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Folate Content Of Mung Bean Flour Prepared By Various Heat-Treatments

Miftakhussolikhah[a*], M. Kurniadi[a], C. Dewi Poeloengasih[a], A. Frediansyah[a], A. Susanto[a]

[a] *Technical Implementation Unit for Development of Chemical Engineering , Process Indonesian Institute of Sciences, Jl. Jogja-Wonosari Km 31.5 Gading, Playen, Gunungkidul, Yogyakarta, Indonesia.*

Abstract

The aim of this study was to determine the pretreatment conditions resulted in the lowest lose of folate content and other macro nutrients of mung bean flour production. The pretreatments applied in this study were: (1) blanching at 100°C for 15 min, (2) steaming at 100°C for 15 min, (3) roasting at 160°C for 15 min. The result of this study indicated that the best pretreatment condition for producing mung bean flour was blanching at 100°C for 15 minutes which resulted in the folate content of 18.66 ppm.

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Keywords: folate, mung bean, Gronong, pretreatment.

Introduction

Mung bean (*Vigna radiate* L.) is a popular legume in Indonesia. The beans are usually consumed as a traditional food. Mung beans are important source of protein. Mung bean supplies a higher proportion of protein than any other plant food can. When mung beans are combined with cereals, the result is a complete protein. Mung beans are also rich in lysine. Sprouted mung beans contain vitamin C that is not found in the bean [1]. Mung bean extracts showed anti diabetic, anti-inflammatory, anticancer, antibacterial and anti-oxidant activities [2]. Mung bean contain protein, fat, carbohydrates, vitamins B1 and B2, carotene, niacin, folic acid, also contains minerals calcium,

* Corresponding author.
E-mail address: miftalipi@gmail.com

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phosphorus, iron, etc [3].

Folate is a water-soluble vitamin B that is naturally present in some foods. Folate deficiency can cause neural tube defects in babies born, brain disorders, megaloblastic anemia, dementia, alzheimer's, colon cancer, and coronary heart disease. Folate deficiency anemia happens when a lack of folate force the body to produce abnormally red blood cells that cannot function properly.

Processing mung bean into flour could increase its shelf life and economic value. Pretreatment of mung bean should be done to eliminate unpleasant odors in mung bean flour. Mostly food processing involved heating process using high temperature such as roasting, steaming, boiling. Folate is a compound that is not stable at high temperature. Folate lost during cooking process is a result of vitamin thermal degradation into the cooking water and heat damage [4]. Folate content lost during processing need to be determined. The aim of this study was to determine the optimum pretreatment condition wich have the lowest contain lose of folate and proximate in mung bean flour production.

Materials and Methods

Materials

Mung bean variety Gronong was obtained from Balai Pengembangan Perbenihan Tanaman Pangan dan Hortikultura (BPPTPH) Yogyakarta. Chemicals such as methanol, petroleum ether, etc were obtained from a local agent.

Methods

Mung bean flour processing

Mung bean flours were prepared by three different pretreatment methods i.e. (1) by blanching the mung bean at 100^{o}C for 15 min followed by drying, grinding and screening; (2) by steaming the mung bean using a steamer at 100^{o}C for 15 min followed by drying, grinding and screening ; (3) by roasting the mung bean using a roaster at 160^{o}C for 15 min followed by drying, grinding and screening.

Flour characterization

The macro nutrients of flours were determined according AOAC [5]. Ash, fat and water content were determined using gravimetry method and the protein content was determined using destruction method.

Folate analysis

Folate analysis conducted by Owen and Robert [6]. Two grams samples added with 0.1 M acetate buffer pH 4.5 with ratio 15:1. Samples were filtered, then centrifuged 8000 rpm for 10 min at 4°C. Samples were filtered again with milipore 0.22 µm. Then, the sample wass ready to be injected into the HPLC Shimadzu LC-6A, TSK-Gel

column length 25 cm, diameter 4.6 mm, buffer column Novapak C18, K_3PO_4:acetonitrile (10:1) as mobile phase, wavelength 250 nm was used to detect the output. Flow rate has been set to 0.8 ml / min and 10 µL of injection volume at room temperature has been applied.

Results and Discussion

Flour Characterization

Based on table 1, mung bean variety Gronong had protein content higher than that of protein content in corn flour (20%) [7] but lower than that of protein content in soy bean flour (46,06%) [8]. Protein content of mung bean were different in various pretreatment condition. The highest protein content was achieved in mung bean flour prepared by roasting. This was because hydrophilic protein would be soluble in the water that was used in blanching process. Steaming resulting on mung bean exposed to the heat of the steam. Heating with steam affected to denatured proteins and modified into secondary, tertiary or quaternary structure of a protein without breaking the peptide bond and the result was change in protein content [9].

Table 1. Chemical composition of mung bean flour

Chemical composition	Mung bean flour			
	Without pretreatment	Blanching	Steaming	Roasting
Ash (%)	2.98	2.21	2.62	3.98
Fat (%)	1.36	2.05	1.32	0.90
Protein (%)	22.67	25.22	26.02	27.05
Carbohydrate (%)	63.90	62.06	63.53	64.72
Water (%)	9.09	8.47	6.52	3.34

Water content will influence flour shelf life during storage and flour quality. High water content contributes to the damage because fungi will grow easily. Based on SNI 01-2997-1992 [10] about cassava flour quality requirement, water content of mung bean flour met the requirement (<15%). Water content of mung bean flour by roasting pretreatment was the lowest among other pretreatment methods. Roasting by high temperature causes higher water evaporation than other pretreatment methods.

Folate content of mung bean flour is shown in Table 2. Folat content in mung bean (31.36 ppm) was higher than that conducted by Rychlik *et al* [11]. Rychlik determined mung bean content by microbial assays and stable isotope dilution assays. The difference may be due to several factors including varieties, growing conditions, and methods of analysis. When compared to folate content in soybean [8], folate content of mung bean was lower (87.1 ppm), but higher than that conducted by Ginting *et al* (27.34 ppm) [12] and Arcot *et al* (19.11 ppm) [13].

The results showed that mung bean flour without pretreatment had the highest folate levels than those

mung bean flour with pretreatment. Steaming causes the highest folate lossing compared to other pretreatment methods. High temperature causing folate in mung bean to be degraded. Contact between sample with water could decrease folate content because of leaching [14]. Steaming process involved heating in a constant high temperature (100^{o}C) and contact between sample and water, so that the folate content of mung bean flour by steaming process was the lowest among the other.

Folate Content of Mung Bean Flour

Table 2. Folate content of mung bean flour

Mung bean flour	Folate Content (ppm)	Folate Ratio (%)
Without pre treatment	31.36	100
Blanching	18.66	59.50
Steaming	0.58	1.85
Roasting	8.62	27.49

While blanching causes less folate losing because only involving contact with water on moderate temperature. The temperature of water that was used in blanching was 100^{o}C in the beginning process and decrease over time. Roasting method involving high temperature (160^{o}C) affecting the higher folate losing compared to mung bean flour by blanching pretreatment. Folate standard that used in folate analysis was folic acid. Concentrations standard has a linear relationship with the area of the chromatogram.

The use of antioxidants in food processing can prevent a decrease in folate content. Several studies have shown impairment of folic acid content in foods as a result of autoclave utilization (121^{o} C) on food and the absence of protective antioxidants. Further research was needed to study the folate protective agent for food especially mung bean flour.

Conclusion

Blanching was the best pretreatment condition for producing mung bean flour with high folate content and minimum changes in chemical composition.

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