Product Characterization and Marketing Strategy of “BREM UNGU”: Rejuvenation of Indonesian Traditional Food with Local Purple Sweet Potato as the Source of Natural Colorant

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Abstract

Solid brem is an indigenous fermented food of Indonesia, which often has typical form of long thick bar, white to yellow in color, sweet-savour taste with cooling sensation, and it is easy to crumble by the presence of water. These unique characteristics are generated through alcoholic fermentation of glutinous rice, followed by filtration, concentration, whipping and dehydration. Although it is continuously produced and sold as regional specialties of Madura, East Java, most people refuse to consume this solid brem due to its high sugar content and lack of information that describes its potential health benefits. The present study is attempting the possibility of combining glutinous rice with another local food material having well-known health benefit. Here, we utilize the potency of local purple sweet potato (Ipomoea batatas var. Gunung Kawi), being rich in carbohydrate and anthocyanines, to partly substitute the glutinous rice while adding the health benefits of the final product. The present anthocyanins in purple sweet potato has been well-studied, exhibiting antioxidant, anti-inflammatory, and hepatoprotective activities. The raw materials were subjected to yeast fermentation for 7 days, and subsequently extracted using manual mechanical press. A series of materials ratio (extract of fermented glutinous rice: purple sweet potato = 30:1, 15:1, 15:2) was determined prior to dehydration of brem, and then the color, sugar content, pH, antioxidant activity, and sensory properties of the resulted product were analyzed. Moreover, the competitive analysis and marketing strategy will also be discussed in order to make sure the sustainability of this new innovation.

“BREM UNGU” was developed as the reborn product of authentic solid brem of Madura. Increased proportion of fermented purple sweet potato toward fermented glutinous rice altered the texture of solid brem, but improve the color and antioxidant activity of the final product, being able to increase the overall preferences of panelists. The market potency was approached by re-setting the serving size and packaging design in order to create a competitive product which has uniqueness and bring benefits to local communities.

Keywords: anthocyanins, brem, glutinous rice, purple sweet potato

INTRODUCTION

Indonesia is a country extremely rich in cultural heritages, such as the diverse languages, artworks, dancing, ceremonies, architectures, as well as the traditional food recipes. Almost each tribe and region in Indonesia has its own specialities. One of the most famous traditional food in East-Java is the solid brem originated from Madura Regency. Solid brem is prepared from the extract of fermented glutinous rice which is concentrated, whipped, and solidified upon drying at ambient temperature to generate a sweet final product with a very distinctive taste and flavor.

Almost every family in Madura has developed their own ancient recipe and continued to produce solid brem to this day. Although this solid brem has been well-recognized as typical edible souvenir of Madura, any possible development or modification in the raw materials of brem has become an unsolved mistery until today. Therefore, the local communities fully rely on the use of white sticky rice with slight modification in taste and appearance of brem by adding synthetic colorants and flavor. There are only few reports on material modification of solid brem, i.e. the use of cassava and addition of orange flavor, which have been carried out by Widjanarko et al. [1–4], but there is no consideration on additional health benefits of the main product. In the other words, glutinous rice is still the only main raw material for solid brem until today.
The glutinous rice (Oryza sativa var. glutinosa) is a kind of rice cultivated mainly in Southeast and East Asia, Northeastern India, and Bhutan, which is characterized by opaque grains, low amyllose content (1-2%), and becomes sticky when cooked. Milled glutinous rice could be processed into various food products, such as sweets, rice cakes, puffed rice, and rice crackers, being well-adopted by local recipes of communities in most Asian countries [5]. It belongs to the main staple food for most Asian people thus its demand and price are fairly competing. Glutinous rice is one of Indonesia’s leading export commodities, especially to Singapore [6].

On the other hand, purple sweet potato, which belongs to dicotyledonous plants, are widely grown and consumed by the people worldwide [7]. Sweet potatoes are the sources of complex carbohydrates, not only simple starches, but also oligosaccharides and dietary fibers, hence they are often consumed by those who want to control the body weight. In addition, the purple sweet potato contains significant amounts of anthocyanins (6.5–29.1 mg/100 g fresh weight) which can be functioned as natural colorant and antioxidant for the development of functional food [8,9]. Consumption of natural antioxidants can help the human body to minimize oxidative damages and prevent premature aging. Interestingly, East Java is also bestowed with certain cultivar of purple sweet potato (Ipomoea batatas var. Gunung Kawi) which is locally grown and could be obtained with cheaper price by local communities [10]. The health benefits of anthocyanins from this cultivar have also been well-investigated and documented [11–13].

The present study was aimed to: (i) investigate the best ratio (extract of fermented glutinous rice: purple sweet potato) to prepare solid brem with preferable color and additional health benefits, and (ii) to determine the marketing strategy for sustainable production. The given name for this newly developed product is “BREM-UNGU” with great hope of bringing Indonesian local heritage to have a global image.

EXPERIMENTAL
Preparation of Tapai from Glutinous Rice and Purple Sweet Potato

The glutinous rice and tapai starter (Na Kok Liong, NKL) were purchased from local market in Malang, East Java, Indonesia. The rice was weighed two kilograms and rinsed twice under running tap water. Then, the rice was steamed for 35 mins, and intermittently a cup of hot water was poured and the rice was stirred. The steamed rice was cooled down by aerated above a layer of banana leaf on a wide tray, until it reached the ambient temperature (25–30°C). Four grams of tapai starter was ground and sprinkled evenly over the steamed sticky rice, then the mixture was packed closely with banana leaf and let to ferment at room temperature for 7 days.

The purple sweet potato var. Gunung Kawi was obtained from local farming in Gunung Kawi, Malang, East Java, Indonesia. The sweet potatoes were peeled and weighed three kilograms, rinsed under running water, and subsequently cut into small pieces (approx. 1 cm × 1 cm × 1 cm). The sweet potatoes were steamed for 35 mins and then cooled down into room temperature. An amount of ground tapai starter (5 grams) was spread above banana leaves, and the steamed sweet potatoes were rolled around to make sure the yeast powder cover the entire surface. The comparable anaerobic fermentation occurred for 6 days in a closed container.

The liquor of tapai was generated after the fermented raw material was collected in a cloth and manually pressed using hands. The liquor of fermented sticky rice and purple sweet potato were contained separately and directly used in further process. In this step, 2,200 mL and 500 mL of tapai extract were obtained from glutinous rice and purple sweet potato, respectively.

Preparation of Solid Brem

The liquor of tapai from glutinous rice was boiled and concentrated at 95±5°C until it turned clear and viscous. Furthermore, the concentrated liquor was cooled down and whipped using a hand mixer (high speed) for about 30 minutes until the color was turned white. This material was blended with the liquor from fermented purple sweet potato at various ratios (extract of fermented glutinous rice: purple sweet potato = 30:1 (A), 15:1 (B), and 15:2 (C)), and subsequently dried as thin layer by means of drying oven at 50°C for 3 days.

Determination of Physical, Chemical, and Sensory Characteristics

The analyses of physical properties consisted of water content and color value, whereas those of chemical properties involved the measurement of pH, sugar content, and antioxidant activity. Moisture content of the brem was determined by means of Moisture Analyzer MOC63u (Shimadzu, Japan). The color value according CIELab System (L* - Lightness, a* - redness, b* - yellowness) was measured by “Color Grab” (Mobile Application) before and after drying, under the same light condition and background. Moreover, small amount of the resulted products (0.5 gram) were dissolved in 5 mL aquadest and the solution was analyzed for pH value as well as sugar content (Refractometer Brix ATC 19003, calibrated). The antioxidant activity of the product was determined using DPPH method, in which 0.25 gram of sample was extracted in 5 mL methanol, vortexed for 10 seconds, and centrifuged. An aliquot of the supernatant (4 mL) was reacted with 1 mL of 0.2 mM DPPH for 30 mins and its absorbance was measured at 517 nm by means of a spectrophotometer (UV-1700, Shimadzu, Japan). The antioxidant activity (%) was calculated according to the formula: \[ \text{As} = \frac{A_{0}-A_{s}}{A_{0}} \times 100 \], in which; As = absorbance of the blank, A0 = absorbance of the sample after reaction with DPPH.

In addition, sensory evaluation was carried out to evaluate the hedonic scores of colors, aroma, texture, flavor, as well as the overall preference for each ratio of the treatment. Thirty untrained panelists (20–40 years old) were selected through online questionnaire, being in good health, non-smoking, and willing to participate. The product from each ratio was coded with three-digit random number and the panelists were asked to select the representative score among 7-level hedonic scale (1-dislike extremely, 2-dislike very much, 3-dislike, 4-neither like nor dislike, 5-like, 6-like very much, 7-like extremely).

RESULTS AND DISCUSSION
Development of Traditional Solid Brem and Characteristics of “BREM UNGU”

The processing of solid brem in Madiun, East Java, Indonesia, is absolutely a manifestation of the intelligence of our ancestors. The preparation of solid brem contains the basic principles of food preservation, yeast fermentation, concentration of sugar solution, whipping or foam formation, as well as dehydration. To the best of our knowledge, there is no similar product which has been developed by certain cultures in any other region in the world.
It has been known that any commodities rich in starch could be the substrate of yeast fermentation. The closest principle of local fermented product is the making of tapai from cassava. However, there are very limited reports which revealed the basic function of waxy rice as the main raw material of brem. The hint might be provided by the researches related to yeast fermentation or ethanolic fermentation. The amylopectin, the branched fraction of starch which is dominant in waxy rice, was found to be more fermentable than amylose [14,15]. Moreover, several preliminary studies have proven that partly substitution of glutinous rice with cassava need additional maltodextrin to improve the texture and amount of rendements [2,3].

The additional material in the present study is purple sweet potato which is also low in amylopectin content. Thus, the amount of additional liquor from fermented purple sweet potato become the main limiting factor. Greater ratio of the extract of fermented purple sweet potato will impact on the solidification problem of brem as well as on the use of baking soda. Commercial solid brem is often used baking soda to improve the texture and the drying was then conducted at ambient temperature. The use of baking soda will alter the color of anthocyanins into green. However, in the present study, we have successfully incorporated the extract of fermented purple sweet potato by eliminating the use of baking soda and replace conventional drying at ambient temperature with oven drying at 50°C for 2 days. Figure 1 provides the documentation of “BREM UNGU” product preparation steps.

Table 1 provides the physical and chemical properties of “BREM UNGU”. Based on physical characterization, “BREM UNGU” has low moisture content and water activity, which is an important aspect in food preservation that will be further discussed in the section of HACCP plan. The moisture content of “BREM UNGU” in all ratios were lower than 16% as determined by SNI No. 01-2559-1992 [16] for minimum water content of commercial brem. Furthermore, based on acidity level, the measured pH value for “BREM UNGU” was 4–5 (upon ten times of dilution) and hence compromises the requirement of SNI.

<table>
<thead>
<tr>
<th>Properties</th>
<th>“BREM UNGU”</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture content</td>
<td></td>
<td>max. 16%*</td>
</tr>
<tr>
<td>pH</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Sugar content</td>
<td>57.22</td>
<td>70.25%</td>
</tr>
<tr>
<td>Antioxidant activity</td>
<td>67.65%</td>
<td>67.84%</td>
</tr>
</tbody>
</table>

*SNI: **Brem “Suling Gading”

High sugar content is one of typical characteristic of solid brem. The sugar content of “BREM UNGU” was 57.22–70.25%. Commercial brem has ~70% of sugar content as the consequences of yeast fermentation and the concentration of tapai liquor [3]. Yeast fermentation is known to breakdown polysaccharides into simple sugars, and hence increase the sweetness of the product. The high sugar content of brem influences the taste and texture of brem which is also easily crumbled when consumed [17]. Besides sugars, other products of yeast fermentation are ethanol and organic acids. The ethanol content can be significantly reduced during concentration of the tapai liquor, whereas the organic acids will remain and give a distinctive flavour of brem.
Interestingly, “BREM UNGU” has distinctive color which is originated from anthocyanins of purple sweet potato. Common color of commercial brem is yellow to brownish yellow as the consequences of browning reaction of the sugars. Table 2 shows the discrepancy of color value of “BREM UNGU” in each treatment before and after drying. The representative appearances provide illustration of associated color values. The dehydration of brem caused reduction in lightness, but increase the redness, yellowness, as well as chroma values. The color measurement also revealed the powerfulness of oven drying to replace conventional drying without causing unwanted change of anthocyanins color.

Besides the additional natural color, the presence of anthocyanins was supposed to enhance the antioxidant activity of brem. The antioxidant activities of “BREM UNGU” were 67.65 %, 67.70%, and 67.84% for treatment A, B, and C, respectively. Although the difference was quite small, the increasing antioxidant activity was along with the increased proportion of the liquor from fermented purple sweet potato. Besides the anthocyanins, the present flavonoid and polyphenols in purple sweet potato may also contribute to provide the antioxidant activity [18].

Furthermore, the result of organoleptic evaluation was depicted in Figure 2 as the prediction of consumer acceptance. Most panelists (97.4%) declared that they have tried commercial brem, and 66.7% stated they have never found brem modified color. Generally, all treatments of “BREM UNGU” are acceptable for the consumers, since the value of hedonic scores refer to “like” to “like very much”. The treatment B, having the ratio of extract of glutinous rice to that of purple sweet potato 15:1 has superior acceptance based on its color, flavor, and overall preference, thus can be selected for further production plan of “BREM UNGU”.

**Marketing Strategy**

The competitor analysis was firstly determined to ensure the position of “BREM UNGU” among sweets product in the market. Figure 3 depicts the competitive framework for sweets in current markets for both traditional and modern products. Many sweets are now developed and sold, whether having or without any health claim, from either made of fermented or non-fermented material. Most crowded market is found in the sweets which has no health claim and use non-fermented material, such as jelly candies, hard candies, marshmallow, etc. Then, some typical local sweets could be found in the market with health claim and made from non-fermented material, in which the manufacturers incorporate some famous natural compounds bearing biological activities, i.e. the extract of tamarind, eucalyptus, ginger, and curcuma. On the other hand, several traditional sweets have been produced from fermented material but have no health claim, such as “Madumongo” from fermented black waxy rice, as well as “Suwar-Suwar” and “Permen Tape” from fermented cassava. Interestingly, until today, no sweets were found to have certain health claim and made of fermented material. This empty space is specifically targeted in the development of “BREM UNGU”.

**Table 2. Comparison of color values of “BREM UNGU” at various treatment before and after drying based on CIELab system and Chroma**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Before /After Drying</th>
<th>CIELab color value</th>
<th>Chroma</th>
<th>Rep. Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>L*</td>
<td>a*</td>
<td>b*</td>
</tr>
<tr>
<td>A</td>
<td>before</td>
<td>91.35</td>
<td>-0.08</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td>after</td>
<td>78.25</td>
<td>2.88</td>
<td>8.96</td>
</tr>
<tr>
<td>B</td>
<td>before</td>
<td>91.98</td>
<td>0.48</td>
<td>4.72</td>
</tr>
<tr>
<td></td>
<td>after</td>
<td>90.07</td>
<td>4.03</td>
<td>9.87</td>
</tr>
<tr>
<td>C</td>
<td>before</td>
<td>98.12</td>
<td>3.02</td>
<td>8.92</td>
</tr>
<tr>
<td></td>
<td>after</td>
<td>93.40</td>
<td>5.30</td>
<td>10.60</td>
</tr>
</tbody>
</table>

According to consumers survey, 71.8% panelists stated that they have consumed brem more than once, and 61.5% panelists declared that they liked these typical Indonesian traditional sweets. Therefore, the local market opportunity is available for further development of brem. In addition, more than 50% respondents answered that they have not known the health benefits of anthocyanins. This finding should be resolved by adding information of the bioactivities of anthocyanins of purple sweet potato in the packaging box of “BREM UNGU”. The packaging design for this product is given in Figure 4.
The reasonable price for each packed product is IDR 15,000 which contains 8 individual sweets. This price has included 30% markup for each box. The packaging strategy for “BREM UNGU” is mainly aimed to perform a repositioning for conventional brem to become modern sweets that hopefully could have better market opportunity both in local and international. The grand marketing strategy for “BREM UNGU” is given in Figure 5. We do hope to explore the indigenous healthy food for promoting the uniqueness and richness of Indonesia. The materials of “BREM UNGU” are totally originated from local produce and further processed according to traditional recipe. The additional health claim of brem is expected to promote the market value for both brem as well as local purple sweet potato, and finally will increase the utility of local resources and the wheath of local farmers.

CONCLUSION

The best ratio for the extract of fermented glutinous rice to that of purple sweet potato to prepare “BREM UNGU” is 15:1 (treatment B), having the average organoleptic score of 6.1 in color (liked very much), 6 in taste (liked very much), 5.1 in aroma (liked), and overall preference of 6 (liked very much). This product exhibits antioxidant activity as 67.70% of DPPH scavenging activity. In order to ensure sustainable production of this newly developed product, market analysis was carried out according to competitor analysis and triangle strategy, having the speciality in the region of sweets product with health claim and made of fermented material. The continuous development of "BREM UNGU" should be maintained as the effort to preserve cultural heritage, increase the exploration of local natural resources in Mount Kaw, and bring traditional heritage to have a global image.

Acknowledgement

The authors would like to thank Diah Mustika Lukitasari for her guidance in conducting antioxidant analysis, as well as Supriadi, the owner of local brem industry (U.D. Brem Sari Gading) in Madura, East Java, Indonesia, for providing the technical guidance and fruitful discussion in the production process of solid brem.

REFERENCES

Abstrak


Kata kunci: antosianin, brem, beras ketan, telo ungu