Banana (Musa sapientum var. Cavendish) Flour As Wheat Flour Extender in Selected Bakery Products

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Abstract:
Banana flour made from fresh, mature green Cavendish variety was used to partially replace wheat flour in soft bun (“pan de sal”) and doughnut in concentrations ranging from a minimum of 10% to a maximum of 50% using the baker’s percentage (i.e. partial replacement of wheat flour with banana flour was based on the total wheat flour weights in the formulation) using the no time dough method. No adverse effects were observed on the over-all baking and sensory qualities of the baked products. A savings of 3-5% for soft bun and 27% for doughnut was obtained in terms of direct material costs. Moreover, the inclusion of banana flour effectively increased the theoretical Vitamin C, potassium and dietary fiber contents of the baked goods. Approximately 3-5 pieces of soft bun and doughnut can satisfy ¼ of the average per day Recommended Dietary Allowance for Filipinos for Energy and Specific Nutrients (RENI) for children ages 7-9 years old. On the other hand, approximately 10-13 pieces of the same products can satisfy at least ¼ of the US Recommended Dietary Allowance (RDA) for potassium and the Dietary Reference Intake (DRI) for dietary fiber, respectively.

Keywords: banana flour, composite flour, wheat flour extender, no time dough method, level of inclusion

Introduction
The banana fruit is a healthy, nutritious commodity which contains 74%, 23% carbohydrates, 1% protein and 0.5% fat. Without its peel, it is a good source of Vitamin B6, potassium and fiber (http://www.extento.hawaii.edu). Moreover, it has no sodium and cholesterol and is a great source of Vitamin C and magnesium and contains three natural sugars – sucrose, fructose and glucose giving an instant, sustained and substantial boost of energy (http://www.antioxidant-fruits.com). Potentially, it can be processed and preserved to expand its market value, such as, puree from ripe fruits for use in ice cream, yogurt, cake, baby foods and nectar; sliced and canned in syrup for use in fruit salads and as toppings; sun dried banana crispy; and, fermented to produce vinegar and alcoholic beverage.

A new product with commercial value is the banana flour which can be used as a mixture for various cakes and breads. But since it does not contain gluten, it could not be used as the main ingredient but rather mixed with wheat flour in the production of quality baked products (http://www.ffc.agnet.org/library).. The
main objective of the study was to extend the utilization and increase the consumption of banana flour in
two selected bakery products, soft bun and doughnut. Specifically it sought to:
1. Determine the practicality of using of using banana flour as wheat flour extender in bakery products;
2. Determine the minimum and maximum levels of inclusion in the standard bread formulation;
3. Determine the effects of banana flour on the baking quality; over-all product acceptability; nutrient
content (theoretical) and direct material cost

Materials and Methods

Product Formulation
Banana flour made from fresh mature green Cavendish variety were made to replace part of the
wheat flour requirements in the basic recipes for soft bun (“pan de sal”) and doughnut in concentrations
ranging from 10% to 50% of eight (8) experimental lots including the control samples using the no time
dough method (http://www.seabeecook.com).

Acceptability Tests
Sensory evaluation using the 7- and 9-point hedonic scales by thirty (3) untrained laboratory panel
composed of faculty members, college students and non-teaching personnel from the Cluster of Food
Science, Tourism and Hospitality Management.

Theoretical Nutrient Content of Experimental Products
Banana flour samples were subjected to proximate analysis (i.e. moisture, protein, potassium, total
dietary fiber and Vitamin C) at the NFA Food Development Center. Results of analysis together with the
use of the FNRI Philippine Food Composition Tables were used in the calculation of the theoretical nutrient
contents of the baked products.

Direct Material Costs of Most Acceptable Formulations
The following assumptions were used in computing the direct material costs of the products under
study:
Banana Flour = PhP 18.50/kg
Bread Flour = PhP 39/kg
Mark up = 20%

Results and Discussion

Product Formulation

Table 1. Percentage Formulation of Soft Bun (“Pan de sal”)

<table>
<thead>
<tr>
<th>Raw Materials</th>
<th>Control</th>
<th>Lot 1 10% BF</th>
<th>Lot 2 15% BF</th>
<th>Lot 3 20% BF</th>
<th>Lot 4 25% BF</th>
<th>Lot 5 30% BF</th>
<th>Lot 6 40% BF</th>
<th>Lot 7 50% BF</th>
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<tbody>
<tr>
<td>Bread flour</td>
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<td>90</td>
<td>85</td>
<td>80</td>
<td>75</td>
<td>70</td>
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<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
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<td>50</td>
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<tr>
<td>Total</td>
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<td>100</td>
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Table 2. Percentage Formulation of Doughnut

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<th>Lot 2</th>
<th>Lot 3</th>
<th>Lot 4</th>
<th>Lot 5</th>
<th>Lot 6</th>
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<td></td>
<td>BF</td>
<td>10% BF</td>
<td>15% BF</td>
<td>20% BF</td>
<td>25% BF</td>
<td>30% BF</td>
<td>40% BF</td>
<td>50% BF</td>
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Figure 1. Flow Chart for the Preparation of Banana Soft Bun Using the No Time Dough Method

Figure 2. Flow Chart for the Preparation of Banana Doughnut Using the No Time Dough Method

Acceptability Tests
Sensory evaluation results showed both products with 10%-40% banana flour were all acceptable by the taste panel in terms of all sensory attributes rated with the lot containing 10% and 15% banana flour as the most preferred by the taste panelists. **Theoretical Nutrient Content of Baked Products**

A 30-gram piece of soft bun with 10-15% banana flour can theoretically provide 87-91 kcal, 8-9 mg. Vitamin C, 18-27 mg. potassium and 15 mg. calcium. On the other hand, a 35-gram piece of doughnut with the same amounts of banana flour theoretically contains 96-99 kcal, 2.8 gm. protein, 25-26 ug. Vitamin A, about 10 mg. Vitamin C, 29 mg. calcium and 18-27 mg. potassium. In addition, both products are able to satisfy from 4% - 11% of the ¼ daily US RDA for potassium and from 1.4 to 3.4% of ¼ of the US daily DRI for various age groups (i.e. 1-9 years).

**Direct Material Costs**

At 10% and 15% wheat flour replacement, the total direct material costs was approximately US$1.50 to US$3.00, for the soft bun and doughnut, respectively. Average yields of 52 pieces @ 30-gram and 35-gram per piece of soft bun and doughnut were obtained.

**References**


Figure 3. The Banana Soft Bun and Banana Doughnut with 15% Banana Flour