Utilization of Gabus Pasir fish waste meal (*Butis Amboinensis*) to substitute commercial fish meal on Pekin duck’s performance

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Abstract. The purpose of this study was to determine the effect of the utilization of Gabus Pasir (*Butis Amboinensis*) waste fish meal (GPWFM) as a substitute for commercial fish meal (CFM) on feed consumption, body weight gain, final weight, and feed conversion ratio of Pekin duck at 8 weeks. This research method uses a completely randomized design (CRD) with 5 treatments and 4 replications, each replication consisting of 5 day old duck. The treatments consisted of P0 (diet with 10% CFM); P1 (diet with 7.5% CFM and 2.5% GPWFM); P2 (diet with 5% CFM and 5% GPWFM); P3 (diet with 2.5% CFM and 7.5% GPWFM) and P4 (diet with 10% GPWFM). Based on the analysis of variance, it showed that all treatments did not have a significantly effect (P>0.05) on feed consumption, body weight gain, final weight and feed conversion ratio of Pekin ducks at the age of 8 weeks of maintenance. It can be concluded that Gabus Pasir fish waste meal can be used in diet to substitute commercial fish meal at a level of 100%, that is 10% of the level of fish meal in the diet.

1. Introduction

Poultry farming is one of the efforts in order to meet the needs of animal protein for humans, including ducks farming. Generally, ducks have a role as egg producers, it's just that male ducks have good potential as meat producers because their growth rate is fast compared to females. In the livestock, the main problem is the availability of affordable feed. Likewise, in the maintenance of ducks. One of the reasons for the expensive price of poultry feed is the use of feed raw materials that are still imported from outside Indonesia, including fish meal, given that the maximum use of fish meal is 10% of the total diet.

Fish meal is one of the raw materials for animal protein sources which is needed in the composition of animal feed. Fish meal contains high protein and is composed of amino acids, lysine and methionine, which until now are still difficult to replace by other raw materials. One of the efforts to replace the presence of fish meal is to use feed ingredients derived from agricultural, fishery and industrial waste [1]. One of the fishery wastes that has the potential to be used as a feed ingredient is the Gabus Pasir (*Butis Amboinensis*) fish waste because of its abundance and its use does not compete with human needs.

Gabus Pasir fish is a fish that is located on the coast of the sea and is widely available in the North Sumatra area, especially at fish auction places (TPI) in Belawan. Usually, the Gabus Pasir fish meat is processed into meatballs and exported abroad, while the fish head, bone and stomach contents have not
been utilized properly. Production of fish waste can reach 500 kg - 1 ton/day or 7-8 tonnes/week. This shows the large potential of fishery waste generated from TPI in Belawan.

This Gabus Pasir fish waste meal can be used as a substitute for commercial fish meal, because it contains very high protein. Fish meal, which is the main protein source for poultry, contains all the amino acids that birds need. Amino acids from fish meal are a good source of lysine and methionine [1]. The best Gabus Pasir fish waste meal is obtained in processing by steaming. The nutritional content is respectively of the water content by 7.71%; dry matter by 92.82%; crude fat by 4.32%; crude protein by 53.59% and ash by 21.85% [2]. According to SNI [3] that the standard requirements for quality fish meal with high quality contain components are 10% of water content, 8% of crude fat, 65% of crude protein, 20% of ash and 1.5% of crude fiber, while the standard requirements for low quality fish meal are 12% of water content, 12% of crude fat, 45% of crude protein, 30% of ash, and 3% of crude fiber.

One of the alternatives meat of animal protein for humans is duck meat especially Pekin duck. The fast growth of ducks but using less feed can save maintenance costs which of course must be supported through the use of appropriate diets and nutritional content. The problem faced is the inefficiency of ducks in utilizing feed, so that feed production costs are high. Commercial fish meal can cost up to Rp. 7500-8000/kg in market around the Medan city, therefore it is necessary to find ways to replace fish meal so that the cost of feed production is not high and easy to obtain. After the alternative fish meal is obtained, it is then used in the duck diets according to its life phase and is expected to have a positive effect on feed consumption, body weight gain, final weight and feed conversion of Pekin ducks on 8 weeks old.

2. Materials and methods

2.1. Materials and tools
The materials used are 100 day old of Pekin ducks. The feed ingredient consist of corn, rice bran, coconut meal, soybean meal, fish meal, vegetable oil, palm kernel meal, Gabus Pasir fish waste meal, top mix, drinking water, vitamins, vitamins and supplements, and ND vaccines. The diet formulation used follows the results of research [2] whose nutritional content is listed in Tables 1 and 2. The tools used are 20 plots of stage model cages, feed and drinking places, digital balance scales, lighting equipment and heater in the form of a thermometer incandescent lamp to measure the temperature of the cage.

2.2. Research methods
The research was conducted experimentally used was a completely randomized design (CRD) consisting of 5 treatments and 4 replications and each replication consisted of 5 Pekin ducks. The diets are given the following treatment:
P0 = diet with 10% commercial fish meal (CFM) + 0% Gabus Pasir fish waste meal (GPFWM)
P1 = diet with 7.5% CFM + 2.5% GPFWM
P2 = diet with 5.0% CFM + 5.0% GPFWM
P3 = diet with 2.5% CFM + 7.5% GPFWM
P4 = diet with 0% CFM + 10% GPFWM

2.3. Data analysis
Data were analyzed using a linear model for a completely randomized design or CRD [4]. The results of the analysis if the F-count> F-table at the level of α = 0.05, it is said that the treatments are significantly different. If the F-count is greater than the F-Table at the level of α = 0.001, it is said that the treatments are very significantly different. If F-count is smaller than F-table, H_0 is accepted. This means that the effect of the treatment is not significantly different

2.4. Making of Gabus Pasir fish waste meal
Fishery waste is a part of fish that is no longer used economically [5]. Gabus Pasir fish waste consists of the head, bone and stomach contents. This waste can be processed by heating, pressing, oven and
grinding into fish waste meal. Fish waste meal contains high protein which can increase the production and nutritional value of eggs or livestock meat. The nutritional content of fish meal depends on the type of fish used as the raw material [6]. The best Gabus Pasir fish waste meal is obtained in processing by steaming [2]. Making of this fish waste meal began with cleaning the Gabus Pasir fish waste with water, then steamed it for 15 minutes ± 100˚C, then pressed it and put it in an oven at 60˚C for 8 hours. The cooking temperature for fish meal is usually around 95-100°C with a cooking time of about 20 minutes or can be done for 15-30 minutes at a temperature of 97°C [7].

2.5. Compilation of Pekin ducks diet
The ingredients for the Pekin ducks diet used consisted of corn, rice bran, soybean meal, CFM, palm kernel meal, vegetable oil, GPFWM and top mix. The ingredients of the diets were weighed in advance according to the composition of the diets composition that had been determined in the formulation of each treatment following the research results reported by [2]. The method used in mixing the diets was manual and mix twice a week to prevent rancidity in the diet. The nutritional content of the research is listed in Tables 1 and 2 below:

| Table 1. Nutritional content of starter period Pekin duck diets |
|---------------------------------------------------------------|
| Nutritional content                                          | P0     | P1     | P2     | P3     | P4     |
| Protein (%)                                                  | 22.36  | 22.5   | 22.39  | 22.29  | 22.19  |
| Metabolisable energy (kcal/kg)                               | 2871.7 | 2874   | 2856.2 | 2858.1 | 2859.95|
| Crude fiber (%)                                              | 7.91   | 7.69   | 7.66   | 7.63   | 7.6    |
| Crude fat (%)                                                | 9.74   | 9.57   | 9.39   | 9.22   | 8.89   |
| Ca (%)                                                       | 0.67   | 0.99   | 1.32   | 1.64   | 1.96   |
| P (%)                                                        | 0.66   | 0.8    | 0.94   | 1.08   | 1.22   |

Note: BPT USU Laboratory based analysis

| Table 2. Nutritional content of finisher period Pekin duck diets |
|---------------------------------------------------------------|
| Nutritional content                                          | P0     | P1     | P2     | P3     | P4     |
| Protein (%)                                                  | 17.09  | 16.98  | 16.88  | 16.77  | 16.67  |
| Metabolisable energy (kcal/kg)                               | 2960.7 | 2962.58| 2964   | 2966.3 | 2968.2 |
| Crude fiber (%)                                              | 7.96   | 7.93   | 7.9    | 7.87   | 7.84   |
| Crude fat (%)                                                | 9.84   | 9.67   | 9.49   | 9.32   | 9.14   |
| Ca (%)                                                       | 0.63   | 0.95   | 1.28   | 1.6    | 1.92   |
| P (%)                                                        | 0.6    | 0.74   | 0.88   | 1.02   | 1.16   |

Note: BPT USU Laboratory based analysis

3. Results and discussion

| Table 3. Growth performance of Pekin ducks |
|-------------------------------------------|
| Treatment | Feed consumption (g/head/day)$^{ns}$ | Body weight gain (g/head/day)$^{ns}$ | Final body weight (g/head)$^{ns}$ | Feed Conversion Ratio$^{ns}$ |
|           |                                          |                                          |                                |                            |
| P0        | 110.83 ± 6.04                           | 32.16 ± 1.79                           | 1362.00 ± 91.57               | 3.63 ± 0.03               |
| P1        | 110.93 ± 0.41                           | 31.85 ± 3.78                           | 1274.42 ± 88.10               | 3.97 ± 0.16               |
| P2        | 110.24 ± 2.00                           | 31.90 ± 4.31                           | 1389.17 ± 29.69               | 3.81 ± 0.11               |
| P3        | 110.21 ± 1.88                           | 33.53 ± 6.26                           | 1326.42 ± 66.82               | 3.65 ± 0.18               |
| P4        | 109.22 ± 1.25                           | 33.89 ± 5.49                           | 1430.92 ± 99.82               | 3.62 ± 0.51               |

Note: ns = not significant (P>0.05)
The results of the average research parameters regarding the use of GPFWM as a source of protein substitute for CFM in the 8 weeks old Pekin duck diets are presented in Table 3.

3.1. Feed consumption
The feed consumption of Pekin ducks (g/head/day) in Table 3 shows that the highest average was produced by giving P1 diets using GPFWM as much as 2.5% and TIK as much as 7.5%, namely 110.93 g/head/day and the lowest on the P4 diets that only used GPFWM as much as 10%, namely 109.22 g/head/day. The results of the analysis of variance showed that giving GPFWM in the diet had no significantly different effect (P>0.05) on the feed consumption of Pekin ducks for 8 weeks. These results illustrate that the growth response generated by all ducks is the same. This is presumably because the nutritional content in each diets (Tables 1 and 2) is considered sufficient to support duck growth and has good quality because it has followed the NRC [8] recommendation that the nutritional needs of Pekin ducks aged 0-2 weeks are amounted to 22% protein and 2900 kcal/kg of energy in feed. The nutritional requirements of Pekin ducks at the age of 2-7 weeks are 16% protein and 3000 kcal/kg of energy.

These results can already illustrate the similar response of ducks to the palatability of feed containing GPFWM and CFM. The real response to the consumption of this feed will be seen in the increase in body weight. In line with the opinion of [9] which states that the nutrients in the diet must be in accordance with the needs of the livestock and must not be excessive or deficient. Ducks or other animals, will consume the amount of energy needed for maintenance, including to carry out basal metabolic processes and body temperature regulation, routine activities, and normal growth. Efficient growth requires adequate nutrition, a balance of essential amino acids, vitamins and minerals. Pekin ducks consume a diet of about 350 g/day and energy requirements of less than 1 Mcal during this period.

Many factors affect the consumption of poultry diets including livestock genetics, area of pen, energy levels and protein in the diet. One of the main factors is the quality of the diets, especially the nutritional content contained in it [10-12]. The feed consumption value of Pekin duck as a result of the research which has an average of 109.22-110.93 g/head/day, this result is in line with the research of [13], namely 103.31-112.20 g/head/day but it is still better than the recommendation from [9] which is 350 g/head/day and [14] namely 180g/head/day

3.2. Body weight gain
The body weight gain of Pekin ducks (g/head/day) in Table 3 shows that the highest average was produced by giving P4 diet using 10% GPFWM and the lowest on P1 diet using only CFM of 7.5 and GPFWM by 2.5%. The results of the analysis of variance showed that giving all of fish meal (CFM and GPFWM) in the diet had no significantly effect (P>0.05) on the body weight gain of Pekin duck for 8 weeks. These results illustrate that the growth response generated by all ducks is equally good. The protein content contained in the Gabus Pasir fish waste meal was able to match the protein content in commercial fish meal, this result is in line with the nutritional content (Table and 2) which is relatively the same in each diets. This is supported by the opinion of [15] that in general, broiler ducks should be given high nutritious feed to support their relatively fast growth. The main need for nutrients in the form of protein contained in the diet with a balanced content of essential amino acids and adequate energy content, besides that the levels of vitamins and minerals must also be considered.

In general, the average of body weight gain of Pekin ducks for 8 weeks of the research results (Table 3), namely 31.90 to 33.89 g/head/week is better than the results of [16] research using Pekin ducks for 8 weeks given mud. *Aspergillus niger* fermented palm in diets, namely 22.93-25.36 g/head/week. This is presumably because in study using a mixture of agricultural waste in diets containing very high crude fiber, whereas in this study, the crude fibre content was only around 7.83-8.13%, while the results of research by [17] showed that the maintenance of peking ducks with limited feed can produce a body weight gain of 29.71 g/head/day and by providing various types of diet, peking ducks are able to produce a daily weight gain of 26.30-27.66 g/head/day [18].

The body weight gain that was not significantly different indicated that the physiological rate of Pekin duck in all treatments was the same. The diets consumed using both commercial fish meal and
Gabus Pasir fish waste are thought to have an effect on the physiological conditions of the digestive tract, namely increasing the viscosity of the digesta, thereby affecting the rate of digestion. The slow digestion rate is due to the low crude fibre content of the diet. This is in line with the opinion of [19] stated that the slow digestion rate causes a lot of nutrients to be digested and absorbed by the body so that the availability of nutrients for body tissue synthesis increases.

3.3. Final weight
The final weight of Peking ducks in Table 3 shows that the highest average final weight was obtained in treatment P4, namely diet with 10% GPFWM of 1430.92 g and the lowest in treatment P1 of 1274.42 g. Based on the results of the analysis of variance, it is known that giving Gabus Pasir fish waste meal in the treatment has no significant effect (P> 0.05) on the final weight of Pekin ducks for 8 weeks. The absence of a significant effect on the final weight was in line with the weight gain which was also the same for all treatments because the nutritional content of the diets was almost the same in each treatment (Tables 1 and 2).

Ducks can take advantage of the protein contained in each diet, for each treatment required by different livestock. Protein as a building block for the body replaces body cells that have been damaged. This opinion is supported by [20] and [21] which states that protein in the body of livestock acts as a building block for the body and a substitute for damaged cells and the building blocks for several hormones and proteins are the basic building blocks of all body tissues formed, for example muscles, cells, blood for growth and development. Provision of animal protein must be carried out continuously through diets for growth, cell replacement and other production, if the protein given is not enough it will cause abnormal livestock growth.

The effect of final weight between treatments is influenced by feed consumption and differences in protein absorption in the body. The highest feed consumption in this study was found in P1 treatment of 110.93 g/head/day, while the lowest dietary consumption was found in treatment P4 of 109.22 g/head/day. This is in accordance with [15] that to achieve a body weight of about 3.5 kg at the age of 8 weeks, Pekin ducks must consume as much as 9.5 kg of feed with an average feed consumption of 170 g/day for 8 weeks.

The final weight is also influenced by body weight gain. The highest body weight gain from the research results was also found in the P4 treatment, which was 33.89 g/head/day while at P0 was 32.16 g/head/day, but the final weight produced by the P1 treatment was still higher than the control treatment. This is presumably because the growth that occurred in the ducks treated with P0 was more towards non-carcass (weight of the organs in fat). This is also because the final weight is closely related to body weight gain. This is in accordance with the statement of [22] which states that body weight gain greatly affects the final weight and body weight gain can also affect the feed hold for the diet.

The final weight average of 8-week-old Pekin ducks of this study were higher than the results of research reported by [23] that the average slaughtered weight of Peking ducks with the use of ginger flour was 1247.50g and the results of [24] showed that the average final weight of Peking ducks with the use of cocoa bean shells of 1343.25g. This is because the ability of protein in the diet is completely able to be converted into amino acids which are then absorbed by the duck's body through the small intestine. However, the final weight average of the results of this study is still lower than the results of the research [14], namely 1709 g. The final weight is also related to ambient temperature, feed consumption in the same treatment. This is according to what [25] states that body weight gain can be influenced by feed consumption, health, environmental temperature and gender.

3.4. Feed conversion ratio
The average of Pekin ducks feed conversion ratio ranged from 3.62-3.97. The highest average was produced by Peking ducks by P1 diet with 2.5% GPFWM and 7.5% CFM and the lowest by giving P4 diet using 10% GPFWM. This result is in line with the weight gain value and final weight of ducks in the previous explanation. It is suspected that the use of Gabus Pasir fish waste meal at a level of 10% is already effective to substitute commercial fish meal. In line with the opinion of [26] that in fact for areas
that have marine waters, fish meal is one of the feed ingredients that is always available as a perfect source of protein and feed ingredients compared to other feed ingredients. The use of fishmeal in diets ranges from 10% to 20% in ducks and chickens [27].

The difference in feed conversion ratio was then carried out analysis of variance which showed that there was no significant effect (P> 0.05) on all treatments of diets. This is presumably because in fact all diets are equally good at converting nutrients into meat products. Besides this, it is also suspected that it is influenced by the age and sex of the ducks used during the study. In line with the opinion of [1], and [28] that feed conversion ratio is influenced by several factors such as: age of livestock, nation, nutritional content of diets, especially protein and energy, temperature and health of poultry, availability of nutrients in sufficient quantities. sufficient, ambient temperature, and health.

The average value of feed conversion ratio with the use of cheap diet based on Gabus Pasir fish waste meal, ranging from 3.62 to 3.98, is still lower than the research of [14] which is 4.61 but higher than the results of research by [18] which is around 3.16-3.37 and the results of research by [29] that is 2.5 at 0-49 days old. The conversion value describes the level of effectiveness of the diet in producing body weight, so it can be explained that the P4 diet is more effective than other diets. In accordance [1,30] which states that feed conversion ratio is a technical indicator that can describe the efficient level of diet use, the lower the feed conversion rate means the more efficient its use and conversely the higher the feed conversion rate the more inefficient its use.

4. Conclusions

Utilizing of Gabus Pasir fish waste meal at various levels had no significantly effect on the performances (feed consumption, body weight gain, final weight and feed conversion ratio) of Pekin ducks until 8 weeks old so that it conclude that Gabus Pasir fish waste meal can be used to substitute commercial fish meal up to a level of 10% fish meal in the diet. It is suggested that the Gabus Pasir fish waste meal can be used as a protein source as well as the commercial fish meal in duck and poultry diets in general.

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