THE POTENTIAL OF VELVET BEANS *(Mucuna pruriens L.)* AS A SOURCE OF PROTEIN IN FOOD PRODUCTS

POTENSI KACANG KORO BENGUK (Mucuna pruriens L.) *SEBAGAI SUMBER PROTEIN PRODUK PANGAN*

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ABSTRAK

Penelitian ini bertujuan untuk memperoleh kondisi/perlakuan optimum awal untuk menghilangkan kadar HCN, membuat tempe, dan tahu koro benguk serta mengetahui daya terima konsumen terhadap produk yang dihasilkan. Perlakuan awal yang dilakukan adalah perendaman koro benguk selama 12 jam, perendaman tiga hari, dan perendaman 12 jam dengan penambahan $NaHCO_3$ *1% yang dapat menghilangkan kandungan HCN. Koro benguk dapat dijadikan tempe tanpa substitusi kedelai, sedangkan pembuatan tahu harus disubstitusi kedelai hingga 65%. Tempe koro benguk yang paling disukai adalah tempe dengan perlakuan awal perendaman tiga hari dengan kandungan protein 12,2%. Tahu koro benguk yang paling disukai adalah tahu dengan formula 20% koro benguk dan 80% kedelai, baik dengan perlakuan awal perendaman 12 jam dengan penambahan* $NaHCO_3$ *maupun dengan perendaman selama tiga hari. Ini untuk pertama kalinya dilaporkan tentang tahu koro benguk.*

Kata kunci: *Koro benguk, Tempe, Tahu, Sumber protein, Produk pangan*

ABSTRACT

The objectives of this research were to obtain the optimum early condition/treatment to eliminate HCN from velvet beans, to produce tempe and velvet beans tofu, and to find out consumer acceptance toward the products produced. Velvet beans pretreatment was conducted by soaking them for 12 hours, 3 days, and 12 hours by addition of $NaHCO_3$ 1% to reduce the content of HCN. Tempe can be made of whole velvet beans without addition of soybean, while tofu has to be substituted with soybean up to 65%. The most preferred velvet bean tempe is the one with 3 days pretreatment with protein content of 12.2%. Meanwhile the most preferred velvet beans tofu is the one with 20% velvet beans and 80% soybean formula either the one with 12-hour soaking (with 1% $NaHCO_3$ addition) and with 3-day soaking. This is for the first time velvet beans tofu preparation is reported.

Keywords: Velvet beans, Tempe, Tofu, Protein source, Food product

INTRODUCTION

Indonesia is the biggest soybean importer. The value of soybean importation increases every year[1]. The dependence on soybean importation happens because local soybean production is lower than its demand. Therefore it is important to introduce alternate bean as soybean substitute to build food security.

Soybean import volume keeps increasing over the years, while in 2011 it reached 2,088,437 tons, equal to USD 1,245,867,649.[1] Since soybean price has significantly increased, tempe and tofu producers have met difficulty in production. If it is assumed that velvet bean can replace 30% of soybean for tempe production, and velvet bean is produced continuously, we can save approximately USD 360 million. This is in line with government programs i.e. to improve food security by utilizing any natural resources available.

Velvet bean (*Mucuna pruriens* L.) is a kind of bean which, when compared to soybean, has lower protein and fat level, yet higher carbohydrate level up to twice than soybean. Velvet bean *(Mucuna pruriens* L.*)* is quite popular around Yogyakarta. It is usually consumed as "tempe besengek", which is well known there. This popularity needs to be disseminated simultaneously with exploring other kinds of product from soybean. Soybean itself is renowned as the main ingredient for tempe and tofu that are very familiar for meal.

Velvet bean is an under-utilized tropical legume grown in Africa, South America, and South Asia as a green manure/cover crop.[2] It is known as a source of high protein and other nutrient.[3,4] Velvet bean has a potential to become an alternate source of protein as well as a substitute for soybean. High quality protein ingredients providing both nutritional quality and functional property are compatible with other ingredients under processing conditions and contain minimum anti-nutritional factors.[5]

Some researches over velvet bean have been carried out. One of them aimed to evaluate some functional and biological properties of hydrolysate protein of velvet bean (*Mucuna pruriens* L.) from Yucatan, Mexico, equipped with gastrointestinal enzymes.[6] Madzimure *et al.*[7] have conducted research to compare different levels of velvet bean seed meal feeding on feed intake and growth in Mashona goats. Furthermore, Susanti *et al*[8] have conducted research on *Canavalia ensiformis* DC as basis to investigate various potentials of different varieties of beans.

The presence of anti-physiological and toxic factors in legume decreases the overall nutritional qualities. Seeds of *Mucuna* contain several anti-nutritional factors such as L-DOPA, total free phenolics, tannins, haemagglutinin, trypsin, and chymotrypsin inhibitors, anti-vitamins, protease inhibitors, phytic acid, flatulence factors, saponins, and hydrogen cyanide.[9,10] An adequate processing would be necessary to reduce the level of anti-nutrients/toxicants present in the seeds of the plant in order to maintain minimum safe consumption levels, thus make velvet bean ideal food for human nutrition.[3]

The objectives of this research were to obtain the optimum early condition/treatment to eliminate HCN from velvet bean, to produce tempe and tofu from velvet beans, and to know consumer acceptance.

MATERIALS AND METHODS

Materials

Mature and dried seeds of velvets bean were purchased from pasar Wates, Yogyakarta. Soybean, yeast for tempe, acetic acid, and palm oil were purchased from Pasar Bogor. Equipments needed for the research were disk mill, knife, plastic basin, pan, *nampah*, skillet, cast out, filter cloth, plastic packaging, and other glassware.

Methods

Preliminary study

The preliminary study was carried out to discover the characterization of the raw materials and to get the optimum pretreatment. The pretreatment are soaking beans for 12 hours, soaking beans for 3 days, soaking bean for 5 days, germination, soaking the beana by adding 1% $NaHCO_3$ for 12 hours; and soaking beans by adding 1% $NaHCO_3$ for 3 days. The pretreatment was taken to reduce HCN in the velvet beans before continuing the process.

The making of velvet beans product

1. Tempe[11]

To produce tempe, velvet beans have to be boiled before soaked. It helped bean dehulled so that easy to cut. Velvet beans (best pretreatment) were then boiled again for 1 hour and drained. The beans were cut then added with 0.1% yeast (1 gr per 1 kg velvet beans). The beans were packed with plastic wrapping. The wrapping then was punched to make the steam being entrapped inside. The fermentation took 2 days.

2. **Tofu**[12]

Velvet beans (best pretreatment) were mixed with soybean with ratio 20 : 80 (the 20% formula), and 35 : 65 (the 35% formula). Mixed beans then were grounded by adding some water and then filtrated. The filtrates then were cooked until boiling and removed from the stove afterward. Some amount of acetic acid was poured into the filtrates to agglutinate the protein. Then the water was removed from the tofu concentrate and tofu was formed using wood block.

3. **Analytical methods**

Moisture analysis was conducted using AOAC Official Method 931.04, crude protein content using AOAC Official Method 955.04C, lipid content using AOAC Official Method 932.06, carbohydrate content using reduction method, cyano acid content using HPLC.

Preference test was conducted using level of preference test with level 1 until 5. The interpretation are: 1 = really dislike; 2 = dislike; 3 = neutral; 4 = like; 5 = really like. The results were then described based on frequency referring to panelist preference. Number of panelists are 30.

RESULTS AND DISCUSSION

Velvet Beans Characterization

The proximate analysis showed that velvet bean contained of 25.2% crude protein. This result showed the potential of velvet beans as a source of protein in food products. The proximate composition of velvet bean is presented in Table 1. The image of velvet bean is shown in Figure 1.

Table 1 showed that velvet bean contains HCN and needs to be eliminated. If swallowed, it will very quicklty absorbed by the digestive tract into blood and bound together with oxygen. Pretreatment can be expected to remove all HCN content.[13]

Tabel 1. Proximate Analysis of Velvet Bean

Parameter	Content
Protein (N x 6.25) (%)	25,2
Water (%)	12,9
Ash (%)	3,81
Lipid (%)	2,44
Carbohydrate (%)	55,7
HCN (mg/kg)	7,13

Figure 1. Velvet Bean (*Mucuna pruriens* L.)

Pretreatment optimization

The pretreatment results to reduce HCN are presented in Table 2.

Pretreatment	HCN Content (ppm)
12-hour soaking	0,4
3-day soaking	Not detected
5-day soaking	Not detected
Germination	Not detected
Soaking by adding 1% $NaHCO_3$ for 12 hours	Not detected
Soaking by adding 1% $NaHCO_3$ for 36 hours	Not detected

Table 2. HCN Content of Velvet Beans After Pretreatment

Table 2 showed that HCN content has been elliminated from beans until undetectable. It means that soaking treatment can dissolve HCN into the water. The pretreatment was chosen based on the data for time of soaking beans for 3 days and soaking by adding 1% $NaHCO_3$ for 12 hours can reduce HCN content. Germination was not chosen because more time is required for germination process. Therefore the process of soaking by adding 1% $NaHCO_3$ for 36 hr and 5-day soaking process was inefficient.

Velvet beans products

1. Tempe

The velvet bean velvet bean was visible when it was cut. Velvet bean tempe is shown in Figure 2. The characterization of velvet tempe is presented in Table 3.

Table 3 shows that protein content of velvet bean tempe is lower than that of soybean tempe (which is 16%). Just like the raw material, protein content of velvet beans is lower than that of soybean. To determine the level of consumer preference for velvet bean tempe, organoleptic test has been done. The test result is presented in Figure 3.

Figure 3 shows the frequency of panelists preference for tempe features, depicted in scores. In terms of color, the highest score, i.e. more than 3 (neutral to really like) is shown by treatment B3, which is 40%. In terms of aroma, the highest score, i.e. more than 3, is shown by treatment B1N, which is 87%. In terms of texture, the highest score, i.e. more than 3, is shown by treatment B3, which is 63%. In terms of taste, the highest score, i.e. more than 3%, is indicated by B1N treatment, which is 93%. It is thought that $NaHCO_3$ functions to soften beans resulting to tempe to become softer.

Figure 2. Velvet Beans Tempe

Table 3. The Characterization of Velvet Beans Tempe

Parameter	Pretreatment		SNI 3144:2009 Tempe Kedelai
	Soaking by adding 1% $NaHCO_{3,}$ for 12 hr	Soaking for 3 days	
Moisture (%)	60,2	60,8	Max. 65
Ash (%)	0,61	0,45	Max. 1,2
Protein (N x 6,25) (%)	12,5	15,4	Min. 16
Lipid (%)	4,13	3,40	Min.10
Carbohydrate (%)	22,6	20,0	not required

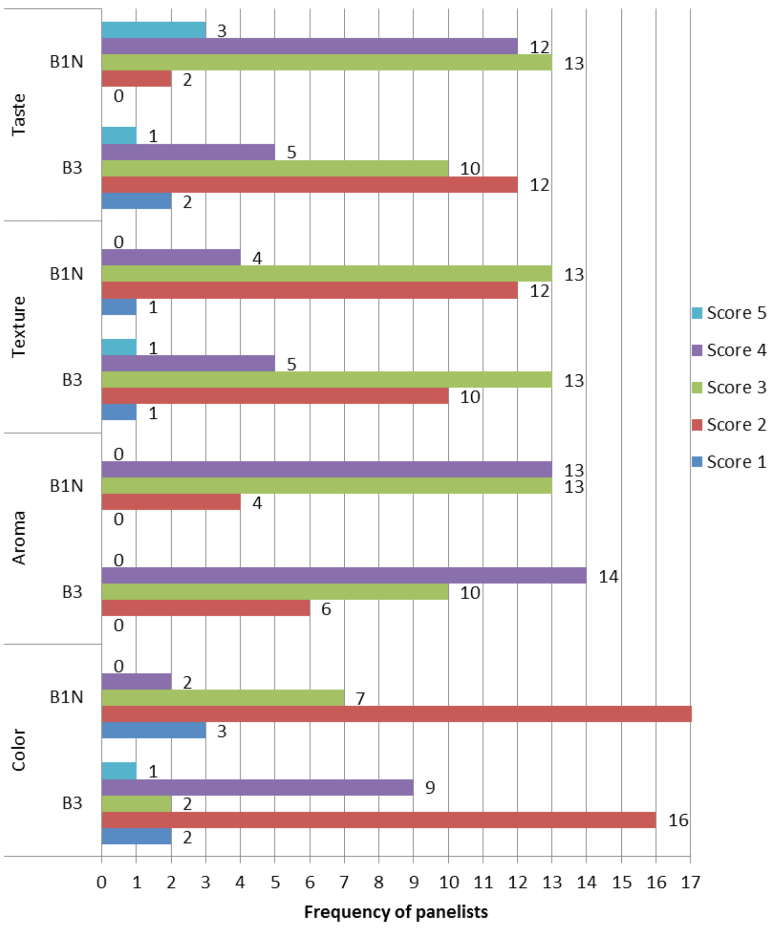

Figure 3. The Frequency of Panelists Preference for Velvet Beans Tempe

Caption:
B3 : velvet beans with 3-day soaking.
B1N : velvet beans with 12-hour soaking (+$NaHCO_3$ 1%)

2. **Velvet bean tofu**

In making velvet bean tofu, the protein of velvet bean filtrate cannot be coagulated either with acid or base. Hence, the tofu dough could not be molded. Therefore, soybean must still be added. The figure of velvet bean tofu can be seen in Figure 4. Organoleptic test results can be seen in Figure 5.

Figure 5 shows the frequency of panelists preference for tofu features, depicted in scores. In terms of color, the highest score, i.e. more than 3 (neutral to really like) is shown by treatment B20R1N, which is 50%. In terms of aroma, the highest score, i.e. more than 3, is shown by treatment B20R3, which is 67%. In terms of texture, the highest score, i.e. more than 3, is shown by treatment B35R3, which is 83%. In terms of taste, the highest score, i.e. more than 3%, is indicated by B35R3 treatment, which is 77%. The velvet bean tofu is not preferable because the color of the tofu tends to be grayish and blackish after being fried. Panelists were not familiar with such colors. The results of the analysis are shown in Table 4.

Table 4 shows that the levels of protein, fat, and ash of velvet bean tofu meet the SNI 01-3142-1998 soybean tofu. Velvet bean tofu had to be mixed with soybean until 65%. With a maximum of 35% soybean mixture, velvet bean tofu can be made and were still accepted by panelists.

Figure 4. Velvet Bean Tofu

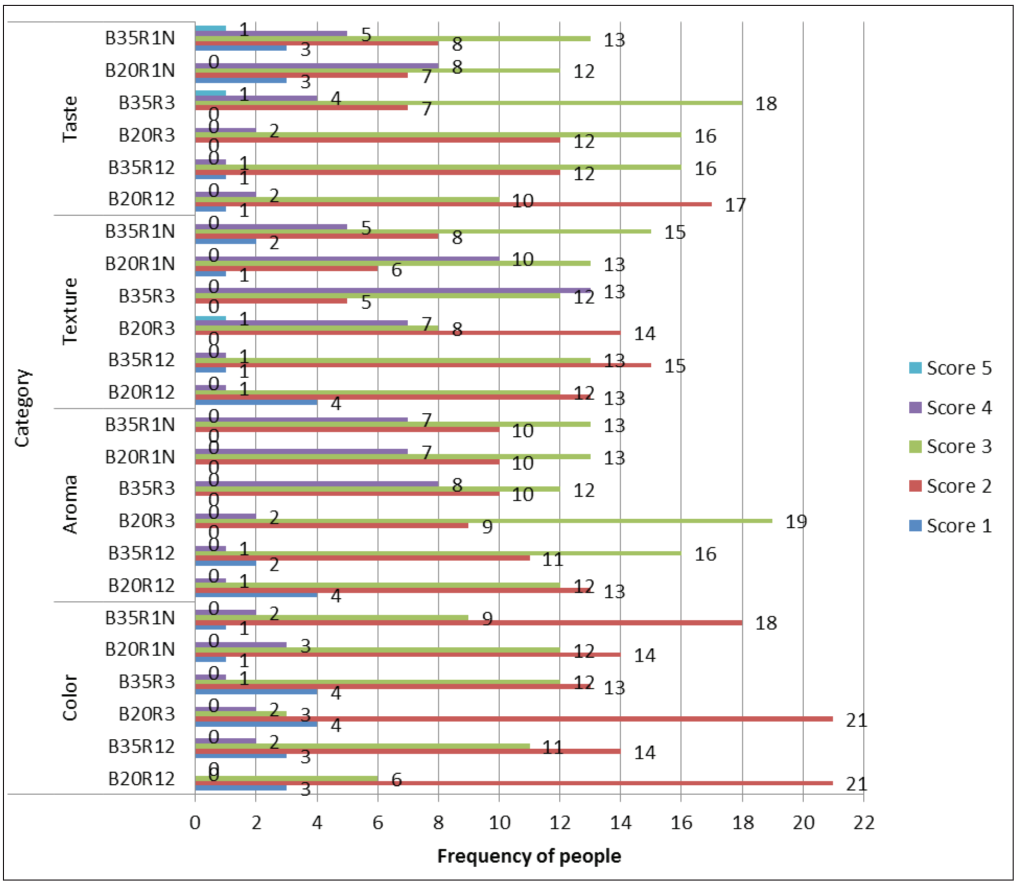

Figure 5. Preference Test Charts of Velvet Bean Tofu

Caption:

B20R12 : 20% velvet beans 80 % soybean with 12-hour soaking.
B35R12 : 35% velvet beans 65 % soybean with 12-hour soaking.
B20R1N : 20% velvet beans 80 % soybean with 12-hour soaking (+NaHCO3 1%).
B35R1N : 35% velvet beans 65 % soybean with 12-hour soaking (+NaHCO3 1%).
B20R3 : 20% velvet beans 80 % soybean with 3-day soaking.
B35R3 : 35% velvet beans 65 % soybean with 3-day soaking.

Table 4. The Characterization of Velvet Beans Tofu

Parameter	Soaking 3 days	Soaking 12 hr with $NaHCO_3$ 1%		SNI 01-3142-1998
	35 %	20 %	35 %	
Moisture (%)	79.4	80.1	81.0	not required
Ash (%)	0.44	0.42	0.34	Max. 1.0
Protein (N x 6.25) (%)	13.8	11.5	9.06	Min. 9.0
Lipid (%)	2.92	5.43	4.27	Min. 0.5
Carbohydrate (%)	3.44	2.55	5.33	not required
HCN (mg/kg)	Ttd	1.17	0.49	not required

CONCLUSION

Velvet bean has the potential as a source of protein. Tempe can be made with whole velvet bean, while tofu cannot. Velvet bean tofu must be made by mixing velvet bean with certain percentage of soybean. The most preferred velvet bean tempe is the one with 12 hours of soaking pretreatment added with 1% $NaHCO_3$ and contains 12.5% of protein. At this condition, HCN has been reduced optimally. The most preferred velvet bean tofu in terms of taste is B35R3, composed with 35% of velvet bean and 65 % of soybean, with 3 days of soaking.

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