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Studies on process standardization and nutritional value of Indian heritage Food-Kharodi

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Abstract

Pearl millet is a highly nourishing food and nutritionally superior to other major cereals with respect to energy, protein, vitamins and minerals. *Kharodi* is the product earlier prepared with pearl millet now newly developed product can be fortified with millets like finger millet and sorghum in addition with spices. It was found that *Kharodi* made from the different formulation of composite flour (pearl millet, finger millet, sorghum) control T₀, T₁, T₂, T₃ and T₄ among these samples T₂ was significantly superior than other sample as judged by panel members. Addition of finger millet and sorghum that increases the mineral content like calcium, iron, zinc and phosphorous of final product also increases the sensory attributes and nutritional value of final product and stored throughout the whole year. The more amount of iron content which helps the person suffering from anemia disease.

Keywords: Pearl millet, Sorghum, Finger millet, Process Standardization, Nutritional Value of *Kharodi*.

1. Introduction

Millet is widely grown in the semiarid tropics of Africa and Asia and constitutes a major source of carbohydrates and proteins for people living in these areas. Millet is one of the most important drought resistant crops and the 6th cereal crop in terms of world agriculture production (Saleh *et al.*, 2013) [23]. Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is one of the most important drought-tolerant crops of the tropical and subtropical regions of the world; As a cereal for human food pearl millet contributes a great part of dietary nutrients for large segments of people in Africa and Asia, and is often considered highly palatable, and a good source of protein, minerals and energy. Antinutrients (phytic acid and polyphenols), present in considerable amounts limit protein and starch digestibilities (Yoon *et al.*, 1983; Carnovale *et al.*, 1988) [27, 7] hinder mineral bioavailability and inhibit proteolytic (Knuckles *et al.*, 1985) [14] and amylolytic enzymes (Sharma *et al.*, 1978) [24]. Nutritionally, pearl millet makes an important contribution to human diet due to high levels of calcium, iron, zinc, lipids and high quality proteins. Carbohydrates are the major component of pearl millet grains varying from 71.82 to 81.02 per cent (Cheik *et al.*, 2006) [8]. Pearl millet usually has higher protein and fat content than sorghum or the other millets because the kernel is a naked caryopsis. Its protein content is not only high but also of good quality except for lysine deficiency (Gill, 1991) [11]. Protein and fat content of pearl millet varieties vary from 12.25 to 13.09 per cent and 4.32 to 5.11 per cent, respectively and protein digestibility ranges from 47.30 to 61.17 per cent (Anju, 2005) [5]. The total sugars in pearl millet ranges from 2.55 to 2.93 per cent, non-reducing sugars ranges from 2.15 to 2.57 per cent and reducing sugars from 0.34 to 0.39 per cent (Rekha, 1997 and Poonam, 2002) [22, 20]. Sorghum (*Sorghum bicolor* L.) and pearl millet (*Pennisetum glaucum* (L.) R. Br.) are major warm-season cereals valued for their food, feed, and fodder uses in various parts of the world. Sorghum is cultivated on more than 42 million ha worldwide with the largest areas in Africa (24.5 million ha) and Asia (10.6 million ha). India ranks first with the largest sorghum area (9.1 million ha) in the world (Rai *et al.*, 2008) [21]. The nutrient composition of sorghum grain indicates that it is a good source of energy, protein, vitamins, minerals and phytochemicals (Badi *et al.*, 1990; Arun *et al.*, 2008) [6, 4]. The fibre and mineral content of grain sorghum is around 2.1 per cent and 1.6 per cent respectively. It is a good source of energy and provides about 349 K cal/100g and gives 72.6 per cent of carbohydrates (Gopalan *et al.*, 1996) [12]. Starch is the major carbohydrate of the grain. About 32 to 79 per cent of sorghum grain weight is due to starch. The other carbohydrates present are simple sugars, cellulose and hemicellulose. The amylose content of sorghum is about 21.28 per cent (Donald *et al.*, 2005; Aviara *et al.*, 2010) [10, 5]. Finger millet (*Eleusine coracana*) also known as *ragi*, *nachani* or *nagli*, is one of the important millets in India. Finger millet is extensively grown on hilly areas and southern part of India and is widely consumed in the form of dumping by vast section of people (Vidyavati *et al.*, 2004) [26].

Finger millet is a rich source of Ca (344 mg %), phosphorus (283 mg %) and Fe 3.9% (Gopalan *et al.*, 2009) [13]. Finger millet has a well-balanced amino-acid profile and is a good source of methionine, cystine and lysine. These essential amino acids are of special benefit to those who depend on plant food for their protein nourishment. It also contains about 72% carbohydrates, a high proportion of which is in the form of non-starchy polysaccharides and dietary fibre, which helps in constipation, and lowering of glucose in blood. It is a rich source of vitamins *viz.*, thiamine, riboflavin, folic acid and niacin (Vidyavati *et al.*, 2004) [26].

Various types of traditional health foods can be prepared from pearl millet such as *Bhakar*, *Bundiladdu*, *Burti*, *Chakli*, *Chiwada*, *Dive*, *Kharibundi*, *Khichadi*, *Masala papad*, *Thalipeeth* and *Vade*. Next is the flat bread either fermented or unfermented. *Idli* is steamed product made in India, usually for breakfast. Different types of food products can be prepared from pearl millet flour such as *Roti*, porridge from grits, non fatty, crisp noodles and puffs etc. Various types of traditional health foods can be prepared from pearl millet like *Bhakar*, *Chakli*, *Dashmi*, *Kharvadi*, *Khichadi*, *Kurdaya*, *Nagdive*, *Papadi*, *Shankarpali*, *Shev*, *Thalipeeth* and *Usal* (Deshmukh *et al.*, 2010).

Kharodi is the product prepared in the Maharashtra recipe. It is popular mostly in the Hindu community. Generally *Kharodi* is prepared from the pearl millet in addition with spices which is used as or consumed as ready-to-eat product. It is prepared in the summer days and stored through the whole year. The present investigation the efforts should be undertaken to prepare the product which can meet the consumers demand, health benefits and cost efficient product. *Kharodi* is the product earlier prepared with pearl millet now newly developed product can be fortified with millets like finger millet and sorghum in addition with spices which increase the nutritive value of food product as well as it increases the taste and colour of *Kharodi*. It has good consumer's acceptability. Addition of finger millet and sorghum that increases the mineral content like calcium, iron, zinc and phosphorous of final product which is increases the sensory attributes of final product.

Materials and Methods

Raw Materials and chemicals

The ingredients like Pearl millet (AHB 1200) Flour was procured from Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani, Finger Millet Flour, sorghum flour and other minor ingredients like salt, oil, chilli powder, cumin seed, garlic, mustard seed, sesame seed etc. were purchased from local market of Parbhani. Most of the chemicals used in this investigation were of analytical grade. They were obtained from different Departments of College of Food Technology, VNMKV, Parbhani.

Equipments and instruments

The different equipments required for the value addition of product like mixer or grinder, Hand Molder were made available from the Department of Food Trade and Business Management and other Departments of College of Food Technology, V.N.M.K.V., Parbhani.

Method

Proximate composition analysis

The proximate composition (moisture, fat, protein, ash, fiber) of raw material were determined using standard procedures (AOAC, 1995) [3]. Carbohydrate content was determined by difference method.

Mineral Analysis

The minerals were estimated according to the respective method as described in AOAC (2005).

Composite flour formulation for preparation of Indian heritage food-Kharodi.

In order to formulate the recipe of composite flour for preparation of *Kharodi* with enhanced nutritional quality, different preliminary trials were carried out followed by information sensorial evaluation of product. Hence, on the basis on preliminary trials, following recipes were finalized for experimentation.

Table 1: Different Formulation of Composite Flour used for the Standardization of *Kharodi*

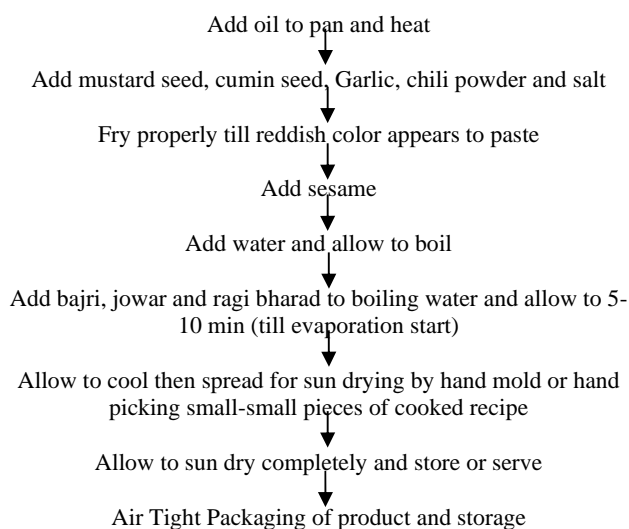
| Sr. No. | Flour | Composition of Composite flour | | | | |
|---------|---------------------|--------------------------------|----|----|----|----|
| | | Control T0 | T1 | T2 | T3 | T4 |
| 1 | Pearl millet flour | 100 | 90 | 80 | 70 | 60 |
| 2 | Finger millet flour | --- | 5 | 10 | 15 | 20 |
| 3 | Sorghum flour | --- | 5 | 10 | 15 | 20 |

Table 2: Standard recipe for the preparation of Indian heritage product *Kharodi*

| Sr. no. | Ingredients | Weight (g) |
|---------|-------------------------------------------------------------------------------------------------------|------------|
| 1 | Composite flour (T ₀ , T ₁ , T ₂ , T ₃ , T ₄) | 100 |
| 2 | Sesame seed | 15 |
| 3 | Salt | 4.5 |
| 4 | Chilli powder | 2.5 |
| 5 | Cumin seed | 2.5 |
| 6 | Mustard seed | 0.7 |
| 7 | Oil | 5ml |
| 8 | Garlic | 7.5 |
| 9 | Water | 250ml |

Method for preparation of Indian heritage food-Kharodi.

The production of *Kharodi* was started by dry mixing the composite coarse flour of millets in a bowl. Add the oil in pan then the spice mix and other dry ingredients were added and mixed thoroughly. Fry properly till reddish color appears to paste. Then add the sesame seed then add the enough water. After boiling of water add the millet flour (Pearl millet, finger millet, sorghum). Allow to 5-10 min (till evaporation start). And cool it. Then, it was placed into hand mold or hand picking is carried out and placed for the sun drying. After complete drying, the products were kept in an airtight container or in LDPE polyethylene material.



Flow sheet 2. Process for Preparation of *Kharodi*.



Fig 1: Kharodi

Where

T₀- pearl millet flour (100%), **T₁**- pearl millet flour, Finger millet flour, sorghum flour (90:5:5), **T₂**- pearl millet flour, Finger millet flour, sorghum flour (80:10:10), **T₃**- pearl millet flour, Finger millet flour, sorghum flour (70:15:15), **T₄** - pearl millet flour, Finger millet flour, sorghum flour (60:20:20)

Overall acceptability of Products

A panel of ten judges comprising of faculty and students of the institute was formed. Sensory evaluation was carried out by standard method using 9 point hedonic scale. All indexes were measured using a scale from 0 to 9, where a score of 9 represents excellent quality and a score of 0 represents the lowest quality level (Meilgaard and Civille, 1999) [17].

Statistical analysis

The analysis of variance was followed for interpreting the differences between the different variations for individual sensory characters (Panse and Sukhatme, 1985) [19].

Table 4: Nutritional composition of different formulated *Kharodi* made from *AHB 1200* variety of pearl millet

| Treatment | Proximate composition (%) | | | | | |
|----------------|---------------------------|--------|---------|--------|--------|--------------|
| | Moisture | Fat | Protein | Ash | Fiber | Carbohydrate |
| T ₀ | 6.0 | 15.30 | 13.17 | 2.3 | 2.23 | 61.00 |
| T ₁ | 6.2 | 14.80 | 13.00 | 2.25 | 2.35 | 61.40 |
| T ₂ | 6.4 | 14.60 | 12.70 | 2.2 | 2.50 | 61.87 |
| T ₃ | 6.3 | 14.35 | 12.50 | 2.15 | 2.60 | 62.15 |
| T ₄ | 6.5 | 14.00 | 12.14 | 2.00 | 2.65 | 62.75 |
| SE (±) | 0.01 | 0.1644 | 0.0096 | 0.0087 | 0.0088 | 0.1636 |
| CD at 5 % | 0.0301 | 0.4948 | 0.0288 | 0.0261 | 0.0265 | 0.4924 |

*Each value is the mean of three replications

The data obtained from the table 4 revealed that the chemical evaluation of *Kharodi* prepared from *AHB 1200* showed that moisture content was found to be in between 6 (T₀) to 6.5 (T₄), fat content was decreased from 15.30 (T₀) to 14 (T₄), protein content was decreased from 13.17(T₀) to 12.14(T₄), ash content was decreased from 2.3(T₀) to 2(T₄), crude fibre content was increased from 2.23(T₀) to 2.65 (T₄) and carbohydrate content was increased from 61(T₀) to 62.75 (T₄).

Mineral content of Kharodi

It was found that the minerals were present in high amount in *Kharodi* incorporated with finger millet and sorghum. Finger millet contains high amount of minerals as calcium which is increased as incorporation level increases.

Results and Discussion

During present investigation the prepared product process was standardized on the basis of sensory and textural qualities. The results pertaining to different analytical evaluation were viewed under scientific relevance and are summarized as follows under suitable main headings.

Table 3: Sensory evaluation of *Kharodi* made from Pearl millet variety *AHB 1200*

| Samples | Appearance and colour | Flavor | Taste | Texture | Overall Acceptability |
|----------------|-----------------------|--------|--------|---------|-----------------------|
| T ₀ | 7.7 | 7.8 | 7.8 | 7.9 | 7.8 |
| T ₁ | 7.8 | 8.1 | 7.9 | 8.0 | 7.95 |
| T ₂ | 8.1 | 8.2 | 8.3 | 8.1 | 8.17 |
| T ₃ | 7.9 | 8.0 | 8.0 | 8.1 | 8.0 |
| T ₄ | 8.0 | 8.1 | 7.9 | 8.2 | 8.05 |
| SE (±) | 0.0874 | 0.0789 | 0.0353 | 0.0874 | 0.0401 |
| CD at 5 % | 0.2632 | 0.2375 | 0.1062 | 0.2632 | 0.1206 |

*Each value is the mean of three replications

Where, T₀- pearl millet flour (100%), T₁- pearl millet flour, Finger millet flour, sorghum flour (90:5:5), T₂- pearl millet flour, Finger millet flour, sorghum flour (80:10:10), T₃- pearl millet flour, Finger millet flour, sorghum flour (70:15:15), T₄ - pearl millet flour, Finger millet flour, sorghum flour (60:20:20)

Data obtained from the Table 3, it was recorded that the overall acceptability score awarded for sample T₂ was found higher than other samples (8.17) whereas T₀ received the lowest (7.8). The acceptance of samples depends on the ingredient variation. The sample T₄ was also reported as statistically as par with T₁ and T₃ samples and significantly superior than the T₁ sample. The next parameter i.e., colour serves as important parameter for the acceptance of food samples. The highest score for taste of *Kharodi* T₂ was obtained as (8.3). The lowest score found in the sample T₀ score (7.8). The sample T₂ was significantly superior than the other samples. There was no significant difference between the samples in context to colour.

The iron content was T₀-9.02mg/100g, T₁-8.61, T₂-8.21, T₃ - 7.8 and T₄-7.4 mg/100g in *Kharodi* which is enriched with finger millet and sorghum samples respectively. The calcium content of sample was T₀-166.30mg/100g, T₁-178.34, T₂-190.39, T₃-202.43 and T₄-214.47mg/100g in *kharodi*. The phosphorous content was decreased as level of finger millet and sorghum increased in sample of *Kharodi* as T₀-319.43mg/100gm, T₁-317.52mg/100gm, T₂-315.60mg/100gm, T₃-313.69mg/100gm and T₄-311.78mg/100gm respectively. The zinc content was decreased as level finger millet and sorghum increased in sample of *Kharodi* as T₀-4.05mg/100gm, T₁-3.92mg/100gm, T₂-3.79mg/100gm, T₃-3.66mg/100gm, T₄-3.50mg/100gm respectively.

Table 5: Effect of different formulations on Mineral composition of *Kharodi* made from pearl millet variety AHB 1200

| Samples | Iron (mg/100g) | Calcium (mg/100g) | Phosphorous (mg/100g) | Zinc mg/100g |
|----------------|----------------|-------------------|-----------------------|--------------|
| T ₀ | 9.02 | 166.30 | 319.43 | 4.57 |
| T ₁ | 8.61 | 178.34 | 317.52 | 4.39 |
| T ₂ | 8.21 | 190.39 | 315.60 | 4.20 |
| T ₃ | 7.8 | 202.43 | 313.69 | 4.02 |
| T ₄ | 7.4 | 214.47 | 311.78 | 3.84 |
| SE (±) | 0.0109 | 0.0088 | 0.0093 | 0.0091 |
| CD at 5 % | 0.0329 | 0.0265 | 0.0279 | 0.0275 |

*Each value is the mean of three replications

Conclusion

It can be concluded that Indian Heritage Food – *Kharodi* could be successfully prepared by using pearl millet in addition to finger millet and sorghum. It having good overall acceptability and improves the nutritional value of food product and rich in iron as well as calcium content and can be stored at room temperature for several months to one year. The more amount of iron content that helps to person suffering from anaemia disease.

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