EFFECT OF STORAGE ON NUTRITIONAL AND SENSORY QUALITIES OF GRAIN AMARANTH (AMARANTHUS HYPOCHONDRIACUS) FLOUR

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ABSTRACT

Grain amaranth (Amaranthus hypochondriacus) flour stored for six months in airtight glass containers at room temperature was analyzed for nutrient composition initially and after 3rd and 6th month of storage. No significant effect on nutrients was observed but sensory qualities decreased in sixth months of storage.

Key words: Amaranthus hypochondriacus, Grain amaranth flour, Nutrients, Storage.

INTRODUCTION

Grain amaranth is a unique, nutritionally rich non-cereal crop and its leaves are eaten as a vegetable while the seeds are used as cereals (Kauffman and Hass 1983). Chapathi, cakes, biscuits, bread, porridge and weaning mixes are some of the products developed from grain amaranth seeds (Bhuvaneshwari 2001). Grain amaranth contains about 15 per cent protein with high levels of lysine and sulfur containing amino acids. Furthermore, the protein in the flour causes no allergic reactions (Konoshi 2002) and is biologically active (Barker et al. 1979). Grain amaranth flour exhibited other health benefits like hypocholesterolemic (Shin et al. 2004) and hypotensive (Martirosyam et al. 2007) in different animal models. The present study was planned to investigate the effect of storage on nutritional and sensory quality of grain amaranth flour.

MATERIALS AND METHODS

White and black varieties of grain amaranth seeds (Department of Olericulture, College of Horticulture, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala, India) were cleaned and sun dried. Black and white seeds were mixed in the ratio of 4:6. Flour was prepared by grinding the seeds in an electric mixer and sieved through a 40-mesh sieve.

Storage of grain amaranth flour: Grain amaranth flour was packed, sealed in airtight glass containers and stored at room temperature (28 - 30°C) away from sunlight for a period of 6 months. Samples were analyzed for nutritional and sensory qualities, initially and after 3rd and 6th months of storage.

Evaluation of nutritional qualities: Grain amaranth flour was analyzed for moisture, protein and starch by AOAC (1980) methods. Fat content was estimated by extracting it in petroleum ether in soxhlet apparatus as suggested in AOAC (1955). Crude fibre content was estimated by acid-alkali digestion method suggested by Chopra and Kanwar (1978). Calcium and magnesium contents were analyzed using titration method with ethylenediaminetetraacetic acid (EDTA) as described by Page (1982). Iron and phosphorus was estimated colorimetrically as described by Raghuramulu et al (2003) and Jackson (1973), respectively. Whereas, potassium estimation was done by flame photometer method suggested by Jackson (1973).

Sensory evaluation: Sensory and organoleptic trails were carried out by simple triangle test at laboratory level to select the judges as suggested by Jellinek (1985). Organoleptic evaluation of amaranth flour was carried out by a panel of ten selected judges using 5-point Hedonic scale for attributes namely...
appearance, colour, flavour, taste, texture and overall acceptability.

**Statistical analysis:** Data were tested for homogeneity of variances by the t test. When homogeneous variances were confirmed, the data were tested by analysis of variance (ANOVA). Differences in means were considered significant at a level of $p < 0.05$.

**RESULTS AND DISCUSSION**

**Nutritional evaluation of grain amaranth:** The results pertaining to changes in the proximate composition during storage in grain amaranth flour are presented in Table 1. The initial moisture content of the flour was 16.66% which reached to a maximum of 17.5% in six months, but during third month of storage a decrease in moisture content (13.5%) was noticed. The increase or decrease in moisture content may be due to changes in relative humidity in the storage vicinity during summer and rainy seasons respectively (Sharif et al. 2003). Initial protein content (g/100g) was 14.7 ± 0.1 and decreased with advancement of storage period which is in close agreement with the findings reported by Mirsa and Kulshrestha (2003) and may be due to browning reaction as reported by Shariff et al. (2003). Initial starch (g/100g) content was 62.2 ± 0.04, but gradually decreased with advancement of storage period, might be due to hydrolysis of polysaccharides like starch to simple sugars (Upadhyay et al. 1994). Fat content was 6.7 ± 0.1% initially which gradually decreased with storage that might be due to lipolytic activity of lipase and lipoxidase (Shariff et al. 2003). The fibre content (%) of the flour decreased from the initial value of 2.9 ± 0.1 to 1.7 ± 0.1 at the end of six months. The decrease in crude fibre content might be attributed by the degradation of hemicellulose and other structural polysaccharide materials in the flour during storage (Mirsa and Kulshrestha, 2003 and Shariff et al, 2003).

Mineral contents of grain amaranth during storage are presented in Table 2. The initial calcium content was 187.2 ± 0.3 mg/100g which decreased to 180.5 ± 0.7 mg/100g at 6 months. The magnesium content was 226 ± 0.7 mg/100g which was slightly lower than the value reported by Mendonca et al. (2004) in whole amaranth flour. Initial iron content was 13.6

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**TABLE 1.** Changes in proximate composition of grain amaranth flour during storage.

<table>
<thead>
<tr>
<th>Nutrient Composition</th>
<th>Initial</th>
<th>Third</th>
<th>Sixth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>$16.66 \pm 0.12^a$</td>
<td>$13.53 \pm 0.11^b$</td>
<td>$17.46 \pm 0.12^c$</td>
</tr>
<tr>
<td>Protein</td>
<td>$14.70 \pm 0.13^a$</td>
<td>$13.90 \pm 0.03^a$</td>
<td>$12.49 \pm 0.09^b$</td>
</tr>
<tr>
<td>Starch</td>
<td>$62.2 \pm 0.04^a$</td>
<td>$59.92 \pm 0.56^b$</td>
<td>$57.40 \pm 0.44^c$</td>
</tr>
<tr>
<td>Fat</td>
<td>$6.73 \pm 0.11^a$</td>
<td>$6.3 \pm 0.02^a$</td>
<td>$5.79 \pm 0.14^b$</td>
</tr>
<tr>
<td>Fibre</td>
<td>$2.87 \pm 0.05^a$</td>
<td>$2.61 \pm 0.04^a$</td>
<td>$1.66 \pm 0.13^b$</td>
</tr>
</tbody>
</table>

* % Composition in 100gm of grain amaranth flour and values are the mean ± SD (n=3). Values in a row sharing common superscript are significantly not different.
The potassium content was 248.2 ± 0.2 mg/100g which was lower than the potassium content of 433.9 mg/100g as reported by Mendonca et al. (2004). Variations observed may be due to difference in the variety and loss occurred during preparation of the flour. The phosphorus content was 315.7 ± 0.2 mg/100g which is in line with the findings of Munjal et al. (1999). In general, mineral content of the flour decreased during storage whereas it was statistically insignificant.

**Sensory quality of grain amaranth:** The sensory qualities of fresh and stored amaranth flour are summarized in Figure 1. Results indicated that the appearance of the fresh flour scored 3.7, which decreased to 3.5 (3rd month) and further decreased to 3.1 (6th month) overtime. The scores for colour decreased from 3.4 to 3.2 and flavour from 3.2 to 2.4 during storage. Texture and taste also decreased from initial scores of 3.6 and 3.0 to 2.7 and 1.8, respectively over storage. Overall acceptability of the fresh flour scored 3.5, which decreased to 3.0 and 3.1 during 3rd and 6th month, respectively. Statistical analysis revealed that there was no significant variation in sensory qualities such as appearance and colour, but the decrease in the mean score for flavour, texture and taste of the flour after 3rd month of storage was found to be statistically insignificant. Upto 3rd month of storage the flour there was no significant loss in any sensory parameters.

The results revealed that grain amaranth flour is a good source of protein, starch, fibre and minerals like iron, calcium, magnesium, potassium and phosphorus. Storage had no significant effect on nutrients, but sensory qualities showed decrease in around sixth month of storage. Grain amaranth could be used to compliment other cereals, as an extender or as a supplement for added nutritional value in traditional foods in developing countries. Commercialization of grain amaranth may help in solving problems related to malnutrition.

**REFERENCES**


