The effect of barnacles powder as a source of protein feed substitution against the digestibility of crude protein and crude fiber on male rabbits rex

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Abstract. The aim of this study was to determine the effect of barnacle powder as a feed substitution in diet on digestibility of crude protein and crude fiber in 100 rex male rabbits. It was an experimental study using a completely randomized design with four treatments and five replications. The substitution of barnacle flour was given for four weeks and each diet was 0%, 2.5%, 5%, 7.5%. Data collection was carried out in the fourth week (for seven days) which included data on consumption, manure weight and analysis of treated feed and manure analysis. The data were analyzed using analysis of variance and Duncan test. The average crude protein digestibility (%) of P0, P1, P2, and P3 for each treatment were 76.84±0.81; 76.45±1.41; 76.09±0.60; and 77.47±1.01. The results showed that there were no significant differences (p> 0.05) in crude protein digestibility but the results showed a significant difference (p> 0.05) in crude fiber digestibility. The average crude fiber digestibility (%) of P0, P1, P2, and P3 for each treatment were 36.67±2.86; 50.81±1.57; 49.42±1.30; and 45.93±2.77. It showed that substitution of barnacle flour in diet can replace the source of protein in fish meal for the complete diet of rabbits.

1. Introduction
Some efforts have been made to improve food yields, one of which is by conducting rabbit farming. Rabbit livestock business is less developed like other livestock businesses such as chickens, ducks, goats, cows and buffaloes [1]. This is due to a lack of public knowledge about economic value or what products can be produced from rabbits [2]. Rabbits have the ability to quickly reproduce and are easy to maintain. Rabbit carcass weight is around 50% - 60% of body weight [3]. Rabbits are potential non-ruminant cattle when viewed from aspects of production and reproduction [2]. Efforts to increase rabbit productivity as one of the meat-producing commodities are through good maintenance management, [4] states that rabbits if managed intensively can breed around 4-8 times a year with the number of children 6-8 per birth.

Feed is used by livestock as a fulfillment of basic necessities of life, growth and reproduction. Broadly speaking, rabbit feed is divided into two groups, namely forage and concentrate [5]. Feed given to rabbits that are kept intensively is 60% in the form of forage and 40% in the form of concentrate. Forage feed is a source of fiber for rabbits, while feed concentrate is a food that has a higher energy, protein and fat content and has a lower crude fiber content compared to forage [6,7]. Feed cost factor in livestock business, is the largest part of the overall production cost. [2] said, that...
the cost of feed is around 60-80% of the total production cost. Concentrates have very good nutritional quality but the price is relatively expensive, therefore efforts are made to find alternative feed ingredients that are cheap, do not endanger livestock, do not compete with humans, are available sufficiently, and have almost the same nutrient content as concentrates [8]. One of the alternative ingredients is barnacles.

Barnacles are easily found in tidal areas, open beaches, open seas, and deep seas. Barnacles are harmful animals, if they are attached to the coral, they will die [9]. Besides that barnacles can pierce the ship when it sticks to the hull of the ship. Therefore barnacles are often overlooked because of their destructive nature, even though barnacles have enormous potential to be used as animal feed with the content they have in it [10]. The nutritional value of a feed ingredient can be determined, one of which is the digestibility of the material. The digestion is a series of processes that occur in the digestive tract, namely breaking down feed ingredients into smaller parts or particles, from complex compounds to simpler ones until they dissolve and can be absorbed through the digestive tract wall into in circulation, which is then circulated throughout the body that needs it or to be stored in the body [5,8,11]. The digestibility value of a nutrient shows how much part of nutrition can be digested and used by livestock for various needs, both basic, production and reproductive life. The higher the digestibility value of a nutrient in feed ingredients, the higher the quality of the feed ingredients, so that it can affect the increase in animal weight [7].

2. Materials and Methods
2.1. Experimental design
This research is an experimental study which aims to determine the effect of barnacle flour as a feed substitute for protein sources in rabbit feed as seen from the digestibility of crude carbonate crude protein. The materials used in this study were 100 Rex’s buck aged between 3-4 months, complete feed with fish meal which has been replaced with barnacle flour, disinfecting cages and water. This study used a completely randomized design (CRD) with 4 treatments and 5 replications, namely P0 (complete feed with 15% fish meal content and 0% barnacle flour), P1 (complete feed with fish meal content of 12.5% and 2.5% barnacle flour), P2 (complete feed with 10% fish meal content and 5% barnacle flour), P3 (complete feed with 7.5% fish meal content and 7.5% barnacle flour).

The tools used in this study are flour mills, basins, digital scales with accuracy of 1 gram, ovens, stirrers, pans, baking pans and manual pellets, plastic containers, individual cages with bamboo walls and pedestals with asbestos roofs to protect from rain and sun. Each bulkhead has a length x width x height = 60 x 40 x 40 cm and each one of the rabbits is filled with one.

2.2. Rearing system
The feed adaptation period (preliminary) was carried out for 10 days giving grass and complete feeds with multilevel concentrations, namely the addition of 10%, 20%, 30% to 100% on the 10th day of the adaptation period. The remaining feed is taken every day for 4 weeks (28 x 24 hours) on each rabbit. The remaining feed is taken from the feed site or falls in the cage. Manure collection is carried out in the fourth week for 7 days (21-28 days) every morning. Manure samples 20 rabbits were put into plastic separately then weighed the wet weight using a scale and labeled according to the treatment given. Manure samples were sprayed at 60°C for 12-24 hours to be dried. The manure of each treatment that has been dried is then taken 50% of the total dry weight and stored in the freezer (temperature -15°C) until the seventh day to prevent decay. The manure of each treatment that had dried on the first day until the seventh day was proximate analysis.

2.3. Statistical analysis
The data obtained and collected during the study will be analyzed using SPSS Version 26.0 software. The data was tested by Analysis of Variance p< 0.05 SPSS v.26 and if there was a significant difference, it would be continued with Duncan's multiple distance test (5%).
3. Results and Discussion

3.1. Digestion of Crude Protein

The average crude protein digestibility in rex’s buck of each type of treatment can be seen in table 1. The results of statistical analysis using variance in the study showed that the addition of barnacle flour as a feed for fish meal substitution had no significant effect (p > 0.05) on the digestibility of crude protein which can be seen in the table (table 1.). The average digestibility of crude protein, respectively P0 was 76.84%, P1 was 76.45%, P2 was 76.09%, and P3 was 77.47%. The data shows that there were no significant differences in each treatment. This is because the feed consumption in each treatment is almost the same amount. Crude protein digestibility is strongly influenced by the amount of feed consumed, so that if the amount and nutritional content of food consumed between treatments is the same or almost the same, it will result in crude protein digestibility that is not much different, and vice versa [12,13].

Crude protein is one of the organic materials in feed, besides that the consumption of crude protein is also strongly influenced by the protein content in the ration. In accordance with High crude protein content in the ration and accompanied by high dry matter consumption resulted in high crude protein consumption and vice versa [14]. The digestibility of crude protein in rabbits in the study was 76.84-77.47%, which is higher than the digestibility of crude protein in rabbits that received complete rations reported by [15], which was 70.75%.

Crude protein digestibility figures obtained in the study were included in the high category. The quality of feed based on digestibility is divided into three categories, namely the digestibility value of protein in the range of 50 - 60% is of low quality, 60 - 70% is of medium quality and above 70% is of high quality [14,15]. The increasing digestibility of protein will facilitate protein metabolism, which means that it will directly have an impact on increasing body weight gain in livestock [16].

Table 1. Effect of substitution of fish flour by barnacle flour on digestion of crude protein of buck (Mean ± SD)

| Treatment | Mean ± SD   |
|-----------|-------------|
| P0        | 76.84 ± 0.81 |
| P1        | 76.45 ± 1.41 |
| P2        | 76.09 ± 0.60 |
| P3        | 77.47 ± 1.01 |

Figure 1. Effect of substitution of fish flour by barnacle flour on digestion of crude protein of buck (Mean ± SD)
3.2. Digestion of Crude Fiber

The average digestibility of crude fiber in male rex rabbits of each type of treatment can be seen in table 2. The results of statistical analysis using variance in this study showed that the addition of barnacle flour as a feed for fish meal substitution had a significant effect (p <0.05) on crude fiber digestibility which can be seen in the table (table 4.2.). The average crude fiber digestibility were P0 of 36.67%, P1 of 50.81%, P2 of 49.42%, and P3 of 49.36% (table2). The data shows that the treatment in the study showed a significant difference in crude fiber digestibility. The digestibility of rabbit crude fiber which received treatment P0 was lower than the digestibility of crude rabbit fibers treated with P1, P2 and P3. Researchers suspect that the high digestibility of crude fiber in P1, P2, P3 compared to the crude fiber content of rabbit feed treated with P0 is a high chitin content in fish meal compared to that substituted using barn flour which can interfere with digestive ability. The chitin is a compound that is difficult for the body to digest because it is a glucose polymer [17,18]. This agrees with [19] chitin is a crude fiber that is difficult to digest because chitin can bind nutrients needed for the growth of livestock so that if not broken down these nutrients cannot be optimally absorbed by the livestock body.

| Treatment | Mean ± SD |
|-----------|-----------|
| P0        | 36.67% ± 2.86 |
| P1        | 50.81% ± 1.57 |
| P2        | 49.42% ± 1.30 |
| P3        | 49.36% ± 2.77 |

Figure 2. Effect of substitution of fish flour by barnacle flour on digestion of crude fiber of buck (Mean ± SD)

4. Conclusion

Based on the results of the study, conclusions can be drawn. The use of barnacle flour as a substitution feed to a level of 7.5% does not significantly affect the value of crude protein digestibility in broiler rabbits. The use of barnacle flour as a substitution feed to the level of 7.5% increases the digestibility of crude fiber in broiler rabbits.

5. References

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