Value Added Products from Millets

Dr. Usha Dharmaraj
Department of Grain Science and Technology
CSIR-CFTRI, Mysore
Major cereals, coarse cereals and millets

Rice

Wheat

Maize

Sorghum

Millet

Pearl millet

Small millets

Pseudo-cereals

1. Grain Amaranthus
2. Buck wheat
3. Quinoa

1. Finger millet
2. Foxtail millet
3. Little millet
4. Proso millet
5. Barnyard millet
6. Kodo millet

Fonio, Teff, Job’s tears
Millet growing areas in world

India, China, Myanmar, Korea and almost all African countries viz., Ethiopia, Namibia, Tanzania, Uganda, Zimbabwe etc.

35 million tons; 34 million hectares
### Nutritional composition of millets compared to major cereals (g/100g)

<table>
<thead>
<tr>
<th></th>
<th>Moisture</th>
<th>Protein</th>
<th>Fat</th>
<th>Dietary Fiber</th>
<th>Carbohydrates</th>
<th>Minerals</th>
<th>Calcium (mg)</th>
<th>Iron (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>13.7</td>
<td>6.8</td>
<td>0.5</td>
<td>1.5</td>
<td>76.9</td>
<td>0.6</td>
<td>10</td>
<td>0.7</td>
</tr>
<tr>
<td>Wheat</td>
<td>12.8</td>
<td>11.8</td>
<td>1.5</td>
<td>12.9</td>
<td>71.2</td>
<td>1.5</td>
<td>41</td>
<td>5.3</td>
</tr>
<tr>
<td>Maize</td>
<td>14.9</td>
<td>11.1</td>
<td>3.6</td>
<td>10.5</td>
<td>66.2</td>
<td>1.5</td>
<td>10</td>
<td>2.3</td>
</tr>
<tr>
<td>Pearl millet</td>
<td>12.4</td>
<td>11.6</td>
<td>5.0</td>
<td><strong>12.0</strong></td>
<td>67.5</td>
<td>2.3</td>
<td>42</td>
<td><strong>8.0</strong></td>
</tr>
<tr>
<td>Finger millet</td>
<td>13.1</td>
<td>7.3</td>
<td>1.3</td>
<td><strong>19.8</strong></td>
<td>66.8</td>
<td>2.7</td>
<td>344</td>
<td>5.0</td>
</tr>
<tr>
<td>Foxtail Millet</td>
<td>11.2</td>
<td>12.3</td>
<td>4.3</td>
<td><strong>14.0</strong></td>
<td>60.9</td>
<td>3.3</td>
<td>31</td>
<td>2.8</td>
</tr>
<tr>
<td>Little millet</td>
<td>11.5</td>
<td>7.7</td>
<td>4.7</td>
<td><strong>12.2</strong></td>
<td>67.0</td>
<td>1.5</td>
<td>17</td>
<td><strong>9.3</strong></td>
</tr>
<tr>
<td>Barnyard millet</td>
<td>11.1</td>
<td>6.2</td>
<td>2.2</td>
<td><strong>13.7</strong></td>
<td>65.5</td>
<td>4.4</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Kodo millet</td>
<td>11.4</td>
<td>8.3</td>
<td>1.4</td>
<td><strong>15.0</strong></td>
<td>65.9</td>
<td>2.6</td>
<td>27</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Nutritional significance

Finger millet
1. Good amount of sulphur amino acids like tryptophan, cystine and methionine
2. Richest source of calcium among cereals
3. High amount of dietary fiber
4. Rich in polyphenols – gallic, ferulic p-hydroxy benzoic, procatechuic and p-coumeric acids
5. Good antioxidant activity
6. Hypoglycemic, hypocholesterolemic and anti-ulcerative properties, inhibit aldol reductase activity

Foxtail millet
1. Contains ferulic and p-coumeric acids
2. Good antioxidant potential
3. Contains carotenes and tocopherols
4. Accumulates gama aminobutyric acid on germination, GABA regulates cardiovascular functions

Little millet
1. Good Source of iron
2. Highest soluble p-coumeric acid among the millets
3. Iron chelating activity is high compared to other millets
Proso millet
1. High content of total carotenoids
2. Good source of tocopherols
3. Exhibits antioxidant activity

Kodo millet
1. Comparatively high in lysine, (3.0-3.5g/100g)
2. Contains phenolics, tannins
3. Good antioxidant potential, highest DPPH quenching activity among millets
4. Hypoglycemic nature
5. Reduces cholesterol levels

Barnyard millet
1. Contains antioxidant compounds
2. Contains serotonin derivative---anti-inflammatory activity
3. Flavonoid-luteolin and tricin-cancer preventive
Constraints

- Lack of awareness
- Lack of suitable milling machineries
- Non availability of ready-to-use products on the shelf
- Food habits
- Organoleptic characteristics
- High fat content, mostly in bran and germ
- Low shelf stability of flour /semolina due to high oxidative & hydrolytic rancidity
- Lack of suitable processing technologies
Processing methods

Traditional Methods

1. Dehusking, milling
2. Malting
3. Fermentation
4. Popping
Contemporary methods

1. Refining
2. Husk free malt flour
3. Polishing/decortication
4. Improved popping process
5. Flaking
6. Extrusion cooking
7. Drum drying
8. Baking
Traditional products

- Roti
- Stiff porridge
- Thin porridge
- Cooked grains
- Sweet and savory products
- Popped products

Newer products

- Refined flour
- Husk free malt flour
- Parboiled grains
- Popped products
- Expanded products
- Extruded products
- Drum dried products
- Flakes
- Health foods and beverages
- Bakery products
- Semolina and composite flour
- Noodles
- Papads

Except for finger millet- All the millets need to be dehusked
Dehusked millet can be cooked like rice or can be milled to prepare flour and can be used in various traditional products
Generally these grains are polished to remove the bran portion
Refining

Parboiling
Expanded product

Health bars

Products from foxtail millet

Extruded product

Popped product
NOODLES

• Ragi-wheat blend based noodles marketed, mostly in southern states,

• Good market potential exists, due to the health benefits - high DF, Ca and non-gluten nature and cost benefits,

• Preparation of 100% ragi noodles feasible
Decorticated ragi

Soup mix from little millet

Ragi papad

Muruku from ragi ready mix
Based on finger millet malt

- Contains about 14% protein compared to 8-9% of the market sample
- Contains about 500 mg/100g of calcium (almost of 1/3rd of the RDA) from the natural source

Seed coat based biscuits

- 3 times higher calcium and dietary fiber than control sample
Malted weaning food

• Milk based weaning food
• Cereal based weaning food

The product can be fortified with added vitamins and minerals and flavored with natural fruit and vegetables.

Provides adequate nutrition to the child.

Ready-to-cook

Ready-to-eat

Ragi based malted weaning food

Rice based malted weaning food

Wheat based malted weaning food
## Malt based infant food

<table>
<thead>
<tr>
<th>Minimum requirement of Infant food</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protein</strong></td>
</tr>
<tr>
<td>1.8-4.5 g</td>
</tr>
<tr>
<td><strong>Fat</strong></td>
</tr>
<tr>
<td>3.3-6.0 g</td>
</tr>
<tr>
<td><strong>Carbohydrates</strong></td>
</tr>
<tr>
<td>7-14 g</td>
</tr>
<tr>
<td><strong>Calcium</strong></td>
</tr>
<tr>
<td>80 mg</td>
</tr>
<tr>
<td><strong>Linoleic acid</strong></td>
</tr>
<tr>
<td>0.5-1.2 g</td>
</tr>
<tr>
<td><strong>Energy</strong></td>
</tr>
<tr>
<td>65 k cal/100ml</td>
</tr>
</tbody>
</table>

## Enteral food (~18% finger millet)

- **2.5 kcal/ml**
Ready-to-eat snack mix

Millets, grain amaranthus, sorghum, legumes

All the grains popped and powdered

The ready mix could be shaped into burfi or laddu form or could be mixed with milk before consumption
Calcium rich ready-to-use product

As a natural mineral and fiber source in different cuisines; (in masala mixes, as chat mix, as a spread, in bakery and other food products)

Calcium 70% of RDA

890 mg of calcium
Convenience flour from finger millet

Parameter convenience flour (B) traditional method (A)

Colour (ΔE) 69.21 64.1

Firmness (N) 15 12.4

Springiness (mm) 2.8 3.0

Chewiness (Nmm) 5.7 4.3
Husk free flour from millets

- Combination of different millet semolina
- Combined health benefits
- Highly nutritious

Multi millet semolina
Foxtail millet coarse & fine semolina

Little millet coarse & fine semolina

Kodo millet coarse & fine semolina

Proso millet coarse & fine semolina
THANK YOU