisting oflong-chain peptides, are insoluble in water and difficult to digest (Van der Poel et al., 1990; Diding Latipudin and A. Mushawwir, 2012). Several methods of treatment that can be done in an effort to overhaul the keratin that is by using steam pressure high, can be hydrolyzed by alkali treatment (acid) or with bacteria that produce the enzyme keratinase (Dalev, 1994; Suntornsuk et al., 1999).

Low of protein content in the result from hydrolysis (in Table) was produced of NaOH processed previously study, reported Abun (2008), hydrolysis by strong bases cause depolymerization due to excessive cuts in the molecular structure of proteins, vitamins, and minerals. It should be considered inthe use of strong base NaOH concentration on the hydrolysis process is not over kill.

The use of 0.5% NaOH in the hydrolysis process before continuing with pressurized ripening proteins contained 3% lower than the proteins produced by the fermentation of processed earlier, and 7% lower than treatment only with pressurized cooking. But this can be off set by the high protein digestibility values in previously processed chicken feathers by 0.5% NaOH, followed by pressure cooking is 23% higher than previously fermented feather meal *Bacillus licheniformis* followed by pressurized cooking, and 40% higher than treatment only with pressurized cooking alone.

Digestibility value of chicken feather meal processed NaOH 0.5% before cooking (P_2) showed value of digestibility was the highest of two other treatment, but the it qualities of digestibility categorized low. Reid (1973) reported that there are three categories of digestibility based on the level ofquality feed ingredients, which isa lot of quality with a lower value range of 50-60%, the quality of being in the range of 60-70%, and high quality with digestibility values above 70%. This results of these studies indicates to improve the a experiment which not only gives rise to digestibility of chicken feather meal, but also creates high protein. One of them, which combine the use of chemical means of processing and fermentation were able to produce enzymes to degrade keratin. One of the methods of research that has been conducted by Papadopoulus et al., (1985), an experiment was performed on addition an enzymes of proteolytic maxatasein the fermentation.

CONCLUSIONS

The results in this study concluded that the processed product was the best chicken feather meal of chicken feathers treated with 0.5% NaOH for 24 hours, followed by 2.5 kgf/cm^2 pressure cooking, the temperature of 140^{0}C for 50 minutes. This method the most solved of the all method (a high-pressure cooking only, an disfermented by *Basciullus licheniformis* followed by high pressure cooking).

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