Some Indigenous Corn-Based Foods from Indonesia, which are potential as staple foods

Meta Mahendradatta*, Abu Bakar Tawali, Amran Laga, Jumriah Langkong, Sitti Nadirah

Food Science and Technology Study Program
Department of Agricultural Technology, Faculty of Agriculture
Hasanuddin University, Makassar 90245, Indonesia

ABSTRACT

Indonesia has many indigenous corn-based foods which are well known in each side of Indonesia particularly in corn-producing region. Corn is an important commodity as carbohydrate-rich foodstuff besides rice. The most common problem faced by corn-based foods is the unwillingness of people to process corn into various products due to the long preparation and cooking time. Through some technological touch, an innovative product called as parboiled polished corn (jagung sosoh pratanak = JSP) was produced. It was a convenient raw material for making some indigenous corn-based foods. By using this product, it was expected that the cooking time of corn-based foods could be reduced.

The aim of this research was to explore some indigenous corn-based foods which are potential as staple foods and to apply the parboiled polished corn (JSP) for making those indigenous foods. The research parameters were data collecting of indigenous corn-based foods (including the origin, procedure of processing, preparation and cooking time) and comparing the foods made from dry polished corn and parboiled polished corn.

There were ten indigenous corn-based foods from Indonesia which are potential as staple foods such as nasi kemunak Batanghari (Jambi, Sumatera), lepet jagung (East Java), jagung bose (East Nusa Tenggara), kambeweno kahitela (Muna, South East Sulawesi), kambewe (Muna, South East Sulawesi), kampalusu (Muna, South East Sulawesi), katumbu (Muna, South East Sulawesi), kina gandu (Tolaki, South East Sulawesi), lapoti gandu (Tolaki, South East Sulawesi) and barobbo (South Sulawesi). The result showed that cooking time of some indigenous foods made from parboiled polished corn was shorter than those made from dry polished corn. These foods were jagung bose (20 & 25min.), kampalusu (20 & 25min.), kina gandu (20 & 25min.), lapoti gandu (30 & 40min.) and barobbo (20 & 25min.). The other foods such as nasi kemunak Batanghari (20 & 15min.), lepet jagung (15 & 10min.) and katumbu (15 & 10min.) showed the longer cooking time than those made from dry polished corn, whereas kambeweno kahitela and kambewe had the same cooking time (25min.). The advantage of using JSP was the process could be conducted without polishing and soaking the dry corn which took until several hours. Sensory evaluation result showed that the most indigenous corn-based foods made by using dry polished corn were more acceptable in odor, color, taste and texture than those made by using JSP. Based on this research, it was concluded that (1) these ten indigenous corn-based foods were potential as staple food and (2) JSP could be processed into certain indigenous corn-based foods with the shorter cooking time and better acceptance.

Keywords: corn-based foods, parboiled polished corn (JSP), original formulation

*Correspondence: meta_mahendradatta@yahoo.com
Introduction

Among some food commodities in Indonesia, corn is potential carbohydrate source foodstuff beside rice. It has relatively low price and produce in large quantities. National corn production in 2006 was 11,609,463 ton, and increased yearly. The production in year 2007, 2008 and 2009 was 13,287,527 ton, 16,317,252 ton and 17,592,309 ton, respectively (Central Bureua of Statistics, 2010).

Since generation, Indonesian people use corn as staple food. Certain ethnic in Indonesia posses indigenous corn-based foods such as bassang and barobbo (South Sulawesi); bintebiluhuta (Gorontalo), jagung bose (East Nusa Tenggara), grontol dan lepet jagung (Java), nasi kemunak Batanghari (Jambi), kagili, lapoti gandu, kina gandu, katumbo, kampalusu, kambewe (South East Sulawesi) and other menus which are made from corn (Mahendradatta dan Tawali, 2008).

These foods disappeared gradually from daily menu and some of these would be unknown, particularly by young generation. It was due to unconvenient preparation and cooking process, need long time, and uninterested appearance (Tawali, 2006). Beside that corn was still being considered as food for marginal people. It was difficult to find corn in supermarket because it was sold only in traditional market and at the side of street without special packaging and in form of dry corn.

Based on survey result it that the interest of people on corn product was actually high, but processing and serving of such products were unconvenient so that most people did not like to prepare it (Tawali et al., 2003). This problem could be solved by preparing the convenient raw material for making indigenous corn-based food from Indonesia. The raw material was parboiled polished corn (JSP) which has been developed through some researches. It became a convenient and interested raw material for many corn-based foods. This has been applied first to make bassang, indigenous corn porridge from South Sulawesi which needed 18 hours to prepare it from waxy dry corn into corn porridge, after polishing and soaking the corn before cooking. Bassang was made commonly from waxy corn with wheat flour, coconut milk and salt. By using JSP, the time could be reduced to 20-30 minutes without polishing and soaking the corn.

This research aimed to explore some indigenous corn-based foods from Indonesia which is potential as staple foods. The next step was to apply the JSP to make these foods and to compare the result of cooking time and sensory evaluation of both treatments.

Material and Methods

Material

Raw material used in this research were polished waxy corn, yellow corn, parboiled polished corn (JSP), kidney bean, mungbean, vegetables, grated coconut, coconut milk, salt, water, banana leaf, corn leaf, slaked lime. Chemicals used for proximate analysis were sulphuric acid, boric acid, chloride acid, potassium permanganat, sodium hydroxyde, chloroform, strong chloride acid, indicator red methil, ammonium hydroxide 1:1, sodium chloride, ammonium oxalate solution, argentums nitrate, NaCl pa, n-heptane and sodium carbonate.

Methods

1. Exploration

The aim of exploration was to identify indigenous corn-based food from Indonesia which potential as staple food. This was conducted by collecting two data:
1.1 Primary data
Primary data was collected from direct interview with persons who knew the indigenous corn-based foods well, i.e. native inhabitant and housewife. The data required included the name of foods, origin, raw material and product formulation.

1.2 Secondary data
Secondary data was collected from literature, internet, books and other authentic source. The data required was similar with primary data.

2. Development of indigenous corn-based foods by using parboiled polished corn (JSP)
2.1 Making of parboiled polished corn (JSP)
Parboiled polished corn was made according to its standard operational procedure as follows: (a) cleaning and washing the corn; (b) soaking the corn in water contained 0.005-0.05% enzim α-amilase and 0.01-0.1 % CaCl (w/w corn) for 24 hours at room temperature with ratio corn : water 1: 2 (v/v); (c) cooking the corn for 45 minutes; (d) dripping the gel, and (d) drying the corn using electric drying machine at temperature 75°C until water content of corn ± 13%.
JSP was evaluated for its nutrition profile (proximate analysis) (AOAC, 1990) and product profile (rehydration time (Hubeis, 1985), yields and physical appearance)

2.2 Making of some indigenous foods using parboiled polished corn (JSP)
Indigenous corn-based foods which were resulted from exploration step were made by using JSP and compared to those made by using original raw material.

3. Observation
3.1 Comparison of cooking time
The indigenous corn-based foods was observed by comparing the cooking time of the products made by using JSP and by using original material. Cooking time was calculated since the corn was put into boiled water until the corn was soft or the product was cooked.

3.2 Sensory evaluation
The products were evaluated for their color, taste, odor, and texture by a sensory panel of twenty members using a five-point scale (5-excellent, 4-good, 3-acceptable, 2-doubtful, 1-unacceptable). Samples graded above point 3 were considered to be acceptable for consumption (Larmond, 1977).

4. Data processing
Data collected was processed using descriptive analysis by explaining the profile of each product. Cooking time was calculated for each food, and the time was then compared. Sensory score was calculated on the average of each panelist score concerning each evaluated product.

Results and Discussion

1. Exploration result
Based on exploration step, a data about ten indigenous corn-based foods was compiled in Table 1. These products came from several regions in Indonesia.

<table>
<thead>
<tr>
<th>No</th>
<th>Name of foods</th>
<th>Origin</th>
<th>Raw materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Nasi Kemunak Batanghari</td>
<td>Jambi</td>
<td>Keladi, yellow corn</td>
</tr>
<tr>
<td>b</td>
<td>Lepet Jagung</td>
<td>East Java</td>
<td>Young corn, grated coconut</td>
</tr>
<tr>
<td>c</td>
<td>Jagung Bose</td>
<td>East Nusa Tenggara</td>
<td>White corn, salt</td>
</tr>
<tr>
<td>d</td>
<td>Kambeweno</td>
<td>Muna, South East Sulawesi</td>
<td>White corn, grated coconut, slaked</td>
</tr>
</tbody>
</table>
The appearance of these foods was displayed in Figure 1. The alphabet showed the name of these foods as written in Table 1.

<table>
<thead>
<tr>
<th>Alphabet</th>
<th>Region</th>
<th>Corn-based Foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>e</td>
<td>Kambewe, Muna, South East Sulawesi</td>
<td>Dry corn, coconut milk, kidney bean, slaked lime</td>
</tr>
<tr>
<td>f</td>
<td>Kampalusu, Muna, South East Sulawesi</td>
<td>Dry corn, grated coconut, slaked lime</td>
</tr>
<tr>
<td>g</td>
<td>Katumbu, Muna, South East Sulawesi</td>
<td>Young corn, coconut milk</td>
</tr>
<tr>
<td>h</td>
<td>Kina Gandu, Tolaki / Moronene, South East Sulawesi</td>
<td>Corn, viscous coconut milk, pandanus leaf, salt</td>
</tr>
<tr>
<td>i</td>
<td>Lapot Gandu, Tolaki / Moronene, South East Sulawesi</td>
<td>Corn, grated coconut, mungbean, salt</td>
</tr>
<tr>
<td>j</td>
<td>Barobbo, South Sulawesi</td>
<td>Corn, spinach, vegetables</td>
</tr>
</tbody>
</table>

Figure 1. Some indigenous corn-based foods from Indonesia

2. Development of indigenous corn-based foods by using parboiled polished corn (JSP)
   2.1 Making of parboiled polished corn (JSP)
   JSP was processed through optimized procedure, which has been selected based on best result from several treatments (Tawali et al., 2003). First of all, dry corn was polished to obtain polished corn and then it was cleaned from the rest of residues and other.
impurities. This process was done three times and produced clean polished corn. Clean polished corn then was soaked in water with addition of reagents. Soaking aimed to let the product to adsorb water rapidly and uniformly (Wimberly, 1983). In order to make the corn tissue open and apart, amylase enzyme and CaCl₂ were added to soaking water. As consequent, some of starch chains were broken and loose so that the starch could swell optimally. The reagents were the mixture of CaCl₂-solution and enzyme α-amylase. Soaking was carried out until the corn swells. Furthermore, corn was cooked in soaked water and additional water was given until the ratio of water and corn was 2:1. Cooking aimed to gelatinize the starch (Miah et al., 2002). During cooking, the starch gelatinization was occurred therefore the texture of corn became soft. Cooking process was carried out until corn became softer and the water was more viscous. It then was washed from mucous and then the water remained was dripped until no more water left and the corn cooler. Finally, the dripped corn was dried using electric drying machine. Nutrition and physical profile of JSP was presented in Table 2. Physical appearance of JSP was displayed in Figure 2.

Table 2. Nutrition and physical profile of parboiled polished corn (JSP)

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Amounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water content (%)</td>
<td>11.46±0.4</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>0.36±0.01</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>8.59±0.01</td>
</tr>
<tr>
<td>Carbohydrate (%)</td>
<td>79.63±0.33</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>0.24±0.06</td>
</tr>
<tr>
<td>Crude fibre (%)</td>
<td>1.1±0.10</td>
</tr>
<tr>
<td>Calcium (%)</td>
<td>0.14±0.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehydration time (min.)</td>
<td>15 ± 0.05</td>
</tr>
<tr>
<td>Yields (%)</td>
<td>64.98</td>
</tr>
<tr>
<td>Physical appearance</td>
<td>Transparent and compact</td>
</tr>
</tbody>
</table>

Figure 2. (from left to right) Physical appearance of dried waxy corn, dried polished corn and JSP

2.2 Making of some indigenous foods using parboiled polished corn (JSP)
These indigenous corn-based foods were made by using JSP in comparison with original raw materials according to the recipe.
<table>
<thead>
<tr>
<th>No</th>
<th>Name of foods</th>
<th>Original Formulation</th>
<th>Modified Formulation (using JSP)</th>
</tr>
</thead>
</table>
| 1  | Nasi Kemunak Batanghari | 1. *Keladi* is cleaned and washed, steamed until done, then cooled and grated crudely.  
2. Corn is cooked until soft  
3. *Keladi* is steamed again shortly if it will be served and is mixed with cooked corn. | 1. *Keladi* is prepared as original formulation  
2. JSP is washed, water is boiled  
3. After boiling, JSP is put into the water, mixed and salt is added  
4. Corn is cooked until done  
5. Corn is served by adding *keladi* |
| 2  | Lepet Jagung | 1. Corn is grated and mixed well with grated coconut, sugar, salt and vanilie.  
2. Mixture is wrapped with corn leaf and formed into small corn cob, steamed until cooked. | 1. JSP is crushed, mixed with salt, sugar and grated coconut, mixed well  
2. The mixture is wrapped with corn leaf and cooked until done |
| 3  | Jagung Bose | 1. Corn is grated and mixed well with grated coconut, sugar, salt and vanilie.  
2. Mixture is wrapped with corn leaf and formed into small corn cob, steamed until cooked. | 1. JSP is washed, water is boiled  
2. After boiling, JSP is put into the water, mixed and salt is added  
3. Vegetables and salt are added, mixed well, kidney bean is added, cooked until done |
| 4  | Kambeweno Kahitela | 1. *Keladi* is prepared as original formulation  
2. JSP is washed, water is boiled  
3. After boiling, JSP is put into the water, mixed and salt is added  
4. Corn is cooked until done  
5. Corn is served by adding *keladi* | 1. *Keladi* is prepared as original formulation  
2. JSP is washed, water is boiled  
3. After boiling, JSP is put into the water, mixed and salt is added  
4. Corn is cooked until done  
5. Corn is served by adding *keladi* |
| 5  | Kambewe | 1. Corn is crushed by mortar, some water is added to ease the crushing process  
2. Crude corn is sieved to separate aleuron and the broken pieces  
3. The broken pieces is cooked until done | 1. Kidney bean is cooked until done  
2. JSP is washed and put into boiled water  
3. Vegetables and salt are added, mixed well, kidney bean is added, cooked until done |
| 6  | Kampalusu | 1. Corn is crushed by mortar, some water is added to ease the crushing process  
2. Crude corn is sieved to separate aleuron and the broken pieces  
3. The broken pieces is cooked until done | 1. Kidney bean is cooked until done  
2. JSP is washed and put into boiled water  
3. Vegetables and salt are added, mixed well, kidney bean is added, cooked until done |
| 7  | Katumbu | 1. Corn is crushed finely and mixed with coconut milk and salt  
2. The mixture is wrapped with corn leaf and cooked until done | 1. Kidney bean is cooked until done  
2. Coconut milk is boiled, then JSP, salt and kidney bean are added, mixed well until coconut milk is adsorbed well  
4. The mixture is wrapped with banana leaf and cooked until done |
| 8  | Kina Gandu | 1. Kidney bean is cooked until done  
2. Corn is soaked in water contained slaked lime, then washed and milled  
2. Grated coconut is added and the mixture is wrapped by banana leaf and tied.  
3. After cooking, it is ready to serve | 1. Kidney bean is cooked until done  
2. Coconut milk is boiled, JSP and salt are put into coconut milk, mixed well until coconut milk is adsorbed  
3. The mixture is wrapped with banana leaf and cooked until done |
| 9  | Lapoti Gandu | 1. Mungbean is cooked  
2. Corn is chopped finely  
3. Salt is added into the mixture, wrapped with corn leaf and formed into corn cob  
4. The mixture is steamed until done | 1. Mungbean is cooked until done  
2. JSP is washed, cooked shortly, mixed with mungbean, grated coconut and salt  
3. The mixture is wrapped with corn leaf and cooked until done |
| 10 | Barobbo | 1. Jagung is grated and cooked.  
2. Vegetables and other spices are added and cooked until done | 1. JSP is washed, put into boiled water and stirred slowly  
2. Vegetables and other spices are added and cooked until done |
3. Observation

3.1 Comparison of cooking time

Figure 3 showed that there were eight products which had different cooking time. From eight products, there were *jagung bose, kampalusu, kina gandu, lapoti gandu* and *barobbo* which had shorter cooking time after application of modified formulation. It indicated that JSP could be used as alternative raw material for making some indigenous corn-based foods which needed relatively shorter cooking time than dry waxy corn. It is important to understand that by using of JSP, the preparation time of food made from dry corn would be reduced until several hours because soaking process (sometimes also polishing) was not necessary. According to Mahendradatta and Tawali (2008), JSP was made due to consideration of long time preparation and cooking time of *bassang*, well-known indigenous corn porridge from South Sulawesi. By using JSP, the time for making *bassang* could be reduced from 18 hours (including polishing and soaking the corn) to 20 minutes.

![Graph showing cooking time of indigenous corn-based foods](image)

**Fig. 3.** Cooking time of indigenous corn-based foods made by original formulation and modified formulation

Research result showed that *nasi kemunak batanghari, lepet jagung, and katumbu* had the shorter cooking time by using original formulation than modified formulation. It was due to the raw materials used by original formulation, i.e fresh yellow corn which contained less starch and more sugar than other type of corn (Suarni and Widowati, 2007) and also young corn which had softer texture than dry corn. Dried gelatinized starch could adsorb water easily and in much amount (R&D Dept. of Agric, 2006). Sugiyono et al. (2004) said that the different variety of corn yield different cooking time. This might be due to the different structure of corn which might affect the water penetration into corn.

3.2 Sensory evaluation

Result of sensory score of the products for its color, taste, odor, and texture ranged between 2.9 – 3.9; 2.85 – 4; 2.75 – 3.8; and 2.9 – 3.65, respectively. Score more than 3 indicated that the product was accepted by the panelist. Some foods such as *nasi kemunak*
Batanghari, lepet jagung and katumbu used yellow and young corn according to the original formulation. It might be the reason why the acceptance of such products better than those made from JSP, because JSP was made from waxy corn. Amylopectin content of waxy corn might affect the acceptability on the products. According to Suarni and Widowati (2007), it has been showed that amylopectin could influence the sensory evaluation of corn particularly texture and taste. Result of sensory score was displayed in Figure 4. In general, indigenous corn-based foods made by using original formulation were better accepted, particularly its odor, than those made from JSP (see Fig.4).

Note:  

|   | a = nasi kemunak Batanghari | b = lepet jagung | c = jagung bose | d = kambeweno kahitela | e = kambewe | f = kampalusu | g = katumbu | h = kina gandu | i = lapoti gandu | j = barobbo |

Figure 4. Sensory score of indigenous corn-based foods
Conclusion

1. There were some indigenous corn-based food which are potential as staple food such as nasi kemunak Batanghari, lepet jagung, jagung bose, kambeweno kahitela, kambewe (Muna, South East Sulawesi), kampalusu (Muna, South East Sulawesi), katumbu (Muna, South East Sulawesi), kina gandu (Tolaki, South East Sulawesi), lapoti gandu (Tolaki, South East Sulawesi) and barobbo (South Sulawesi).

2. Parboiled polished corn (JSP = jagung sosoh pratanak) could be used as alternative raw material for making indigenous corn-based foods, observed from shorter preparation and cooking time than those made from raw material based on original formulation. By using JSP, preliminary step such as polishing and soaking the corn was not necessary.

Acknowledgments

Thank you very much for the Directorate of Research and Community Service, Indonesian Directorate General for Higher Education through RAPID (The Outstanding Research of Higher Education and Industry) Project 2008 - 2010 that has funded the research work.

References


