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THE CRUDE PROTEIN AND FIBER IN TARO LEAF FLOUR FERMENTED BY *TRICHODERMA VIRIDE* AS CATFISH FOOD

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ABSTRACT

Taro leaves contain a high level of protein compared to the roots. However, taro leaves have been treated as the wastes of taro roots processing. In this research, the taro leaves are fermented using *Trichoderma viride* under the treatment durations of 0, 5, 7, and 9 days. Among all the durations, the best result is generated from the fermentation duration of 7 days, with the crude protein of 22.07 and crude fiber of 14.01. Therefore, based on the findings of this research, it is hoped that taro leaves fermented by *Trichoderma viride* can be used as an alternative food for catfish.

KEY WORDS

Taro leaves, fermentation, *Trichoderma viride*, formulation of catfish food.

According to Arini *et al.*, (2013), catfish are one of the freshwater fish. Its easiness to be nurtured, fast growth, resistance against diseases, and economic characteristics are an advantage. Therefore, there are a lot of farmers interested in catfish farming.

In catfish farming, many farmers use fish flour in food formulation. Due to the fact that it is expensive, a more affordable and accessible alternative food substance is considered necessary. The substance could be acquired in vegetables, including taro leaves.

Sudomo and Aditya (2014) state that the taro plant is one of the nutritious plants due to its bioactive substances. Yet, so far the utilization of taro plant has been limited only on its roots while the leaves are left behind as a waste. Therefore, the researchers use taro leaves as a food substance for fish to replace the expensive fish flour.

The taro leaves are processed into flour which contains 16.48% crude protein, 17.33% crude fiber, and 4.30% fat (Aliyani, 2002). With such a high level of crude fiber, fermentation is required to lower it in accordance with the standard of fish food. Therefore, the taro leaf flour is fermented using *Trichoderma viride* in order to lower its crude fiber and enable it to be applied to the catfish food.

METHODS OF RESEARCH

This research is conducted at Faculty of Fisheries and Marine Sciences, Universitas Brawijaya, Indonesia, and on April – June 2018. The material used in this research is taro leaves, collected from Turen, Malang, Indonesia. It is initially washed and dried so that the leaves could become flour. This taro leaf flour is the main material of this research:

- *Trichoderma viride* mold. The *Trichoderma viride* mold is obtained from the Center of Biological Research, Lembaga Ilmu Pengetahuan Indonesia (LIPI).
- Fermentation of Taro Leaf Flour. The taro leaf flour is weighed respectively 100 gr, followed by an addition of *Trichoderma viride* spore solution as much as 3% and fermented throughout the course of 5, 7, and 9 days. The taro leaf flour fermentation result, then, went into the proximate and crude fiber analysis.

RESULTS AND DISCUSSION

According to the statistical analysis, the dose of *Trichoderma viride* mold in the fermentation taro leaf flour process in three different durations of 5, 7, and 9 days shows a real difference toward the nutrition of protein and crude fiber contained in the dry material.

Table 1 – The Crude Protein contained in the Dry Taro Leaves fermented by *Trichoderma viride*

Treatment	Amount of Protein
0 days	19.88 ± 0.15 ^a
5 days	20.60 ± 0.15 ^b
7 days	22.07 ± 0.09 ^c
9 days	20.97 ± 0.11 ^d

Based on the research findings, the highest amount of crude protein is generated in the treatment duration of 7 days with the protein contained as much as 22.07 ± 0.09^c. The treatment duration is significantly different with the duration of 0, 5, and 9 days. According to Gunam *et al.*, (2011), the *Trichoderma viride*'s optimal growth is in the seventh day, which increases the protein. The higher the amount of protein, the higher the cellular activities are. The longer the fermentation duration with the higher concentration of substances, then the higher the amount of protein generated.

The increase of protein is influenced by the protease enzyme. The enzyme can alter protein into a polypeptide and altered further into an amino acid. The amino acid is needed by the microbes to multiply themselves during the fermentation process. Therefore, the increase in the number of microbes can increase the crude protein of a material due to the fact that these microbes are the single cell protein source (Agustono *et al.*, 2011). The single cell protein is a term used by a pure crude protein generated by the single or multi-celled microorganisms which are simple, for instance, mold.

Table 2 – The Crude Fiber contained in the Dry Taro Leaves fermented by *Trichoderma viride*

Treatment	Amount of Crude Fiber
0 days	19,06 ± 0,12 ^a
5 days	16,98 ± 0,20 ^{ab}
7 days	14,01 ± 0,14 ^b
9 days	15,17 ± 0,07 ^c

Based on the research finding, it can be seen that the lowest crude fiber generated in the treatment duration of 7 days with the crude fiber of 14,01 ± 0,14^b. This result is significantly different from the treatment duration of 0 and 9 days yet is not really different with the treatment duration of 5 days fermentation. The additions of *Trichoderma viride* in the fermentation process can generate cellulase enzyme that degrades the cellulose and synthesize cellulose related to hydrogen bond thus lower the crude fiber.

According to Putri (2012), *Trichoderma sp* are cellulolytic microbes which generate cellulase enzyme that degrades cellulose. In the degradation process, the cellulase enzyme consisted of endocellulase (enzyme that break down cellulose randomly into cellulose-oligosaccharide / cellulodextrin) and exocellulase (enzyme that break down cellulose-oligosaccharide into glucose which would be broken further into glucose).

CONCLUSION

The taro leaves which have been treated as wastes of taro roots processing can also be used as an alternative food for catfish. The taro leaves which are fermented using *Trichoderma viride* with treatment durations of 0, 5, 7, and 9 days can increase the amount of crude protein and lower the crude fiber. The findings are acknowledged in the treatment duration of 7 days with the crude protein of 22,07 ± 0,09^c and crude fiber of 14,01 ± 0,14^b. Therefore, through the research findings, it is hoped that the taro leaves fermented by *Trichoderma viride* can be used as an alternative food for catfish.

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