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**Kamble PS**

M.Tech. (Food technology)  
College of Food Technology,  
VNMKV, Parbhani,  
Maharashtra, India

**Sonwane CG**

PhD Scholar at Sandip  
University, Nashik,  
Maharashtra, India

**Khandekar SA**

Sam Higginbottom University of  
Agriculture, Technology and  
Science Prayagraj, Uttar  
Pradesh, India

## Processing and sensory evaluation of Khakhra fortification with Spinach and Aonla

**Kamble PS, Sonwane CG and Khandekar SA**

**Abstract**

Khakhra is handmade or made by machines and roasted to obtain crispiness. It is also a crispy version of roti. This is a healthy snack common recipe in the Rajasthan and Gujarati cuisines. Khakhra when prepared by using Aonla in the form of dried powdered provides a much more nutrition in terms of protein, carbohydrates, minerals and dietary fibers in comparison with the traditional khakhra that is made of only wheat flour. Since over consumption of wheat or its products are known for improper health condition such as celiac disorder may overcome by minimizing its proportion with adding Spinach as it is rich in iron with many health benefits and aonla in powder form which is rich vitamin C helps to cure or precautions to the Scurvy disease. Finally obtained product is kept for evaluation sensory parameters.

**Keywords:** Fortified Khakhra, Traditional Recipe, Nutritional value, Sensory Evaluation

**1. Introduction**

Khakhra is a thin cracker common in the Gujarati and Rajasthan cuisines of western India. It is traditionally made from wheat flour and oil. Khakhra are individually hand-made and roasted to provide a crunchy and healthy snack. This can be enjoyed with a selection of spicy pickles and sweet chutneys. The traditional Khakhra is enriched with protein by adding kidney bean flour. The nutritional and medicinal value of Kidney beans makes it suitable diet for asthma and diabetes patients, boosting their immune system. Such enriched Khakhra are great source of vitamin, minerals, proteins, dietary fibers and iron.

Spinach (*Spinacia oleracea*) is an annual herb belongs to the family *Chenopodiaceae*. It is native to Southwest Asia and widely distributed and cultivated through the world including Iran as vegetables for its high nutritious value. Spinach is a good source of minerals (iron, copper, phosphorous, zinc, selenium), vitamin B complex (niacin and folic acid), ascorbic acid, carotenoids ( $\beta$ -carotene, lutein, zeaxanthin) and phenols (flavonoids, p-coumaric acid), apocynin and Omega-3-fatty acids. It is a relatively quick-growing vegetable and easy to maintain and distinguishable by its green color as well as smooth, oblong shaped leaves that can be either crinkled or smooth. Also, the whole plants is medicinally important and are used in traditional medicine for numerous therapeutic effects because of the presence of biological tannins and phenolic active phytochemicals such as alkaloids, flavonoids, steroids, glycosides, terpenoids. It is used to treat diabetes, leprosy, asthma, urinary diseases, lung inflammation, joint pains, thirst, sore throat, scabies, vomiting, ringworm, sore eye, cold, sneezing, fever and the diseases related to brain and heart (Afra, R. and Seied, M. M) [1].

Aonla (*Emblica officinalis*) is native of tropical India and Southeast Asia, commonly named as 'Indian gooseberry' (Barthakar and Arnold, 1991) [2]. Aonla fruits are fleshy, yellowish green in colour which having six vague perpendicular furrows enclosing seeds. Aonla fruit makes it popular all over the world due to its, commercial and medicinal significance of (Goyal *et al.*, 2007) [3]. Aonla is an excellent source of ascorbic acid (300-900 mg/100 g), amino acid and minerals. It also has phytochemicals such as polyphenols, tannins, emblicol, linoleic acid, corilagin, phyllembin and rutin (Ghorai and Sethi, 1996) [5].

Aonla fruit is useful in the treatment of haemorrhage, dysentery, diarrhoea, gastric disorders, constipation, headache, jaundice and enlargement of liver (Parrotta, 2001; Goyal *et al.*, 2007) [8, 3]. Various research studies show that aonla has prominent antibiotic, antiulcerogenic, diuretic, laxative, adaptogenic, antitumor, antiscorbutic, hepatoprotective, cardio tonic, antiviral and hypoglycemic properties (Rege *et al.*, 1999;). Aonla have good effect on Hypolipidaemic (Mathur *et al.*, (1996) [6]. Aonla is also effective on anti-pyretic and analgesic activity in ethanolic and aqueous extract of *Emblica officinalis* (Perianayagam *et al.* 2004) [9]. Banarasi, Chakaiya, Krishna, Francis (Hathijhool), Kanchan (NA-4), NA-6, NA-7, Anand-1, 2, 3 are some of the commercially cultivated varieties of aonla in India (Goyal, 2008; Singh, 2009) [4, 10].

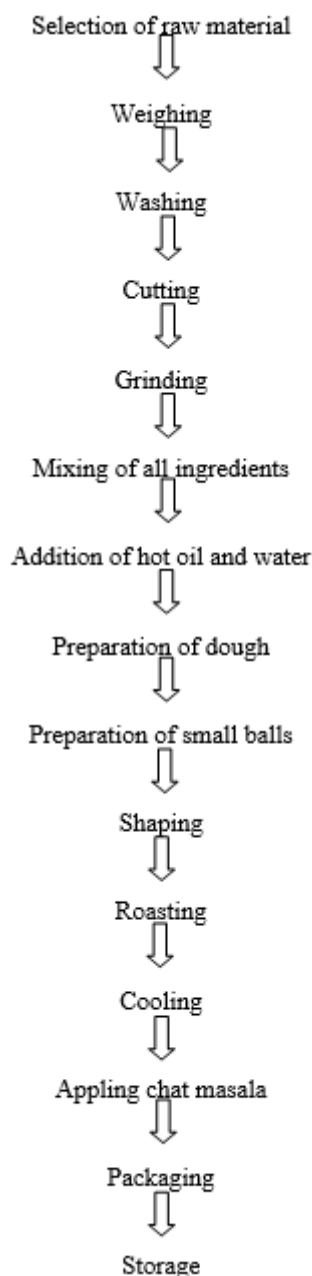
**Corresponding Author:****Kamble PS**

M.Tech. (Food technology)  
College of Food Technology,  
VNMKV, Parbhani,  
Maharashtra, India

Owing to its excellent nutritional profile and physico-chemical properties, aonla is processed into different types of product. Aonla fruit having sour and astringent taste, generally utilised raw, cooked or in the form of pickle. Murrabas, juice, jam, cheese, candy, powder, beverage, chutney are the different types of aonla products available in the market and preferred by the consumer being the rich source of vitamin C and antioxidants. Aonla is one of the main constituent of many ayurvedic preparations like Triphla and Chyawanprash (Pant *et al.*, 2004; Goyal *et al.*, 2007)<sup>[7,3]</sup>.

## 2. Materials and Methods

### 2.1 Flow chart- Manufacturing Process of Aonla and Spinach Fortified Khakhra



Considered as the major ingredient,

T<sub>0</sub> 100% wheat flour by weight (control)

T<sub>1</sub> 10% Spinach juice+ 2% Aonla Powder+ 90% wheat flour by weight

T<sub>2</sub> 15% Spinach juice + 4% Aonla Powder+ 85% wheat flour by weight

T<sub>3</sub> 20% Spinach juice +3% Aonla Powder+ 80% wheat flour by weight

Khakhra is safer and less prone to microbial spoilage.

- It has low moisture content in the product.
- Also possess a longer shelf life.

### 3. Result and Discussion

Aonla and Spinach fortified khakhra prepared from different mixtures of wheat flour and aonla powder and spinach juice is subjected to sensory evaluation and scores are recorded for different parameters are presented in Table 1.

**Table 1:** To sensory evaluation and scores are recorded for different parameters

Treatments	Color and appearance	Flavor	Consistency	Mouth Feel	Acceptability
T <sub>0</sub>	8.02	8.15	8.35	8.01	8.12
T <sub>1</sub>	8.2	8.23	8.66	8.12	8.14
T <sub>2</sub>	8.12	8.32	8.28	8.23	8.20
T <sub>3</sub>	8.10	8.12	8.20	8.01	8.0

#### 3.1 Color and appearance

The mean color and appearance score for different treatments of spinach aonla khakhra are ranged from 8.02 to 8.12. The treatment T<sub>1</sub> (8.12) is found to be significantly superior over the rest of the treatments. It was observed that decrease in the level of spinach and aonla in khakhra decreases the score of color and appearance slightly.

#### 3.2 Flavor

It is observed that the mean score for the flavor of spinach aonla khakhra for treatments T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> are 8.15, 8.23, 8.32, and 8.12 respectively. The treatment T<sub>2</sub> is superior over T<sub>0</sub> and T<sub>3</sub> treatments. It is observed from above findings that 90% of wheat flour mixed with 15% of spinach juice and 4% aonla powder will give rich flavor to khakhra.

#### 3.3 Consistency

The mean score for the consistency attributes of Spinach aonla khakhra ranges from 7.20 to 8.66. The treatment T<sub>1</sub> (8.66) is significantly superior over the rest of the treatments.

#### 3.4 Mouth feel

The highest mouth feel score is observed for treatment T<sub>1</sub> (8.12) followed by T<sub>2</sub> (8.23), T<sub>0</sub> (8.01) and T<sub>3</sub> (8.0). 15% of spinach juice and 4% aonla powder mix is most acceptable (T<sub>2</sub>).

#### 3.5 Overall acceptability

The mean score for treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> are 8.12, 8.14, 8.20 and 8.0 respectively. The treatment T<sub>2</sub> (8.20) is most accepted by the judges. So use of 15% of spinach juice and 4% aonla powder is more acceptable than the other treatment combinations.

### 4. Conclusion

Addition of Spinach juice and Aonla Powder into traditional khakhra makes it more nutritious and also helps in improving the keeping quality of the end product. The optimum amount of Spinach juice and Aonla Powder that can be used in the process of preparation of khakhra is up to 15% & 4%.

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