Vitabread: Consumer and baker preferences, economic and nutrition potentials

Francis Kweku Amagloh
fkamagloh@uds.edu.gh
The issue

• Africa has experienced the highest urban growth during the last two decades at 3.5% per year and this rate of growth is expected to hold into 2050

• Projections also indicate that between 2010 and 2025, some African cities will account for up to 85% of the population

The issue

- Urbanisation leads to high demand for ready-to-eat food or minimally processed foods

- Huge processing potential for sweetpotato
  - Shorter growth period (3 - 5 months)
  - Source of starch & micronutrients
  - OFSP adds significant amounts of vitamin A
  - Bakery products, fried products, juices, noodles, candies, etc. all in use in Asia
Window of opportunity for SP

How can we meet the increasing demand for minimally processed or ready-to-eat food products using a nutritious food?
Making Economic Sense

- Wheat importation costs foreign exchange & is rising
- Sweetpotato can be grown in wide range of agro-ecologies by all types of farmers
- OFSP puree can substitute 20-50% of wheat flour in baked products --for a healthier product
- OFSP flour not economically viable (4.5 kg to 1kg flour vs 1.3 kg to 1kg for puree)

http://www.indexmundi.com/agriculture/?country=gh&commodity=wheat&graph=imports
Objectives

• To assess if consumers and bakers will prefer composite bread containing OFSP (vitabread)
• To refine one of the bread recipes available in Ghana
• To estimate the economic potential of baking vitabread
• To evaluate consumer preference of vitabread
• To determine the vitamin A content of vitabread
Methods

• Survey in 4 regions in Ghana
  – Greater Accra, Ashanti, Northern and Upper East
  – Consumers and bakers

• Benefit-Cost Ratio analysis
  – Large-, medium-, and small-scale bread bakers in Tamale

• Consumer preference evaluation
  – 5-point Likert scale, panel of 100 UDS undergrads
    • (1=least acceptable/dislike extremely and 5=highly acceptable/like extremely)

• β-carotene assay
  – Nutrition Department, Noguchi Memorial Institute of Medical Research, on fee-for-service basis
Methods: Vitabread production

1. Boiling of roots
2. Mashing SP into Puree
3. Puree & other ingredients
4. Puree + wheat flour
5. Ready for kneading
6. Kneading
7. Ready for baking
8. Moulding
9. In oven for baking
Vitabread (OFSP puree @ 45% substitution)

Vitabread, simply yummy!
Results & Discussion

Consumption of bread in Ghana

<table>
<thead>
<tr>
<th>Region</th>
<th>Male Yes (%)</th>
<th>Female Yes (%)</th>
<th>Male No (%)</th>
<th>Female No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Accra (n=47)</td>
<td>53.19</td>
<td>46.81</td>
<td>4.81</td>
<td>55.19</td>
</tr>
<tr>
<td>Ashanti (n=62)</td>
<td>51.61</td>
<td>48.39</td>
<td>4.39</td>
<td>55.61</td>
</tr>
<tr>
<td>Northern (n=153)</td>
<td>66.67</td>
<td>33.33</td>
<td>3.33</td>
<td>66.67</td>
</tr>
<tr>
<td>Upper East (n=388)</td>
<td>52.32</td>
<td>47.68</td>
<td>2.68</td>
<td>52.32</td>
</tr>
</tbody>
</table>

Bread consumption based on Regions and gender
Results & Discussion

Willingness to buy vitabread by consumers

Region and gender

Greater Accra (n=47)
Ashanti (n=62)
Northern (n=152)
Upper East (n=388)

Response in percentage

Yes (%)  No (%)

Male  Female  Male  Female  Male  Female  Male  Female

Willingness to buy vitabread by consumers based on health advice

Region and gender

Greater Accra (n=47)
Ashanti (n=62)
Northern (n=152)
Upper East (n=388)

Response in percentage

Yes (%)  No (%)

Male  Female  Male  Female  Male  Female  Male  Female
Results & Discussion

Willingness to bake vitabread by bakers

Willingness to bake vitabread by bakers based on health advice

Response in percentage

<table>
<thead>
<tr>
<th>Region and gender</th>
<th>Male (n=20)</th>
<th>Female (n=20)</th>
<th>Male (n=11)</th>
<th>Female (n=11)</th>
<th>Male (n=26)</th>
<th>Female (n=26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Accra</td>
<td>40</td>
<td>55</td>
<td>5</td>
<td>75</td>
<td>11.53</td>
<td>84.62</td>
</tr>
<tr>
<td>Ashanti</td>
<td>5</td>
<td>75</td>
<td>54.55</td>
<td>36.36</td>
<td>3.85</td>
<td>92.3</td>
</tr>
<tr>
<td>Northern</td>
<td>20</td>
<td>9.09</td>
<td>3.85</td>
<td>92.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper East</td>
<td>75</td>
<td>5</td>
<td>20</td>
<td>54.56</td>
<td>45.44</td>
<td>92.3</td>
</tr>
</tbody>
</table>

Response in percentage

<table>
<thead>
<tr>
<th>Region and gender</th>
<th>Male (n=20)</th>
<th>Female (n=20)</th>
<th>Male (n=11)</th>
<th>Female (n=11)</th>
<th>Male (n=26)</th>
<th>Female (n=26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Accra</td>
<td>45</td>
<td>55</td>
<td>5</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashanti</td>
<td>5</td>
<td>75</td>
<td>54.55</td>
<td>36.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern</td>
<td>20</td>
<td>9.09</td>
<td>3.85</td>
<td>92.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper East</td>
<td>75</td>
<td>5</td>
<td>20</td>
<td>54.56</td>
<td>45.44</td>
<td>92.3</td>
</tr>
</tbody>
</table>
Results & Discussion

Economic analysis on vitabread

<table>
<thead>
<tr>
<th></th>
<th>Vitabread (2.2 kg + 1.8 kg OFSP)</th>
<th>White Bread (100% wheat flour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Variable cost (GHC)</td>
<td>20.21</td>
<td>25.95</td>
</tr>
<tr>
<td>Number of rolls</td>
<td>38.00</td>
<td>57.17</td>
</tr>
<tr>
<td>Unit price per roll (GHC)</td>
<td>0.83</td>
<td>0.58</td>
</tr>
<tr>
<td>Revenue (GHC)</td>
<td>23.71</td>
<td>25.47</td>
</tr>
<tr>
<td>Net Return (GHC)</td>
<td>3.50</td>
<td>-0.09</td>
</tr>
<tr>
<td>Benefit-Cost Ratio (BCR)</td>
<td><strong>1.18</strong></td>
<td><strong>0.99</strong></td>
</tr>
</tbody>
</table>

- BCR = 1.00, means a breakeven venture
- BCR > 1 more profitable
- BCR < 1 less profitable
## Results & Discussion

### Consumer preference

<table>
<thead>
<tr>
<th>Gender</th>
<th>Bread sample</th>
<th>Appearance</th>
<th>Aroma</th>
<th>Overall degree of liking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Vitabread (sugar)</td>
<td>4.33&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>4.31</td>
<td>4.35</td>
</tr>
<tr>
<td></td>
<td>Vitabread (no sugar)</td>
<td>4.49&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>4.15</td>
<td>4.20</td>
</tr>
<tr>
<td></td>
<td>Wheat (white) bread</td>
<td>4.65&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.30</td>
<td>4.45</td>
</tr>
<tr>
<td>Female</td>
<td>Vitabread (sugar)</td>
<td>4.63&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.37</td>
<td>4.46</td>
</tr>
<tr>
<td></td>
<td>Vitabread (no sugar)</td>
<td>4.40&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>4.50</td>
<td>4.39</td>
</tr>
<tr>
<td></td>
<td>Wheat (white) bread</td>
<td>4.24&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.21</td>
<td>4.46</td>
</tr>
<tr>
<td>P-value</td>
<td></td>
<td>0.03</td>
<td>0.32</td>
<td>0.81</td>
</tr>
</tbody>
</table>

5-point Likert scale: 1=least acceptable/dislike extremely and 5=highly acceptable/like extremely

---

- Male Vitabread (sugar) is preferred among males.
- Female Vitabread (no sugar) is preferred among females.
- Overall, there is a slight preference for white bread over sugar bread, with a non-significant difference in liking degrees.
## RESULTS & DISCUSSION

<table>
<thead>
<tr>
<th>Bread type</th>
<th>Moisture (g)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Ash (g)</th>
<th>Tot. CHO (g)</th>
<th>Tot. Sugar (g)</th>
<th>Energy (kJ)</th>
<th>Vitamin A (mg)</th>
<th>Lutein (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitabread</td>
<td>32.41±1.90</td>
<td>14.75±0.64</td>
<td>11.36±3.92</td>
<td>4.63±0.42</td>
<td>36.85±4.90</td>
<td>29.76±2.00</td>
<td>1297±12</td>
<td>1.57±0.10 (17%)§</td>
<td>0.38±0.03</td>
</tr>
<tr>
<td>Wheat (white) bread</td>
<td>26.83±0.94</td>
<td>14.67±0.22</td>
<td>8.81±1.50</td>
<td>4.57±0.60</td>
<td>45.11±1.40</td>
<td>27.71±1.50</td>
<td>1342±21</td>
<td>0.26±0.03 (3.0%)§</td>
<td>0.06±0.01</td>
</tr>
</tbody>
</table>

| P-value                     | 0.12              | 0.92            | 0.40          | 0.94         | 0.25         | 0.47            | 0.25        | 0.01           | 0.01        |

Table 1. Proximate composition, energy, β-carotene and lutein levels in sweetpotato-based bread (vitabread) and wheat (white) bread. Parameter with $P < 0.05$ indicates that significant difference between the two types of bread; §Value in parenthesis is the percentage of the dietary reference intake per day of vitamin A to meet by a child (1-3 year old) (Food and Nutrition Board, et al., 2004) who will consume 50 g of each bread; Calculation was adjusted to 79% trans β-carotene retention (Low and van Jaarsveld, 2008), and using a conversion ratio of 12 µg of trans β-carotene = 1 µg of retinol activity equivalents (Food and Nutrition Board, et al., 2004).
Challenges

- Assuring year-round supply
  - Need for improved storage
  - Need for irrigation investment

- Research underway at CIP-SSA for shelf-storable puree without refrigeration
  - Potential breakthrough product for baking industry
The potential not to be undermined, BUT wouldn’t be forever

OFSP processed products will create markets for farmers, opportunities for entrepreneurs & healthier products for consumers
Conclusion

• Incorporation of OFSP puree would have double advantage:
  – Making bread baking more profitable
  – A good source of dietary vitamin A
Thank You
Acknowledgement

Funding was received from Jumpstarting of OFSP in West Africa through diversified markets funded this project through a sub grant agreement (SGA 7823-000-00-UDS-01)