Enhancing micronutrient content of beverage powder by incorporating malted finger millet

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Abstract

Introduction: There is growing interest in the role of the micronutrients in optimizing health, and in prevention or treatment of disease. Micronutrients play a central part in metabolism and in the maintenance of tissue function, an adequate intake therefore is necessary. Rationale: This research work was concerned with the development of micronutrient especially calcium rich instant health beverage powder from malted finger millet (Eleusine coracana) and gurhal powder (Hibiscus rosa-sinensis). Aims & Objectives: In this study attempts have been made to investigate that whether the extruded malted finger millet flour and hibiscus flower powder has improved the nutritional and phytochemical quality of instant health beverage powder without deteriorating their sensory properties and whether it can be a supplement for calcium deficit sedentary women. Materials and methods: Instant health beverage powder was prepared by adding malted and extruded finger millet with glucose, hibiscus flower powder, citric acid and vanilla essence. All the ingredients were mixed well. Prior to consumption this powder was dissolved in water and stirred well manually. Further Instant health beverage powder was assessed for nutritional composition. Results: Results shows that beverage powder has very high content of protein (12.25 %) and calcium (96.5 %) along with highly beneficial neutraceutical properties as compared with the health drinks available in market, it is because of enhanced antioxidant activity resulted due to the incorporation of gurhal leaf powder and malting of the finger millet. Conclusion: This study may prove as a potential step to utilise malted finger millet as a supplement for calcium deficit women. The nutritional composition was found sufficient enough to meet approximately one fourth of RDA of Protein and Calcium as prescribed by NIN, India for sedentary women who are the main sufferers of calcium deficiencies in various life stages like pregnancy, lactation and menopause.

Key Words

Beverage Powder; Calcium deficiency; Finger Millet; Gurhal Flower; Sedentary Women

Introduction

Neutraceutical beverages represents one of the fastest annual growing markets worldwide, reaching a compound annual growth rate of 13.6% between 2002 and 2007 (Heckman et al., 2010). Finger millet is a minor millet used in the preparation of infant food and health foods as raw and as well as malted forms. It is basically used for preparation of flour, pudding, porridge and roti (Chaturvedi and Srivastava, 2008). With the changes in scenario of utilization of processed products and awareness of the consumers about the health benefits, finger millet has gained attention because of its components (Wadikar et al., 2007). The malted and fermented finger millet flour are extensively used in preparation of weaning food, instant mixes, beverages and pharmaceutical products (Rao and Muralikrishna, 2001).

Natural antioxidants like phenolic compounds and flavonoids which are secondary plant metabolites present in food products of plant origin (Helle and Bertelsen, 1995; Yeh and Yen, 2003) can trap the free radicals directly or scavenge them through a series of coupled reactions with antioxidant...
enzymes (Rao et al., 1996). Gurhal (Hibiscus Rosa-Sinensis) a well-known member of the family Malvaceae, Hibiscus rosa-sinensis grows as an evergreen herbaceous plant. A native to tropical and sub-tropical regions, this plant is extensively cultivated as an ornamental plant.

**Aims & Objectives**

To investigate that whether the extruded malted finger millet flour and hibiscus flower powder has improved the nutritional and phytochemical quality of instant health beverage powder without deteriorating their sensory properties and whether it can be a supplement for calcium deficit sedentary women.

**Material and Methods**

**Raw materials:** Finger Millet in a single lot was procured from local market of Allahabad, India. Hibiscus flowers used in this instant health beverage powder were obtained from Department of botany, University of Allahabad. Chemicals used for analysis were of AR grade and purchased from Science Corporation, Allahabad, India.

**Preparation of Malted Finger Millet Flour:** The soaking period (16 hours), germination temperature (310°C) and germination period (48 hours) was optimized for malting. The Optimized finger millet was then dried in hot air oven at 500°C for 24 hours. Vegetative parts were removed by rubbing and then were ground to powder followed by storing in air-tight containers at refrigeration temperature.

**Preparation of Gurhal Flower Powder:** The fresh hibiscus flowers were washed thoroughly and were then dried in hot air oven at 500°C for 3-4 hours till the moisture percentage remains 6-7% followed by grinding to powder and were stored in air tight containers (Singh et al. 2007).

**Chemical Analysis:** The proximate composition, Calcium and iron content of instant health beverage powder was determined by AOAC (2007), for estimation of Total Phenolic content, Folin-Ciocalteu method was adopted Singleton et al. (1999). The Radical Scavenging Activity was estimated by DPPH method given by De Ancos et al. (2002).

**Beverage Preparation:** Instant Health Beverage Powder (22 g) was added with glucose (20 g), hibiscus flower powder (0.25 g), citric acid (0.1 g) and vanilla essence (0.5 g). All the ingredients were mixed well. Prior to consumption this powder was dissolved in 168 ml of water and stirred well manually (Jesus et al. 2012).

**Results & Discussion**

**Flour Preparation**

The use of extruded and autoclaved malted finger millet flour was done since the extrusion process is accompanied by pre-gelatinization of starch granules, resulting in loss of the molecular order and the complete degradation of polymers with the formation of highly soluble fragments. Therefore, suspensions of flours precooked by extrusion will have a low tendency to form lumps, since starch granules have been modified showing high swelling capacity under both cold and hot conditions, which makes extruded flours highly recommended for preparation of instant food products (Vasanthan et al., 2001) such as beverages.

**Compositional analysis of ingredients of Instant Health Beverage Powder**

From the results, inferences can be drawn that Instant health beverage powder have higher amount of protein, calcium, TPC and DPPH content as compared to same of malted finger millet or hibiscus powder only. Udeozor and Linda (2012) also studied on development of health drink from tiger-nut and soybean and found the increment in amount of calories, protein and fat content.

**Comparison of Nutrient content of Instant Health Beverage Powder and RDA of Sedentary Women as given by NIN**

Instant Health Beverage Powder was compared with Recommended Dietary Allowances (RDA) of sedentary women as given by National Institute of Nutrition of India. On the basis of results it can be concluded that cereal beverage powder fulfill 20.54% of energy requirement of RDA of a sedentary women whereas protein and fat requirements are fulfilled 20.41 % and 8.90 % respectively. As far Calcium content is considered, this cereal beverage powder mix fulfills approx. 25 % of requirement of calcium which is highly beneficial for sedentary women specially who face bone related problems in menopausal phase. Jesus et al. (2012) also did the similar study on development of nutraceutical beverage from extruded whole maize and chick pea flours and found that the one serving of beverage developed covers 26.36% and 17.65% of the daily protein requirements for children 1-3 and 4-8 years old, respectively.

**Conclusion**

It can be concluded from results that incorporating malted finger millet and hibiscus flower powder led
to an increase in nutritional content specially calcium and antioxidants as like total polyphenols and radical scavenging activity in the beverage powder and this instant health beverage powder could be used for health promotion and disease prevention as an alternative to beverages with low nutritional/neutraceutical value.

**Recommendations**

1. This instant health beverage powder could serve as a supplement for the population suffering from calcium deficiency diseases.
2. This beverage powder can compete with other health drinks available in market in terms of nutritional and phytochemicals content.

**Relevance of the study**

The present study focuses on use of processed i.e. malted finger millet in development of beverage powder because it is evident from studies that malting enhances the nutritive value.

**Authors Contribution**

JT: Substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; drafting the article or revising it critically for important intellectual content; Final approval of the version to be published. AG: Final approval of the version to be published. RP: Final approval of the version to be published. VP: drafting the article or revising it critically for important intellectual content.

**References**

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**Tables**

**TABLE 1 COMPOSITIONAL ANALYSIS OF INGREDIENTS FOR INSTANT HEALTH BEVERAGE POWDER**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Hibiscus powder</th>
<th>Malted finger millet flour</th>
<th>Beverage Powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture %</td>
<td>4.6</td>
<td>7.82</td>
<td>1.12</td>
</tr>
<tr>
<td>Protein %</td>
<td>22.75</td>
<td>10.50</td>
<td>12.25</td>
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<tr>
<td>Fat %</td>
<td>2.39</td>
<td>2.48</td>
<td>1.78</td>
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<tr>
<td>Fibre %</td>
<td>1.25</td>
<td>3.16</td>
<td>3.67</td>
</tr>
<tr>
<td>Ash %</td>
<td>0.44</td>
<td>3.66</td>
<td>2.97</td>
</tr>
<tr>
<td>Calcium (mg/100 g)</td>
<td>0.84</td>
<td>386</td>
<td>96.5</td>
</tr>
</tbody>
</table>
### TABLE 2 COMPARISON OF NUTRIENT CONTENT OF INSTANT HEALTH BEVERAGE POWDER AND RDA OF SEDENTARY WOMEN AS GIVEN BY NIN

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Beverage powder</th>
<th>RDA (Sedentary Women)</th>
<th>RDA % fulfilled by Powder Drink</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron (mg/100 g)</td>
<td>0.38</td>
<td>4.6</td>
<td>1.15</td>
</tr>
<tr>
<td>TPC (mg/100 g)</td>
<td>54.36</td>
<td>124</td>
<td>118</td>
</tr>
<tr>
<td>DPPH %</td>
<td>93.35</td>
<td>47.78</td>
<td>43.66</td>
</tr>
</tbody>
</table>

### Figures

**FIGURE 1 FLOW SHEET FOR PREPARATION OF FLOUR FOR INSTANT HEALTH BEVERAGE POWDER**

1. **Malted Finger Millet Flour + Water**
2. Extrude in Pasta Maker (Dolly Mini P3) and Cut into Pieces of 15-20 mm
3. Autoclave for 15 minutes at 121°C and 15 psi followed by Microwave at 640 watt for 130 Seconds
4. Grind into Powder using Grinder and Sieve through 60 mesh Sieve
5. Store in Air-tight containers