Quality Improvement (Fiber Content and Protein Digestibility Value) of Cassava Peel by Fermentation Using Tape Yeast with Vitamin B Supplementation

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Quality Improvement (Fiber Content and Protein Digestibility Value) of Cassava Peel by Fermentation Using Tape Yeast with Vitamin B Supplementation

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Abstract :

The significant increment of cassava production in Indonesia which reaches 22 million tons in 2009 results a huge number of cassava peels that have potency to be environment pollutant. On the other hand, the value of imported corn for animal feed increase annually and reaches 609,635 tons in 2011. Based on that, it is important to study the potency of cassava peels as raw material for animal feed and to reduce the dependency of animal feed in imported corn. Previously, the fermentation of cassava peel using tape yeast inoculums with vitamin B supplementation can increase its protein content and decreasing the cyanide content. In this work, fermentation process of cassava peel using tape yeast inoculums with vitamin B supplementation were conducted to investigate its influence in fiber content and protein digestibility value. The result shown that vitamin B_1 supplementation in fermentation process using tape yeast inoculums can reduce the crude fiber content from 11.4952% to 4.5603%. Supplementation of vitamin B_1 also increased the value of protein digestibility of cassava peel from 61.0252% to 71.1066%. The best quality was obtained in addition of vitamin B_1 in fermentation process using tape yeast with 6 days fermentation.

Keywords: cassava skin, supplementation of vitamin B, crude fiber, protein digestibility

1. Introduction

The trend of cassava (*Manihot esculenta Crantz* or *Manihot esculenta Pohl*) production in Indonesia are increaced annualy. According to the Ministry of Agriculture data, in 2000 the production of cassava was about 16.1 million tons and increaced up till 22 million tons in 2009 **[1]**. The rapid growth of cassava based food industry was one factor that drive the increments of cassava production. As a concequences, there were a huge number of cassava skin (16% from total production) generated from food industry as waste **[2]**. These huge number of waste will potential to contaminate the environment if it is not utilize in a proper way. One promising solution that can be done is to proceed the cassava skin to be animal feed.

Currently, animal feed is produce from corn. Association of Animal Feed stated in 2011 the consumption of corn for animal feed nationwide is estimated 10.3 million tonnes. This number had increased 4.04 % compared with 2010, where the amount of corn consumption only 9.9 million tonnes. Other data from the Central Statistics Agency (BPS), in the first three months of 2011 the Indonesia imports of corn has reached 609.635 tonnes with the value of $ 181.365 million **[3]**. Processing the cassava skin to be animal feeds, not only one solution for waste utilization but also can reduce the value of corn imports.

Carbohydrates content in cassava flour is equal to 78.203% **[4]**. These carbohydrates can be utilized as a substrate in the fermentation process **[5]**. The fermentation process can increase the digestibility of the material, lower crude fiber content of the material, increasing the protein content of the material, and lower content of toxic materials. The protein content of fermented cassava skin is higher than the skin fresh cassava **[2]**. This fermentation process can remove cyanide content in cassava skin. The fermentation process can increase the protein content of cassava skin **[6]**.

Vitamins play an important role in regulating the enzyme and co-enzyme, with varying amounts of vitamins contained in the substrate and water. Although some natural sources of carbon and nitrogen also containing vitamins that needed in fermentatio process, but vitamin deficiency still occured in the fermentation process. The addition of vitamin into substrate can prevent vitamin deficiency, for example: potassium pantothenic (vitamin B_5)

was used in the formulation of a substrate to produce vinegar, biotin (vitamin B_7) was used on a substrate to produce glutamic acid, and vitamin B_1 is needed to produce some of the strain **[7]**.

The supplementation of vitamin B_1 and mixtures of vitamins B_1 and B_6 in the fermentation of cassava skins provide the most optimal improvement protein content in the fourth day of fermentation **[8]**. On the other side the fiber content and digestibility of protein from the fermentation process with vitamin B supplementation has not yet been studied, therefore this study aims to examine the influence of cassava skin fermentation with vitamin B supplementation on the levels of crude fiber and protein digestibility of cassava skins, with the tape yeast inoculum.

2. Materials and Methods

2.1. *Materials*

The raw material of this study is the cassava skin flour. Cassava skins were obtained from PT. Indofood Fritolay Semarang. Tape yeast brands Gedang used as inoculum of fermentation. Other materials used in this study were vitamin B_1, B_6, B_{12}, and $B_{complex}$ IPI production and chemicals for the analysis of levels of crude fiber (method Wendhe) and the value of in vitro protein digestibility.

2.2. *Equipments*

The tools used include: erlemenyer 250 mL, analytical balance (OHAUS), autoclaf, glass stirrer. Complete equipment for the analysis of levels of crude fiber (method Wendhe) and the value of in vitro protein digestibility.

2.3. *Fermentation*

Five 250-ml erlenmeyer prepared and functioned as a fermentor. Into each erlenmeyer were transfered 100 grams of cassava flour and 125 mL of distilled water, stired evenly and sterilized at a temperature of 121°C for 15 minutes and cooled. Fermentors then supplemented with vitamin B (vitamin B_1, B_6, B_{12}, and $B_{complex}$), while one fermentor is used as a control (without vitamin suplementation). Five of the fermentors are then inoculated with tape yeast 0.3 gr **[6]** and fermented for 6 days. Sampling was done every 48 hours and performed analysis of fiber content (Wendhe method) and the value of in vitro protein digestibility.

2.4. *Analysis Data*

Data obtained from the research (primary data) is displayed in tabular form and analyzed descriptively.

3. Results and Discussions

3.1. *Crude fiber content of fermented cassava flour skin*

Raw material cassava flour used in this study has a crude fiber content of 11.4952%. The results of the analysis of the crude fiber content of fermented cassava flour supplementation in vitamin B (B_1, B_6, B_{12}, and B_{com}) and tape yeast inoculum, presented in Table 1.

Table 1. The value of fiber content in cassava skin fermented with the vitamin B supplementation

No	Process	Levels of Crude Fibre Value (%)		
		Days 2	Days 4	Days 6
1.	Fermentation with vitamin B_1 suplementation	4,9464	4,8212	4,5603
2.	Fermentation with vitamin B_6 suplementation	6,9785	6,3420	5,5156
3.	Fermentation with vitamin B_{12} suplementation	7,0167	6,7206	6,1440
4.	Fermentation with vitamin B_{com} suplementation	6,8225	6,2445	5,5606
5.	Fermentation without vitamin B suplementation (control)	7,0805	6,3438	6,2999

Table 1 shows that the supplementation of vitamin B in the fermentation process of cassava flour can reduce the crude fiber content of cassava flour, in which the lowest crude fiber content was found in sixth day of the fermented cassava flour with vitamin B_1 supplementation that is equal to 4.5603%. Meanwhile, the crude fiber content in fermented cassava flour without vitamin B supplementation (control) was 6.2999% in the sixth day of fermentation. This result shows that the fermentation process with vitamin B supplementation can reduce levels of crude fiber materials better than the fermentation process without vitamin B supplementation. The highest reduction in crude fiber content obtained in the fermentation using vitamin B_1 supplementation. This is linear with the statement that vitamin B_1 is needed to produce a strain, in which supplementation of vitamin B_1 in the fermentation substrate can spur the growth of microbes that can affect the decrease in crude fiber content in the substrate **[7]**.

Overall in all treatments crude fiber content of fermented cassava flour were decreased. This phenomena occurred due to fiber was used for microbial growth. In the process of fermentation, the fermentation substrate serves as a source of nitrogen, carbon, and energy **[9]**. Parts of crude fiber digested by the microbes which can also reduce the levels of crude fiber fermentation product. Crude fiber is usually poorly digested by monogastric animals. Materials that can not be digested can be broken down by certain enzymes in the fermentation process, such as cellulose and hemicellulose into simple sugars. The hemicellulose can be breakdown by microbial fermentation substrate, thus can reduce the crude fiber content of the fermentation substrate **[10]**.

3.2. Protein Digestibility values fermented Cassava Flour Skin

Analysis of in vitro protein digestibility on raw cassava flour obtained a value of 61.0252%. The results of the value of the protein digestibility of the fermented cassava flour with vitamin B supplementation and tape yeast inoculum, presented in Table 2.

Table 2. The value of in vitro protein digestibility in fermented cassava skin with vitamin b supplementation

No	Process	Protein Digestibility values (%)		
		Days 2	Days 4	Days 6
1.	Fermentation with vitamin B_1 suplementation	69.2632	69.8014	71.1066
2.	Fermentation with vitamin B_6 suplementation	66,0313	69.0615	69.9051
3.	Fermentation with vitamin B_{12} suplementation	63.6756	66.5520	68.2495
4.	Fermentation with vitamin B_{com} suplementation	67.0318	68.2242	69.3607
5.	Fermentation without vitamin B suplementation (control)	62.0268	62.5242	64.0313

The above result revealed that the protein digestibility of the fermented cassava flour has increased by the time of fermentation process carried out. The digestibility of the material is divided into three levels, namely low if the digestibility values between 50-60%, while if the digestibility values between 60-70% named medium, and high if the digestibility values between 70-80% **[11]**. In general, the digestibility of protein in this research was in medium level, however the digestibility of protein in the fermentation of cassava flour with vitamin B_1 supplementation on the sixth day tend to the level of high. On this treatment, the protein digestibility value was obtained 71.1066%. While the lowest value is 64.0313% of protein digestibility found in the control treatment on the sixth day of fermentation. In general, supplementation with vitamin B substrates can increase the digestibility of protein material.

4. Conclusions

Vitamin B supplementation in cassava flour fermentation using tape yeast inoculum can reduce levels of crude fiber digestibility of protein and increase the value of materials. The optimum crude fiber content reduction and increment of protein digestibility values can be achieved by the fermentation of cassava flour using tape yeast inoculum with vitamin B_1 supplementation.

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