EFFECT OF MALTING PERIODS ON THE CHEMICAL AND ANTINUTRIENT CONTENTS OF MUNG BEAN (Vigna radiata) ORARUDI FLOUR

Presented by
E.U. Onwurafor, J.C. Onweluzo, I.L. Umunnakwe

Department of Food Science and Technology, University of Nigeria, Nsukka

25-27 September, 2013 (Mensvic Grand Hotel, Accra, Ghana)
High prevalence of both macro and micro nutrient deficiencies especially in the developing regions

Dire consequences of such deficiencies both to the individual and to the Society exist

Unsustainability of some of the present efforts to curb the problem.

A need for locally available, low cost interventions that will be more sustainable

Underutilized/Neglected locally available crops present a rich array of untapped resources/solution
Legumes occupy an important place in the diets of the populations in the developing countries

Legumes are rich sources of protein, calories, minerals and vitamins

Several bioactive compounds in legumes has some health benefits.

Legumes also serve as low cost supplement for animal protein among low income groups in developing countries

NUS 2013
Background cont’d

WHY MUNG BEAN??

Figure 1. Mung bean seeds

Figure 2. Mung bean seeds
1. Mung has low profile of uses in Nigeria

2. Value added product potentials from mung beans in some regions exist

-Mung beans has been used in some regions like Asia, Indian etc in processing of some value-added products example-Dhal, transparent noodle among etc.

Figure 3
Mung beans

Figure 4. Potentials of mung beans

- Have potential to reduce malnutrition among the Vulnerable groups (women and children)
- Only recently came to limelight in Nigeria & there is need for value addition for the crop
- Neglected/underutilized crop with high nutrient potentials
- Is rich sources of protein, calories, minerals etc
Possible limitations in the utilization of mung beans (*orarudi*) in product development includes:

- High Antinutritional factors
- High Viscosity of the Gruel from the flour
- Low Bioavailability of Nutrients
Malting has been identified as simple traditional food processing technique for improving nutrient contents of plant foods and could

- Improve the functional properties of foods
- Promote the development of hydrolytic enzyme-amyloses, proteases etc
- Improve the digestibility of proteins
- Improve bioavailability of nutrients among others.

Flours from legumes malted for different periods may perform differently in product development.
1. To determine the effect of malting periods on:
   ➢ Chemical composition of *Vigna radiata* flour/malt
   ➢ Antinutrient contents of *Vigna radiata* flour/malt
2. To determine the optimal malting period for mung bean (*Vigna radiata*).
Materials and Methods

whole mungbean seeds (*orarudi*)

- cleaning (winnowing and hand sorting)
  - steeping for 3 h
  - air-resting for 90 min
  - re-steeping for 3 h
  - draining
Materials and methods cont’d

Draining

sprouting (24, 48, 72 & 96)

0h  24h  48h  72h  96h
oven drying oven drying oven drying oven drying oven drying

Dehulling Dehulling Dehulling Dehulling Dehulling

Milling Milling Milling Milling Milling

Sieving Sieving Sieving Sieving Sieving

Figure 6. Processing of mungbean malt.
Malted samples
Analyses

The following analyses were carried out on the samples:

- Proximate composition (AACC, 2000). Carbohydrate content was determined by difference.
- Tannins (Buns, 1971)
- Phytate (Latta and Eskin, 1980)
- Oxalate (Fasset et al., 1973)
- pH determination: This was carried out using the method described by Onwuka (2005)
- Titratable acidity determination: This was carried out by using the method described by Pearson (1976)
- Minerals (Calcium, Iron, zinc, copper, magnesium, phosphorous, sodium and potassium contents (AACC, 2000) using Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) - (Model Perkins-Elmer Optima 5300UV)
- Vitamin A and B1 (Arroyave et al., 1982 and AOAC, 2010)
- The result was analysed using ANOVA and Duncan’s multiple range test was used to separate the means. Significance was accepted at p<0.05 levels.
Table 1: Proximate composition (%/100g) of mung bean (*Orarudi*) malted for different periods

<table>
<thead>
<tr>
<th>Malting period/h</th>
<th>Moisture</th>
<th>Protein</th>
<th>Crude Fat</th>
<th>Crude fibre</th>
<th>Ash</th>
<th>Carbohydrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6.58±0.14</td>
<td>30.77±0.0</td>
<td>4.61±0.01</td>
<td>3.11±0.04</td>
<td>1.95±0.00</td>
<td>52.94±0.00</td>
</tr>
<tr>
<td>24</td>
<td>9.19±0.02</td>
<td>32.54±0.0</td>
<td>1.36±0.01</td>
<td>3.44±0.05</td>
<td>2.75±0.26</td>
<td>50.72±0.2</td>
</tr>
<tr>
<td>48</td>
<td>9.79±0.13</td>
<td>33.50±0.1</td>
<td>1.16±0.01</td>
<td>3.57±0.02</td>
<td>3.29±0.14</td>
<td>48.69±0.1</td>
</tr>
<tr>
<td>72</td>
<td>10.10±0.1</td>
<td>34.47±0.0</td>
<td>1.22±0.02</td>
<td>3.63±0.24</td>
<td>4.33±0.00</td>
<td>46.25±0.0</td>
</tr>
<tr>
<td>96</td>
<td>11.45±0.1</td>
<td>31.47±0.0</td>
<td>0.52±0.00</td>
<td>3.49±0.05</td>
<td>4.14±0.03</td>
<td>48.93±0.1</td>
</tr>
</tbody>
</table>

Values are the means ±SEM of triplicate samples. Means carrying different superscripts in the same row were significantly different (p<0.05).
Mung bean contain high levels of protein, ash and carbohydrate.

- Malting of mung bean significantly \((p<0.05)\) increased the protein, ash and crude fibre contents.
- Fat and carbohydrate content decreased as the malting period was increased.
Table 2: Mineral contents(mg/100g) of Vigna radiata( orarudi) malt

<table>
<thead>
<tr>
<th>Constituent</th>
<th>0</th>
<th>24</th>
<th>48</th>
<th>72</th>
<th>96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>98.46±1.02</td>
<td>100.52±0.00</td>
<td>101.74±0.01</td>
<td>122.00±0.08</td>
<td>102.98±0.45</td>
</tr>
<tr>
<td>Zinc</td>
<td>5.16±0.03</td>
<td>4.71±0.00</td>
<td>4.60±0.00</td>
<td>5.31±0.00</td>
<td>3.82±0.03</td>
</tr>
<tr>
<td>Iron</td>
<td>8.06±0.04</td>
<td>7.88±0.06</td>
<td>7.84±0.04</td>
<td>11.02±0.79</td>
<td>10.99±0.08</td>
</tr>
<tr>
<td>Copper</td>
<td>0.73±0.00</td>
<td>0.73±0.00</td>
<td>0.77±0.00</td>
<td>0.92±0.02</td>
<td>0.79±0.02</td>
</tr>
<tr>
<td>Sodium</td>
<td>5.47±0.17</td>
<td>5.26±0.02</td>
<td>5.11±0.02</td>
<td>7.07±0.19</td>
<td>5.63±0.4</td>
</tr>
<tr>
<td>Potassium</td>
<td>1147.80±1.05</td>
<td>1148.89±0.00</td>
<td>1270.21±2.84</td>
<td>1376.78±6.82</td>
<td>1304.98±0.69</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>261.06±1.49</td>
<td>262.55±0.00</td>
<td>274.88±0.05</td>
<td>312.99±0.54</td>
<td>288.87±2.68</td>
</tr>
<tr>
<td>Magnesium</td>
<td>147.03±0.51</td>
<td>147.54±0.00</td>
<td>166.42±0.56</td>
<td>187.31±0.45</td>
<td>165.15±1.60</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>43.7±0.02</td>
<td>54.6±0.00</td>
<td>65.5±0.00</td>
<td>109.2±0.00</td>
<td>163.8±0.00</td>
</tr>
</tbody>
</table>

Values are the means ±SEM of triplicate samples. Means carrying different superscripts in the same row were significantly different (p<0.05)
Ca, Cu, K, P, and Mg increased progressively at a significant levels ($p<0.05$) as malting period was increased.

Zinc, iron and sodium decreased for the 1st 48 h and then increased at 72h.

72 h malt contained the highest value of iron, zinc and sodium.

Vitamin A and B1 content of mung bean was low but increased with malting periods.
<table>
<thead>
<tr>
<th>Malting period/hr</th>
<th>Tannin</th>
<th>Phytate</th>
<th>Oxalate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>475.75\text{a±3.53}</td>
<td>87.10\text{a±0.35}</td>
<td>624.00\text{a±1.14}</td>
</tr>
<tr>
<td>24</td>
<td>384.50\text{b±4.94}</td>
<td>71.10\text{b±0.14}</td>
<td>419.50\text{b±3.53}</td>
</tr>
<tr>
<td>48</td>
<td>213.50\text{e±4.94}</td>
<td>62.25\text{c±0.21}</td>
<td>310.50\text{c±1.20}</td>
</tr>
<tr>
<td>72</td>
<td>220.00\text{d±5.65}</td>
<td>41.21\text{d±0.09}</td>
<td>146.00\text{d±2.82}</td>
</tr>
<tr>
<td>96</td>
<td>231.00\text{c±4.24}</td>
<td>16.05\text{e±0.07}</td>
<td>79.00\text{e±2.82}</td>
</tr>
</tbody>
</table>

Values are the means ±SEM of triplicate samples. Means carrying different superscripts in the same row were significantly different (p<0.05)
Malting periods resulted in between 19.18-57.40% reduction in tannin content, 11.48-81.57% reduction in phytates content, 32.77-87.34% reduction in oxalate content, and the level of antinutrient reduction could account for the high mineral content of the malt.
<table>
<thead>
<tr>
<th>Malting Periods/hr</th>
<th>pH</th>
<th>Titratable Acidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6.8</td>
<td>0.057</td>
</tr>
<tr>
<td>24</td>
<td>6.5</td>
<td>0.069</td>
</tr>
<tr>
<td>48</td>
<td>6.0</td>
<td>0.078</td>
</tr>
<tr>
<td>72</td>
<td>5.7</td>
<td>0.100</td>
</tr>
<tr>
<td>96</td>
<td>5.1</td>
<td>0.143</td>
</tr>
</tbody>
</table>
The results revealed a gradual decrease in pH from 6.8 in unmalted mungbean flour to 5.1 in mungbean malted for 96 hours.

The total titratable acidity for unmalted mung bean flour was 0.057% which gradually increased to 0.143% mungbean malted for 96 hours.
Conclusion

- Increasing the malting periods to 72h resulted to highest increase in all the mineral, protein, ash and crude fibre contents studied.
- Highest reduction in antinutrient occurred at the 96h malt which differed not significantly (p>0.05) from 72h malt.
- Malting of mung bean for 72 h should be encouraged at the community levels to increase the nutrient in content and availability.
Recommendations

- Researchers should focus more attention on community-oriented mung bean research that will have practical impact in the lives of the rural and urban poor in the society.
- Governmental and non-governmental agencies should map out policies and programmes especially for the women on the use of malting to enhance nutrient content of mung bean and its nutritional/health benefits.
- Utilization of mung bean malt in product Development/value addition creation beyond cooking and eating need to be encouraged in Nigeria and other African countries.
The authors wish to acknowledge the USDA through the Norman E. Borlaug Fellowship program who funded part of this research work and the CTA/Bioversity International who sponsored my being here.
THE END

THANK YOU FOR LISTENING