Effect of different pretreatments on nutritional quality of sorghum and mothbean

Kale PR, Syed HM, Sontakke MD, Shinde EM and Salve RV

Abstract

The present study was carried out to know the effect of different pretreatments on nutritional quality of sorghum and mothbean. The process of soaking was carried out for 8 hrs at ambient temperature during this process moisture, carbohydrate, ash and vit. C content increases with a decrease in other parameters. Results obtained shows that moisture, fat, carbohydrate, protein, ash, crude fiber, iron and vit. C content of raw and soaked sorghum varied between 9.9 to 11.8%, 1.9 to 1.75%, 73.5 to 74.45%, 10.9 to 8.2%, 2.3 to 2.5%, 1.5 to 1.3%, 4.4 to 4mg/100g, 0.6 to 1.2mg/100g respectively. In mothbean germination was carried out for 24hrs at ambient temperature. Germination increases moisture, protein, iron and vit. C content with decrease in other parameters. Results obtained shows that moisture, fat, carbohydrate, protein, ash, crude fiber, iron and vit. C content of raw and germinated mothbean varied between 8.3 to 10.8%, 1.1to 1.09%, 61.03 to 57.01%, 21.7 to 24.1%, 3.5 to 3.2%, 4.2 to 3.8%, 8.9 to 9.4mg/100g, 1.84 to 10mg/100g respectively. Therefore, germination and soaking can improve the nutritional value and stability of grains.

Keywords: sorghum, mothbean, soaking, germination, nutritional quality

Introduction

Sorghum (Sorghum bicolor (L.) Moench) is the king of millets and is one of the important food crops in dry lands of tropical Africa, India and China. In India, sorghum is one of staple food crops of many states and is consumed by a large section particularly in the non-irrigated dry land areas with low rainfall. It is grown especially in the arid and semi-arid regions. The major sorghum production areas today include great plains of North America, sub-Saharan Africa, north eastern China and the Deccan plateau of central India, Argentina, Nigeria, Egypt and Mexico (Awika and Rooney, 2000) [4].

Like other plant proteins, Sorghum protein quality is poor. Inadequate intake of good quality proteins is an important factor responsible for the widespread prevalence of protein energy malnutrition. Poor nutritional quality of grain Sorghum has been attributed to the low levels of certain essential amino acids especially lysine, threonine and tryptophan and excessive content of leucine and methionine. The grain Sorghum also contain phenolic compounds namely tannins, which decrease the protein utilization (Salunkhe et al., 1977, Hulse, 1979) [19,8].

Sorghum does not have gluten and hence becomes a very good ideal gluten free energy source for the people suffering from wheat or gluten allergies. Normally sorghum for consumption is used in the form of Roti, unleavened breads, porridges, boiled grains and steam cooked products such as couscous. Karnataka is second only to Maharashtra with regard to area coverage in India (Vikas, 2003) [22].

Protein quality and essential amino acid profile of sorghum is better than many of the cereals and millets. Sorghum in general is rich source of fiber and B-complex vitamins (Gopalan et al., 2000; Patil et al., 2010) [7,16].

Mothbean (Vigna aconitifolia L.) is a drought resistant legume belonging to the family Fabaceae, commonly grown in arid and semi-arid regions of India. It is exceptionally hardy legume and known by various other names including mat bean, Matki, Turkishgram, or dew bean. India’s driest state, Rajasthan, is the major mothbean growing state contributing almost 86% area of the country (NAS, 1979) [10].

Moth bean is considered to be native crop of India and Pakistan and is grown during the kharif season. In the event of the grim situation of water shortages and rising agricultural input prices. Moth bean is an ideal crop to grow since it requires very low inputs (no or little water) and is grown in arid and semi arid regions of South Asia and India like Rajasthan,
The good quality of Sorghum and mothbean were procured from Parbhani local market.

Materials and Methods
The present investigation was carried out in Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani during year 2018-19.

Materials

Moisture content
Moisture content was determined as per the method given by AOAC (2005) [1]. It was calculated using following formula.

\[
\text{% Moisture content} = \frac{\text{Loss in weight}}{\text{Weight of sample}} \times 100
\]

Fat
AOAC (2005) [1] method using Soxhlet apparatus was used to determine crude fat content of the sample. The percent of crude fat was expressed as follows:

\[
\text{% Crude Fat} = \frac{\text{Weight of oil}}{\text{Weight of sample}} \times 100
\]

Protein
Protein content was determined using AOAC (2005) [1] method. Percentage of nitrogen and protein calculated by the following equation:

\[
\text{% Protein} = \text{Nitrogen} \times 6.25
\]

Total carbohydrate
Total carbohydrate content of the samples was determined as total carbohydrate by difference that is by subtracting the measured protein, fat, ash and moisture from 100 phenol sulphuric acid method as given by AOAC (2005) [1].

Ash
Drying the sample at 100 °C and churned over an electric heater. It was then ashes in muffle furnace at 550 °C for 5 hrs. It was calculated using the following formula:

\[
\text{% Ash content} = \frac{\text{Weight of ash}}{\text{Initial Weight of sample}} \times 100
\]

Determination of minerals
Two grams of defatted sample was weighed and heated at 550°C. Then, the obtained ash were digested with concentrated Hydrochloric acid (HCL) on hot plate. The digested material was then filtered using whatman No. 42 filter paper and the final volume made to 100ml with distilled water that was further used for analysis with respects to minerals contents by using methods of AOAC (2005) [1].
**Determination of Vitamin C**
Vitamin C contents were determined by titrimetric methods described by (Ogunlesi et al., 2010) [14].

**Results and Discussion**

**Physical properties of sorghum and mothbean**
Various physical properties of sorghum and mothbean were determined, and results obtained are presented in Table 1.

**Nutritional composition of raw and soaked sorghum**
The data pertaining to nutritional composition of raw and soaked sorghum were determined and results obtained and illustrated in Table 2.

**Nutritional composition of raw and germinated mothbean**
The data pertaining to nutritional composition of raw and germinated mothbean were determined and results obtained and illustrated in Table 3.

**Conclusion**
The present investigation reveals that soaking of sorghum and germination of mothbean enhances the nutritional quality just before the development of food products. These processes also significantly reduce the antinutritional components in the same. Therefore, moth bean and Sorghum can be used as singly or in combination food products; therefore, considered to be one of the best preventable measures for disorders of protein malnutrition. The germination of moth bean increases the protein content and vit. C content. Therefore, germination and soaking can improve the nutritional value and stability of grains.

**References**


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**Table 1: Physical characteristics of sorghum and mothbean**

<table>
<thead>
<tr>
<th>Physical Parameters</th>
<th>Sorghum</th>
<th>Mothbean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Chalky white</td>
<td>Yellow brown</td>
</tr>
<tr>
<td>Shape</td>
<td>Oval</td>
<td>Rectangular</td>
</tr>
<tr>
<td>Wt. of 1000 seed (g)</td>
<td>34.04</td>
<td>30.80</td>
</tr>
<tr>
<td>True Density (g/ml)</td>
<td>1.12</td>
<td>1.43</td>
</tr>
<tr>
<td>Bulk Density (g/ml)</td>
<td>0.69</td>
<td>0.80</td>
</tr>
<tr>
<td>Porosity (%)</td>
<td>38.12</td>
<td>38.95</td>
</tr>
<tr>
<td>Angle of repose (°)</td>
<td>26.31</td>
<td>27.80</td>
</tr>
</tbody>
</table>

*Each value represents the average of three determinations*

The data given in Table 1 revealed various physical characteristics of sorghum and mothbean. The colour of sorghum was found to be chalky white whereas oval in shape. The results for weight of 1000 seed was reported to 34.04 (g), true density 1.12 (g/ml), bulk density 0.69 (g/ml), Porosity 38.12 (%), angle of repose 26.31 (°) respectively. Results reported are in close agreement with these findings of Gikuru et al. (2013) and Wu and Wall., 1980) [9].

The colour of moth bean was found to be yellow brown whereas rectangular in shape. The results for weight of 1000 seed was reported to 30.80 (g), true density 1.43 (g/ml), bulk density 0.80 (g/ml), Porosity 38.95 (%), angle of repose 27.80 (°) respectively. Results reported are in close agreement with these findings of Nimkar et al., (2005) [11].

**Table 2: Nutritional composition raw and soaked sorghum**

<table>
<thead>
<tr>
<th>Nutrient content</th>
<th>Raw sorghum</th>
<th>Soaked sorghum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>9.9±1.1</td>
<td>11.8±0.41</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>1.9±0.04</td>
<td>1.75±0.10</td>
</tr>
<tr>
<td>Carbohydrate (%)</td>
<td>73.5±0.4</td>
<td>74.45±0.20</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>10.9±0.62</td>
<td>8.2±0.5</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>2.3±0.02</td>
<td>2.5±0.31</td>
</tr>
<tr>
<td>Crude fiber (%)</td>
<td>1.5±0.01</td>
<td>1.3±0.65</td>
</tr>
<tr>
<td>Iron (mg/100g)</td>
<td>4.4±0.2</td>
<td>4±0.10</td>
</tr>
<tr>
<td>Vit. C (mg/100g)</td>
<td>0.6±0.2</td>
<td>1.2±0.2</td>
</tr>
</tbody>
</table>

*Each value represents the average of three determinations*

Results given in above Table.2 indicated that the mean value for moisture, fat, carbohydrate, protein, ash, crude fiber, iron and vit. C content of raw and soaked sorghum varied between 9.9 to 11.8%, 1.9 to 1.75%, 73.5 to 74.45%, 10.9 to 8.2%, 2.3 to 2.5%, 1.5 to 1.3%, 4.4 to 4mg/100g, 0.6 to1.2mg/100g respectively. Results reported are in close agreement with these findings of (Onoja et al., 2014 and Singh et al., 2018) [15, 21].

Soaking increases moisture, carbohydrate, ash and vit. C content with a decreases in other parameters. The increase in moisture content was due to the uptake of water during soaking. An increase in ash content is considered to be apparently caused by the loss of starch, while a decrease can be attributed to leaching losses during soaking (Ahmed et al., 2013 and Wu and Wall., 1980) [3, 23].

**Table 3: Nutritional composition raw and germinated mothbean**

<table>
<thead>
<tr>
<th>Nutrient content</th>
<th>Raw mothbean</th>
<th>Germinated mothbean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>8.3±2.0</td>
<td>10.8±1.2</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>1.1±0.5</td>
<td>1.09±0.03</td>
</tr>
<tr>
<td>Carbohydrate (%)</td>
<td>61.0±4.5</td>
<td>57.0±4.20</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>21.7±1.43</td>
<td>24.1±0.45</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>3.5±1</td>
<td>3.2±0.15</td>
</tr>
<tr>
<td>Crude fiber (%)</td>
<td>4.2±0.3</td>
<td>3.8±0.52</td>
</tr>
<tr>
<td>Iron (mg/100g)</td>
<td>8.9±1</td>
<td>9.4±0.6</td>
</tr>
<tr>
<td>Vit. C (mg/100g)</td>
<td>1.8±0.2</td>
<td>10±1.2</td>
</tr>
</tbody>
</table>

*Each value represents the average of three determinations*

Results given in above Table.3 indicated that the mean value for moisture, fat, carbohydrate, protein, ash, crude fiber, iron and vit. C content of raw and germinated mothbean varied between 8.3 to 10.8%, 1.1to 1.09%, 61.03 to 57.01%, 21.7 to 24.1%, 3.5 to 3.2%, 4.2 to 3.8%, 8.9 to 9.4mg/100g, 1.84±10mg/100g respectively. Results reported are in close agreement with these findings of (Mankotia and Modgil, 2003 and Singh et al., 2018) [9, 21]. Germination increases moisture, protein, iron and vit. C content with a decrease in other parameters. Loss of dry weight (carbohydrates) during sprouting may show apparent increases in protein, while loss of low molecular weight nitrogenous compounds during soaking and rinsing of grains cause a decrease in crude protein on sprouting (Ahmed et al., 2013) [3]. It was also possible that the increase in protein was due to the uptake of water during germination. Decrease in starch content was maximum in sprouted grain this decrease might have been due to hydrolysis of starch during germination. The decrease in fat in moth bean during germination may be due to increased activity of lipase (Pawar and Ingle., 1988) [17].
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