Preparation of *kharudi* from germinated Bajara using *chakka* whey as soaking agent

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**Abstract**

In present study bajra groat were soaked in *chakka* whey for different durations 8, 12 and 16 hr. for preparation of *kharudi*. Bajra groat was evaluated for its physico-chemical, and organoleptic parameters of raw *kharudi* and fried *kharudi* evaluated. Yield of bajra groat prepared using *chakka* whey as a soaking agent was ranged from 261.34 to 258.67 gm. *Bajara* groat prepared had moisture per cent for treatments T1, T2, T3 and T4 content ranged from 43.6 to 44.46, protein per cent ranged from 11.49 to 12.78, carbohydrate per cent 71.64 to 72.10 and ash per cent from 1.7 to 2.2 respectively. As compared to control (T1), bajra groat prepared using water as soaking agent soaked for 12 hr. moisture, protein and carbohydrate increased in treatment in T1 bajra groat prepared using *chakka* whey as soaking agent for 12 hr., pH of bajra groat decreases from T2 to T4 (6.06 to 5.36) while titratable acidity increased from T1 to T4 (0.37 to 0.89) as the soaking period increases from 8 to 16 hr. Significant change in pH and titratable acidity was observed when *chakka* whey used as soaking agent T1 instead of water T1 control for same duration of soaking period. Organoleptic evaluation of raw *kharudi* and fried *kharudi* in respects of overall acceptability scored highest for raw *kharudi* and fried *kharudi* samples prepared from bajra groat using *chakka* whey as soaking agent for 12 hr.

**Keywords:** Kharudi, bajra groat, chakka

**Introduction**

Most of the millets are grown in different regions of the world from east to west. The world total production of millet grain was 762712 metric tonnes and India top ranking with a production of 334500 tonnes in 2010 (FAO, 2012) [1]. Millets are considered as crop of food security because of their sustainability in adverse agro-climatic conditions (Ushakumari et al., 2004). These crops have substantive potential in broadening the genetic diversity in the food basket and ensuring improved food and nutrition security (Mal et al., 2010) [1]. Along with nutrition millets offer health benefits in daily diet and help in the management of disorders like diabetes mellitus, obesity, hyperlipidemia, etc. (Veena, 2003) [12]. Millets offer unique advantage for health being rich in micronutrients, particularly minerals and B vitamins as well as nutraceuticals. Millets are also importance as ingredient in multigrain and gluten-free cereal products. In India millet are used to prepare various traditional foods and beverages like idli, dosa, papad, *chakli*, porridges, breads, infant and snack foods (Chandrasekara and Shahidi, 2011). Total world production of whey was approximately 85 million tones in 2008, out of which India contributes approximately 8 million tones of the total global production (Anon, 2009). About 40% of the total global production of whey is disposed as raw whey causing serious problems of environmental pollution due to high organic matter content (Reddy et. al., 1987; Mishra, 2008) [10]. Whey disposal is a serious problem for dairy industry. In order to reduce pollution load, whey should be treated to obtain commercial products (Gupte and Nair, 2010).

**Materials and Methods**

Pearl Millet (*Pennisetum typhoideum*) cultivar variety PPC-6 (Parbhani Sampadha) was procured from Jowar Research Station, VNMKV, Parbhani and *Chakka* whey was prepared using buffalo milk from Department of AHDS, VNMKV, Parbhani.

**Treatment Details**

For preparation of *Kharudi* using *chakka* whey as soaking agent was carried out using following treatments

T1: Bajra groats using water as soaking agent for 12 hr.
T1: Bajra groats using chakka whey as soaking agent for 8 hr.
T2: Bajra groats using chakka whey as soaking agent for 12 hr.
T3: Bajra groats using chakka whey as soaking agent for 16 hr.
The different levels were tried and compared with control (T4).

Receiving Bajra Grains
↓
Soaking grain in water (10 hr.)
↓
Tie in moist muslin cloth and put in clean and dry place (48 hr.)
↓
Sprinkling water (after every 12 hr.)
↓
Drying grains in sunlight (for 2 hr.)
↓
Remove plumule and radicale
↓
Coarse grinding
↓
Soaking in chakka whey →
↓
Tempering
(Edible oil, Garlic paste, Cumin, Chilli powder, Common salt)
↓
Add water and boil
↓
Add soaked groats in boiled water
↓
Add sesamum with stirring
↓
Cooking
↓
Excruiding through mould
↓
Sundrying
↓
Kharudi
↓
Storage
Flow diagram for preparation of Kharudi using chakka whey

Sensory Evaluation
Sensory evaluation of Kharudi using chakka whey was carried out by a panel of judges comprising “9 point Hedonic scale”.

Analysis
The samples of finished product from various treatment combinations were chemically analyzed for acidity was determined as per the method described in BIS (1981); Moisture content of soaked bajra groat was determined by standard procedure as described by (Anonymous, 1959); Protein content of bajra groat was determined by the Micro-kjeldhal method as described in (BIS, 1981); lipid content was calculated (AOAC, 1990); The total ash content of soaked bajra groats sample was determined by method given by ISI: (1981) [6].

Result and Discussion
Chemical Composition
The mean pH of fermented Bajara groat prepared using water and chakka whey as a soaking agent for different treatments given in table no.1 ranged between 5.56 to 6.06; Maximum pH was observed for T1 prepared using water as soaking agent for 12 hr. (6.06) and minimum for T4 prepared using chakka whey as soaking agent for 16 hr. (5.56) (Table 1.). It was observed that pH of Bajara groat prepared using chakka whey as soaking agent decreases as soaking period (fermentation) increases from 8 to 16 hr. Titratable acidity of Bajara groat prepared using water and Chakka whey as soaking agent was ranged between 0.37 percent to 0.89 percent (Table 1). Titratable acidity were observed by Ghosh and Chattopadhyay (2010) they reported that in idli batter preparation per cent titratable acidity of idli batter ranged 0.44 to 0.91, seemed to be in increasing order as the fermentation time extended. Surve et al. (2014) [11] also reported that the acids produced during fermentation lowers pH of batter thereby increasing activity of micro-organisms resulted in increased acidity of wheat batter.
The average carbohydrates of Bajara groat prepared using water and Chakka whey as soaking agent for different treatments is was ranged between 71.64 per cent to 72.10 per cent Maximum carbohydrate was observed for treatment T4 prepared using Chakka whey as soaking agent for 16 hr. (72.10 per cent) and minimum for T1 prepared using water as soaking agent for 12 hr. (71.64 per cent) (Table 1); The average moisture percentage of Bajara groat prepared using water and Chakka whey as soaking agent under different treatments is Maximum moisture content was noted for treatment T4 prepared using Chakka whey as soaking agent for 16 hr. (44.46 per cent) and minimum for T2 prepared using whey as soaking agent for 8 hr. (43.4 per cent) (Table 1). Similar finding were reported by Myrene (2013) [9] in which they studied legume fermentation. They observed that, legumes rapidly take up water from the surroundings to commence the metabolic process. The increase in water uptake with time is due to increasing number of cells within the seeds becoming hydrated.
The mean protein per cent of Bajara groat prepared using water and Chakka whey as soaking agent for different treatments is Bajara groat prepared using water and Chakka whey as a soaking agent at different treatments is at par with each other (Table 1). The above results were in accordance with results reported by shukla and Dubey (2014) reported increase in protein per cent during preparation of idli using whey based dhal-rice blend.
The average fat percentage of Bajara groat prepared using water and Chakka whey as a soaking agent at different durations is fat percentage of Bajara groat prepared using water and Chakka whey as a soaking agent for different period was ranged from 11.49 per cent to 12.78 per cent (Table 1). Result were in accordance with results reported by Shukla and Dubey (2014) in which the fat per cent of idli prepared using whey based dhal rice blend was increased from 0.58 per cent (control) to 0.62 percent. Changade et al. (2012) [11] also reported the increase in fat per cent of mungwadi prepared using chakka whey as compared to the mungwadi without chakka whey.
The average ash content of Bajara groat prepared using water and Chakka whey as soaking agent for different treatments is for different durations was ranged from 1.7 per cent to 2.2 per cent (Table 1). The above results were in accordance with
results reported by Changade et al. (2012) [1] in which the ash per cent of "mungwadi" prepared using Chakka whey increased as compared to "mungwadi" prepared without Chakka whey. Myrene et al. (2013) [9]. The average moisture percentage of Bajara kharudi prepared using water and Chakka whey under different treatments ranged from 6.21 to 8.13 per cent (Table 2). Ikuomola et al. (2013) also reported the similar trends in the moisture content of soy-snack. The average protein per cent of Bajara kharudi for different treatments is the protein content of Bajara kharudi was ranged from 12.95 to 13.09 per cent. Maximum protein content was observed for the Treatment T2, and minimum in T1 (Table 2). The present findings were in agreement with results reported by Kamat and Yenagi (2012) [7] in the preparation of NereHappala of cereals and millets. The average ash content of Bajara kharudi for different treatments ranged from 2.17 to 2.19 per cent. Maximum ash percentage was noted for treatment T1 and minimum for T4 (Table 2).

Sensory Properties
The sensory parameters chosen to assess the quality of Kharudi prepared using water and Chakka whey as soaking agent are flavour, colour and appearance, body and texture and overall acceptability. The flavour score of raw Kharudi and fried Kharudi samples of different treatments influenced by soaking period (fermentation) prepared from Bajara groat for different treatments was ranged from 6.7 to 8.13 and 6.5 to 8.2 respectively (Table 3). The flavour score of raw Kharudi is higher than the fried Kharudi. Present results are in agreement with Kamat and Yenagi et al. (2012) [7] in the preparation of NereHappala of cereals and millets. The colour and appearance score of raw and fried Kharudi samples prepared from Bajara groat for different treatments was ranged from 5.93 to 8.53 and 6.86 to 8.2 respectively (Table 3). The maximum score was given to raw and fried Kharudi samples prepared from Bajara groat for treatment T3 8.53 and 8.2 respectively using Chakka whey as soaking agent for 12 hr. and minimum for raw Kharudi T1 (Table 3). The present results are in good accordance with the results reported by Kamat and Yenagi et al. (2012) [7] in preparation of NereHappala of cereals and millets. The Body and texture score of raw and fried Kharudi samples prepared from Bajara groat for different treatments was ranged from 7.2 to 8.93 and 6.83 to 8.3 respectively (Table 3). The present findings were in accordance with results reported by Kamat and Yenagi et al. (2012) [7] in the preparation of NereHappala. Overall acceptability score of raw and fried Kharudi samples prepared from Bajara groat of different treatments was ranged from 6.33 to 8.53 and 6.5 to 8.36 respectively (Table 3). The present results are in agreement with results reported by Kamat and Yenagi (2012) [7] in preparation of NereHappala of cereals & millets.

### Table 1: Effect of soaking period on different constituents of Bajara groat

<table>
<thead>
<tr>
<th>Chemical constituents (%)</th>
<th>Moisture</th>
<th>Protein</th>
<th>pH</th>
<th>Carbohydrate</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>43.60</td>
<td>12.95</td>
<td>2.31</td>
<td>62.33</td>
<td>2.19</td>
</tr>
<tr>
<td>T2</td>
<td>43.40</td>
<td>13.09</td>
<td>2.31</td>
<td>62.49</td>
<td>2.18</td>
</tr>
<tr>
<td>T3</td>
<td>44.06</td>
<td>13.21</td>
<td>2.25</td>
<td>62.81</td>
<td>2.17</td>
</tr>
<tr>
<td>T4</td>
<td>44.46</td>
<td>13.48</td>
<td>2.23</td>
<td>62.03</td>
<td>2.17</td>
</tr>
</tbody>
</table>

### Table 2: Effect of different treatments on chemical composition of kharudi

<table>
<thead>
<tr>
<th>Chemical constituents (%)</th>
<th>Moisture</th>
<th>Fat</th>
<th>Protein</th>
<th>Crude fibre</th>
<th>Carbohydrate</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>6.22</td>
<td>16.31</td>
<td>12.95</td>
<td>2.17</td>
<td>62.33</td>
<td>2.19</td>
</tr>
<tr>
<td>T2</td>
<td>7.21</td>
<td>15.02</td>
<td>13.09</td>
<td>2.31</td>
<td>62.49</td>
<td>2.18</td>
</tr>
<tr>
<td>T3</td>
<td>7.42</td>
<td>14.39</td>
<td>13.21</td>
<td>2.25</td>
<td>62.81</td>
<td>2.17</td>
</tr>
<tr>
<td>T4</td>
<td>8.19</td>
<td>14.12</td>
<td>13.48</td>
<td>2.23</td>
<td>62.03</td>
<td>2.17</td>
</tr>
</tbody>
</table>

### Table 3: Organoleptic quality of raw Kharudi

<table>
<thead>
<tr>
<th>Organoleptic parameters</th>
<th>Flavour</th>
<th>Colour &amp; Appearance</th>
<th>Body &amp; Texture</th>
<th>Overall Acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>6.70</td>
<td>5.93</td>
<td>7.20</td>
<td>6.33</td>
</tr>
<tr>
<td>T2</td>
<td>7.63</td>
<td>7.70</td>
<td>7.36</td>
<td>6.63</td>
</tr>
<tr>
<td>T3</td>
<td>8.13</td>
<td>8.53</td>
<td>8.93</td>
<td>8.50</td>
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<tr>
<td>T4</td>
<td>7.20</td>
<td>7.86</td>
<td>7.83</td>
<td>8.03</td>
</tr>
</tbody>
</table>

### Table 4: Organoleptic quality of Fried Kharudi

<table>
<thead>
<tr>
<th>Organoleptic parameters</th>
<th>Flavour</th>
<th>Colour &amp; Appearance</th>
<th>Consistency</th>
<th>Overall Acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>7.80</td>
<td>8.20</td>
<td>7.80</td>
<td>7.93</td>
</tr>
<tr>
<td>T2</td>
<td>8.10</td>
<td>8.05</td>
<td>8.00</td>
<td>8.05</td>
</tr>
<tr>
<td>T3</td>
<td>8.25</td>
<td>7.90</td>
<td>8.10</td>
<td>8.08</td>
</tr>
<tr>
<td>T4</td>
<td>7.65</td>
<td>7.80</td>
<td>7.67</td>
<td>7.00</td>
</tr>
</tbody>
</table>
Conclusions

1. Soaking period of bajra groat in chakka whey medium increased yield of bajra groat at optimum hydration level i.e. for 12 hr. soaking period, colour characteristic also varied as the maximum brightness was observed for the bajra groat prepared using chakka whey as soaking agent for 12 hr.

2. Soaking period of bajra groat for different durations affected chemical characteristic of bajra groat as moisture percentage increases for 16 hr. and ash percentage decreases as the soaking period increases from 8 to 16 hr., variation in protein content was also observed. Significant increase in moisture, protein, carbohydrate and ash per cent was observed.

3. Soaking period of bajra groat for different durations affected colour characteristic of bajra groat, yellowness increased as the soaking period increased from 8 to 12 hr. and highest redness observed for 12 hr. soaked bajra groat in chakka whey.

4. Expansion ratio and oil absorption also affected in fried kharudi samples as the soaking period different for various treatments. Expansion ratio decreased as the soaking period increases from 12 to 16 hr. and oil absorption variation due to varied moisture content in dried kharudi sample.

5. Soaking period affected organoleptic evaluation of raw and fried kharudi prepared from bajra groat. Kharudi samples prepared from 12 hr. soaked in chakka whey scored high for overall acceptability.

References


