Effect of Malting on Nutritional Contents of Fingermillet and Mungbean

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Abstract: Malting of seeds enhance its nutritional value through induced hydrolytic activity. Local varieties of fingermillet and mungbean were selected to evaluate the nutritional changes during malting process. Both fingermillet and mungbean seeds were steeped in boiled cool water (w/v=1:2) for 6 hours at ambient temperature (30°C) and germinated for different time of 12, 24 and 36 hours. The germination stopped at different time interval by drying in sunlight. The raw and malted seeds of fingermillet and mungbean were ground into fine flour and analyzed for their proximate composition. The results revealed that there was a significant increase (p<0.05) found in reducing sugar and free amino acid content, a significant decrease (p<0.05) found in total protein and no significant difference (p>0.05) found in moisture, total fat, crude fibre, ash and total sugar content during malting of both fingermillet and mungbean for 36 hours.

Key words: Fingermillet • Mungbean • Malting • Nutritional contents

INTRODUCTION

Malting is the process of limited germination of cereal grains or the seeds of pulses under controlled conditions [1]. During this process the grains develop enzymes include diastatic enzymes which are required to modify the starch into sugars, including monosaccharides such as glucose or fructose and disaccharides, such as sucrose or maltose. It is also develops other enzymes, such as proteases, which break down the proteins in the grain. In addition, malting will also improve the quality of grains by removal of undesirable components such as antinutritional factors [2].

During malting, grains are hydrated in ambient conditions and the endogenous enzyme start to modify the grain constituents in particular changes to soluble sugars, protein and activities in enzyme [3]. Thus, malting generally improves the nutritive value and digestibility of foods and it could be an appropriate simple technique to derive iron and other minerals maximally from the grains [4].

Fingermillet (Eleusine coracana L.) belongs to family Poaceae. It is a major source of dietary carbohydrates and a good source of valuable micro nutrients along with major food components [5]. Mungbean (Vigna radiata L.) belongs to the family Fabaceae. Mungbean is one of the important pulse crops [6].

The malting potentials of different cereals such as barley, wheat, corn, sorghum and millets have been studied from over the time [7-8]. Fingermillet has superior malting characteristics compared to other millets and ranks next to barley malt. Malting of fingermillet improves its digestibility, sensory and nutritional quality as well as pronounced effect in the lowering the antinutrients [9]. Malting of mungbean also altered its biochemical composition. The decrease in carbohydrate level is beneficial to diabetes mellitus patients. In addition, the increase in total dietary fiber and decrease in fat content can give benefit for persons with cardiovascular disease and hypercholesterolemia [10]. Malting is a simple biotechnological technique to bring about sufficient increase in enzyme activities and causes predigestion of carbohydrate and protein in legumes [11].

Fingermillet and mungbean are the locally available cheaper food materials and widely consumed in Sri Lanka. In addition, fingermillet is a good source of carbohydrates and mungbean is rich in proteins. Therefore, the present study was undertaken to evaluate the nutritional changes in fingermillet and mungbean during malting process.
MATERIALS AND METHODS

Raw materials of fingermillet (Eleusine coracana L. Jaffna local variety) and mungbean (Vigna radiata L. Jaffna local variety) were procured from the Department of Agricultural extension office, Jaffna, Sri Lanka. The study was carried out in the Laboratory of Agricultural Chemistry, Department of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna, Sri Lanka in 2013. The chemicals used for this experiment were purchased from BDH Chemicals (L-Tyrosine) and Research-Lab fine chemicals (others). All the chemicals used in the analysis were analytical grade and each experiment was done in triplicates. The instruments used were including UV-Visible spectrophotometer (Thermo Scientific, Evolution 220), Centrifuge (Sigma, 3K 30), Fat extractor (Velp Scientifica, SER 148 solvent extractor) and Raw fiber extractor (Velp Scientifica FIWE).

Statistical Analysis: The triplicate data of nutritional contents were statistically analyzed by Completely Randomized Design (CRD) using analysis of variance (ANOVA) in SAS statistical software (Version 9.1). The significant differences were compared at 95% confidence interval (p<0.05) using Duncan’s New Multiple Range Test (DNMRT).

RESULTS AND DISCUSSION

Table 1 and 2 represents the changes in nutritional content of fingermillet and mungbean during malting.

Table 1: Changes in nutritional content of fingermillet during malting

<table>
<thead>
<tr>
<th>Constituents (%)</th>
<th>Un-germinated</th>
<th>12 hrs after germination</th>
<th>24 hrs after germination</th>
<th>36 hrs after germination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>7.67±0.45</td>
<td>8.42±0.55</td>
<td>7.90±0.44</td>
<td>7.81±0.37</td>
</tr>
<tr>
<td>Total protein (g)</td>
<td>10.66±0.18</td>
<td>9.98±0.23</td>
<td>9.57±0.16</td>
<td>7.51±0.27</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>1.42±0.11</td>
<td>1.40±0.08</td>
<td>1.37±0.15</td>
<td>1.32±0.10</td>
</tr>
<tr>
<td>Crude fibre (g)</td>
<td>3.94±0.36</td>
<td>4.25±0.12</td>
<td>4.26±0.12</td>
<td>4.26±0.11</td>
</tr>
<tr>
<td>Ash (g)</td>
<td>2.84±0.13</td>
<td>2.83±0.08</td>
<td>2.83±0.04</td>
<td>2.72±0.11</td>
</tr>
<tr>
<td>Total sugar (mg/g)</td>
<td>11.23±0.92</td>
<td>11.32±0.61</td>
<td>11.02±0.78</td>
<td>11.42±0.77</td>
</tr>
<tr>
<td>Reducing sugar (mg/g)</td>
<td>5.53±0.58</td>
<td>4.96±0.53</td>
<td>9.56±0.62</td>
<td>10.80±0.29</td>
</tr>
<tr>
<td>Free amino acid (mg/g)</td>
<td>0.24±0.02</td>
<td>0.19±0.04</td>
<td>0.34±0.06</td>
<td>0.29±0.04</td>
</tr>
</tbody>
</table>

Mean ± SD values with different letters of superscripts in the same row are significantly different.
Table 2: Changes in nutritional content of mungbean during malting

<table>
<thead>
<tr>
<th>Constituents (%)</th>
<th>Un-germinated</th>
<th>12 hrs after germination</th>
<th>24 hrs after germination</th>
<th>36 hrs after germination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>8.05±0.30</td>
<td>8.03±0.44</td>
<td>7.90±0.20</td>
<td>7.33±0.45</td>
</tr>
<tr>
<td>Total protein (g)</td>
<td>26.07±0.67</td>
<td>24.78±0.67</td>
<td>24.75±0.55</td>
<td>22.28±0.92</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>2.17±0.11</td>
<td>2.06±0.09</td>
<td>2.08±0.13</td>
<td>2.14±0.09</td>
</tr>
<tr>
<td>Crude fibre (g)</td>
<td>6.62±0.11</td>
<td>6.61±0.04</td>
<td>6.62±0.11</td>
<td>6.64±0.08</td>
</tr>
<tr>
<td>Ash (g)</td>
<td>3.74±0.09</td>
<td>3.70±0.11</td>
<td>3.71±0.10</td>
<td>3.69±0.07</td>
</tr>
<tr>
<td>Total sugar (mg/g)</td>
<td>19.06±0.60</td>
<td>18.93±0.85</td>
<td>18.52±0.71</td>
<td>19.06±0.73</td>
</tr>
<tr>
<td>Reducing sugar (mg/g)</td>
<td>10.63±0.09</td>
<td>10.97±0.65</td>
<td>16.59±0.66</td>
<td>17.45±0.51</td>
</tr>
<tr>
<td>Free amino acid (mg/g)</td>
<td>0.76±0.08</td>
<td>0.58±0.06</td>
<td>1.24±0.05</td>
<td>0.93±0.06</td>
</tr>
</tbody>
</table>

Mean ± SD values with different letters of superscripts in the same row are significantly different

**Crude Fibre:** Un-germinated fingermillet had 3.94% of crude fibre and it was gradually increased to 4.26% after 24 hrs of germination time. Crude fibre content of un-germinated mungbean was similar to that of germinated mungbean. The results showed that there was no significant difference (p>0.05) found in both fingermillet and mungbean seeds during germination. There was no significant difference in crude fibre content of 12 hr soaked Asparagus bean with increase in germination time [17]. But, the gradual increase observed in fingermillet may be due to the synthesis of structural carbohydrates such as cellulose and hemicelluloses. A considerable increase in crude fibre content was observed in malted barley [18].

**Ash:** Ash content of un-germinated seeds was similar to that of germinated seeds for both Fingermillet and mungbean. The results showed that there was no significant difference (p>0.05) in ash content for both Fingermillet and mungbean during malting. There was no much variation of ash content in malted mungbean compared to un-malted seeds [16]. Another study also reported that no significant difference in ash content during malting of both 12 hrs and 24 hrs soaked Asparagus bean [17].

**Total Sugars:** Total sugars content of fingermillet and mungbean were ranged between 11.02-11.42 mg/g and 18.52-19.06 mg/g, respectively. Both fingermillet and mungbean had no significant difference (p>0.05) for total sugar content for un-germinated and the germinated seeds.

**Reducing Sugars:** The reducing sugars content was increased significantly (p<0.05) during germination for both fingermillet and mungbean. It would be due to the hydrolysis of starch into reducing sugars by activity of amylase enzyme produced during malting. Similar increase in reducing sugar content with increase in germination time was observed in rice [19]. In another studies the starch content was decreased and reducing sugar content was increased in malted barley compared to un-malted [18]. A significant increase in amylase enzyme activity was observed in mungbean, cowpea, chick pea and lentil from 24 to 72 hrs germination time [11].

**Total Protein:** The total protein content was decreased significantly (p<0.05) for fingermillet during malting and a
significant decrease (p<0.05) found from 24 hr to 36 hrs germination for mungbean. A decreasing trend of total protein content during malting of fingermillet and mungbean was shown in Figure 1. A decrease in protein content in germinated mungbean and rice compared to non-germinated one [10]. In another studies protein content was decreased in malted barley [18].

**Free Amino Acid:** Fingermillet and mungbean had significant increase (p<0.05) in free amino acid content from 12 to 24 hrs germination and there was no significant difference (p>0.05) from 24 to 36 hrs germination. The increase in free amino acid content would be due to the activity of enzyme protease. The decrease in total protein content with increased in amino acid content was observed in rice due to the increase in level of protease enzyme [19]. In another studies significant increase of protease enzyme activity was observed in germinated legumes of mungbean, cowpea, chick pea and lentil [11].

**CONCLUSION**

This study reveals that the malting process improve the nutritional quality of both fingermillet and mungbean in terms of increase in reducing sugar and free amino acid content and decrease in total protein content.

**REFERENCES**

