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Nutritional Enrichment and Health Benefits of Broccoli Flour in Making Dhokla

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Abstract

Dhokla is easy to cook and very popular as a snack. Traditional dhokla is a lactic acid-fermented cake prepared from a batter of coarsely ground rice (*Oryza sativa* L.) and Bengal gram dhal (*Cicer arietinum* L.) Broccoli flour is an excellent fortification ingredient for food products due to its nutritional properties, high antioxidant activity, and good sensory characteristics. Presently, food sectors, food manufacturers, and food processing producing "Ready-to-eat-food" products are developing day by day according to the demand for public health and their time saver. The study was carried out in the Research laboratory of Food Science and Technology, School for Home Sciences, Babasaheb Bhimrao Ambedkar University, Lucknow. Develop the product, with a simple form of chickpea flour, rice flour with the incorporation of broccoli flour and converted into a healthy and therapeutic diet. Broccoli flour are rich in anti-inflammatory, anti-oxidant, sulphonates, minerals, vitamins and fibre. Rice flour is an excellent source of zinc, magnesium, iron, vitamin B which helps in the production of new cells. Chickpea flour is an excellent source of several minerals including iron, magnesium, phosphorus, copper, and manganese. It is higher in protein, lesser in calories, reduce the formation of harmful compounds in processed foods. Product was nutritionally analysis and the result of "Ready to mix fortified dhokla" product which have nutrient as per 100 grams, energy (389 Kcal), protein (46.2 g), carbohydrates (77.8 g), fibers (52 g), fats (18.4 g), vitamin C (0.74 mg), vitamin A (95 µg), calcium (58 mg), Iron (2.72 mg), Niacin (28 mg). Nutritional value is compared with fortified dhokla and both products are ready to eat and recommended by all the age groups.

Keyword: Antioxidant; Anti-inflammatory; Fortified dhokla; Therapeutic diet

Introduction

Dhokla is originated from Gujarat. It is legume-based fermented foods constitute an important part of the human diet in developing countries, including India. Dhokla, a lactic acid fermented cake. It is prepared usually from a batter of coarsely ground rice (*Oryza sativa*) and Bengal gram (*Cicer arietinum*), fermented at low temperature, steamed in a pie dish, cut and seasoned. During recent years, the importance of B complex vitamins, β -carotene and vitamin C, has been realized in terms of their antioxidative properties. Dhokla is a vegetarian food item that is made with a fermented batter derived from rice or semolina and chickpea. Dhokla can be eaten for breakfast, as the main course, as a side dish or as a snack and is usually tangy and slightly sweet. It is liked by all age group, soft therefore is suitable even for old people and children. However, as it is prepared by using only either rice or semolina and chickpea it is essential to convert the traditional dhokla into nutritious dhokla with an enhanced content of nutrients by value addition, so that, it can be used as a nutritional supplement in addition to the daily diet. Traditional dhokla preparation takes a longer time as overnight fermentation is necessary for getting the desired texture. Preparation of dhokla from the instant mix may not require fermentation and hence can be prepared immediately. Elevation of nutritional value and time saving can be achieved by the development of instant mix. Therefore, an attempt is made to develop a value-added instant dhokla mix. Value added by utilization of iron, protein, and energy-rich foods with the incorporation of broccoli flour. Broccoli is significantly known not only for its nutrient content but also for its health-related benefits.

Rice

Rice (*Oryza sativa*) is the second most important cereal crop and staple rice remains a staple food for the majority of the

world's population. Rice as a rich source of carbohydrate which is the staple food for more than two-thirds of the world's population who rely on the nutritional benefits of rice. Rice has the following nutritional benefits: Excellent source of carbohydrates: Rice is a great source of complex carbohydrates, which is an important source of the fuel our bodies need.

Good energy source: Carbohydrate is biodegraded and converted into glucose, most of which is used as energy for exercise and as essential fuel for the brain. There is Low fat, Low salt, No cholesterol. Rice is healthy for a good source of vitamins and minerals such as thiamine, niacin, iron, riboflavin, vitamin D, calcium, and fiber. Rice is gluten-free and low sugar [1]. During polishing, a major portion (80 - 90 %) of the rice vitamin, 60 % of the iron and 50 % of the manganese and phosphorus and a considerable amount of valuable antioxidant compounds is lost as well as it also destroys almost all of the dietary fat and fiber decreasing the overall nutritive value of the rice. It is interested to note that consumers preferred debran (milled/polished) rice, although it has low nutritive and functional food value due to the loss of major amounts of functional components such as fat, vitamins, protein, antioxidants, and minerals [2].

Broccoli

Broccoli is a cruciferous vegetable that belongs to the family *Brassicaceae* (*Cruciferae*) and scientifically known as Brassica oleracea. The origin of the broccoli plant is in Italy and now in India, it can be grown successfully. It is a source of valuable nutrients like vitamin A, C, riboflavin & possesses various medicinal properties as well. In broccoli, it is also enriched with calcium that is equivalent to milk and also a good source of phosphorus, calcium, manganese, iron, magnesium, selenium, zinc, and phosphorus. In addition to that this vegetable is also a rich source of electrolytes [3]. Broccoli plays a vital role in the anti-cancerous property which contains the compound "glucoraphanin", which can be processed into an anti-cancer compound "sulforaphane", though the benefits of broccoli are greatly reduced if it is boiled or raw [4]. Broccoli is also an excellent source of "indole-3-carbinol", a chemical which boosts DNA repair in cells and appears to block the growth of cancer cells. Broccoli has a chemical component called "indole-3-carbinol" that can combat breast cancer by converting a cancer-promoting estrogen into a more protective variety [5].

Chickpea

Chickpea (*Cicer arietinum* L.) is an important pulse crop grown and belongs to the family Fabaceae. It is consumed by all over the country especially in the Afro-Asian countries. Chickpea has significant amounts of all the essential amino acids except sulfur-containing amino acids. Chickpea is rich in nutritionally important unsaturated fatty acids such as linoleic and oleic acids and also a good source of important vitamins such as riboflavin, niacin, thiamin, folate, and vitamin A precursor β-carotene [6]. It is a rich source of vitamins, minerals & fiber. Chickpea offers a diversity of health benefits such as improving digestion, aiding weight management, and reducing the risk of several diseases. Additionally, chickpeas are high in protein and make an excellent replacement for meats for vegetarian consumers. Chickpeas are packed with many nutrients and also it is inexpensive and easy to add in the diet. Chickpeas can be complemented by adding cereals to the daily diet with keeps appetite under control. Overall, chickpea is an important pulse crop with many potentials, nutritional and health benefits [7]. It can be utilized to develop nutritious value-added products and hence products can also be used as nutritious food for a low-income group in developing countries and patients suffering from lifestyle diseases [8].

Methodology

The experiment was carried out in the Research Laboratory of Department of Food Science and Nutrition, School for Home Science, BBAU, Lucknow. The required sample for the developed product is presented in Figures 1, 2. Allow both the products to cool down and store in airtight containers until evaluation. During packaging, no any preservative is added and both the products are separately packed in 50 gm of pouches and sealed. Accurate information of Ingredients in grams is mention above Figures 1 and 2.

Product Development

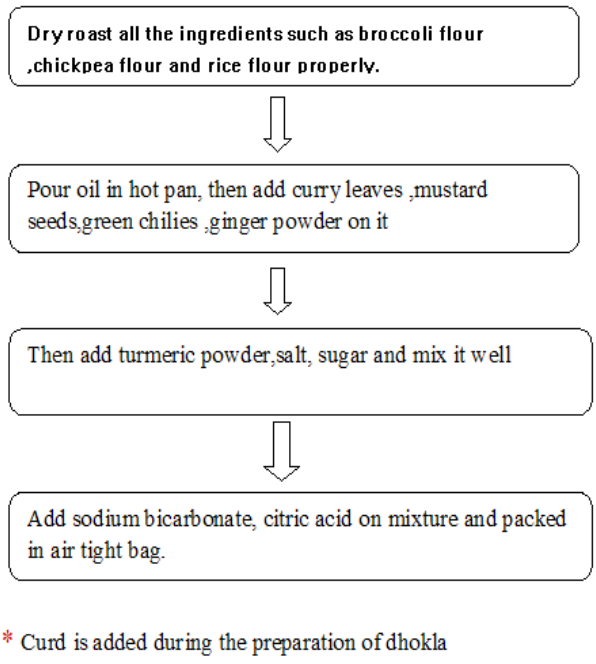


Figure 1: Preparation of fortified dhokla (Ready to mix F1).

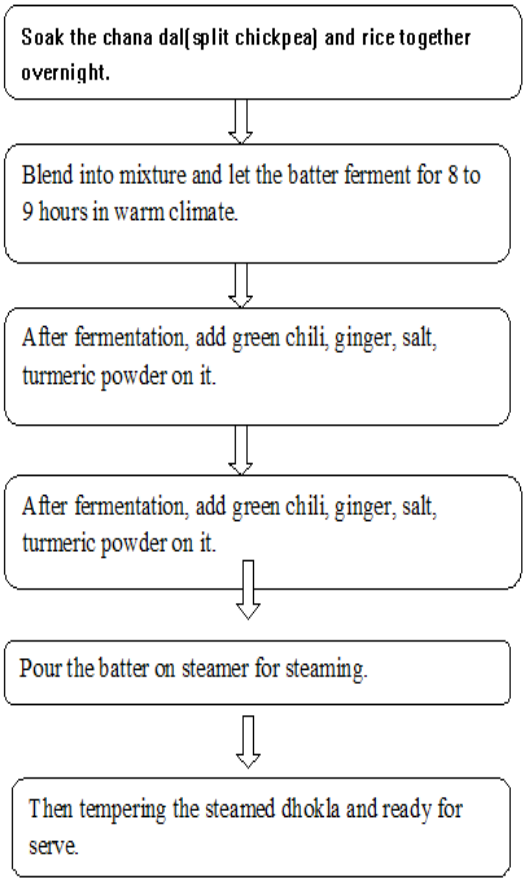


Figure 2: Preparation of traditional dhokla (F2).

Nutritional Analysis

The test was experimentally analyzed in the Department of Food and Science Technology at Baba Saheb Bhim Rao University, Lucknow.

1. Determination of ash content: Weigh accurately about 5 gm of the prepared sample in a Tared, clean, and dry silica dish difference. Ignite the material in the dish with the flame of a suitable burner for about one hour. Complete the ignition by keeping in, a muffle furnace at 550^{0}C until grey ash results. Cool in desiccators and weigh. Record the observation.

Calculation: Total ash content (on dry basis), percentage by mass

$$= (M2 - M) \times 100 \div M1 - M$$

M: Mass in gm of the empty crucible.

M1: Mass in gm of the dish with the material taken for the test.

M2: Mass in gm of the crucible with the ash.

2. Determination of carbohydrate content

The carbohydrate content was determined by the SP:18 test method.

Calculation: Carbohydrate percentage = 100 – (% Moisture content + %Fat content + % Ash content + % Protein content)

3. Determination of protein

Protein content was determined by Automated Biokjgel (Protein estimation Machine) (IS: 7219:1973 RA 2005). Weigh 0.5 to 1.00 gm test portion into, digestion tube. Add 30 gm potassium sulphate. 0.5 gm anhydrous cupric sulphate Add 10 ml Concentrated H_2SO_4.

Digestion: Place the tube with-rack in the digestion unit and lock the tube with a bioscrub fume neutralizer. Select program 01 and click to start. Adjust the temperature 250 ˚C - 10 min, 300 ˚C - 10 min, 350 ˚C - 10 min, 420 ˚C - 75 min. After Completion of digestion, cool the tube at room temperature.

Automatic Distillation: Place the tube into an automatic digestion unit add 40% NaOH 40 ml in the tube and 4% Boric acid 25 ml in the receiver by machine. Select program 01 and distillation will complete in 9 minutes.

Titration (Manually): Remove the receiver flask and add the mix indicator 2-3 drop and titrate with 0.1 N HCl /0.1 N H_2SO_4 endpoint shows pink color. It is proceeded by Kjeldahl's method. Take 2gm of a sample in a Kjeldahl's flask. Add 1-2gm of catalyst mixture. Now keep the flask in protein digester. In this digester chamber, add 5.8ml hydrogen peroxide and 12ml concentrated sulphuric acid. Heat till mixture boils briskly at ˚C and the moderate rate at a temperature of 420 color changes to pale blue. Transfer the content to a 100ml flask and place it automatic protein distillation unit. It has a mixture of 35% NaOH, 25ml H_2O, and 4% boric acid. When the flask is placed under the condenser of the distillation unit, nitrogen is obtained as small droplets another conical flask that is collected. Titrate it with 0.2N HCl till faint pink color appears, using methyl red as an indicator. Note down the titration value.

ProteinContent=

$$\text{Titration value} \times \text{Normality of HCL} \times 6.25 \times 2.809 \times 100 \div \text{Sample Weight} \times 0.2 \times 1000$$

Determination of crude fiber

The crude fiber was determined by gravimetrically after chemical digestion and solubilization of other materials present. The fiber residue weight is then corrected for ash content after ignition IS: 1155: 1968.

% Crude Fiber (dry basis) =

Dry Residue Wt. (g) Ignited Residue Wt. (g) Blank Wt. Loss (g)) × 100 × 100 ÷ SampleWt. (g) × Sample Moisture, (%)

Determination of fat

Fat was determined by the Soxhlet Extraction apparatus (IS:12711:1989:RA 2005). Weigh accurately about 5 to 10 gm of the dried material sufficient to give about 1.0 g of fat in the suitable thimble and dry for 2 hours at 100 ± 5 °C. Place the thimble in the Soxhlet extraction apparatus and extract it with the solvent for about 16 hours. Dry the extract contained in the Soxhlet flask, the empty mass of which has been previously determined by taring at 95 °C to 100 °C for an hour. Cool in desiccators and weigh. Record the weigh.

Fat content by mass = 100 × (M1 − M2) ÷ M100 × (M1 − M2) ÷ M

M1 - Mass in gm of the flower flask with the extracted fat.

M2 - Mass in gm of the empty Flower flask clean and dry.

M - Mass in gm of the material taken for the test.

Calcium, iron, magnesium, and zinc were determined by the standard method using Atomic Absorption Spectrometry (AAS). Test portions are dried and then ashed at 450 °C under a gradual increase (about 50 °C/hr) in temperature, 6 N HCl (1+1) is added and the solution is evaporated to dryness. The residue is dissolved in 0.1N HNO_3 and the analytes are determined. Reagents: (a) Water - redistilled or deionized. (b) Hydrochloric acid A.R (6N) - Dilute 500 ml HCl to 1 liter with water (c) Nitric Acid A.R 0.1M - dilute 7 ml conc. acid to 1 liter. (d) Nitric acid concentrated (Sp. Grade 1.40) (e) Standard solutions of calcium, iron, magnesium, and zinc prepared as1mg / ml. Dissolve 1.000 gm calcium/iron/ magnesium/ zinc in14 ml water + 7 ml conc HNO_3 in 1 litre volumetric flask and dilute to volume with water. Working Standard solution - For graphite furnace analysis dilute standard solutions with 0.1 M HNO_3 to a range of standards that cover the linear range of the elements to be determined. For Flame, analysis dilutes standard solutions with 0. 1 M HNO_3 to a range of standards that covers the concentration of the elements to be determined.

The moisture content of the sample was determined by the standard method described as Moisture percent by mass = 100 × (M1 − M2) ÷ M1 – M 100 × (M1 − M2) ÷ M1 – M

M1 - Mass in gm, of the dish with the material before drying.

M2 - Mass in gm of the dish with the material after drying.

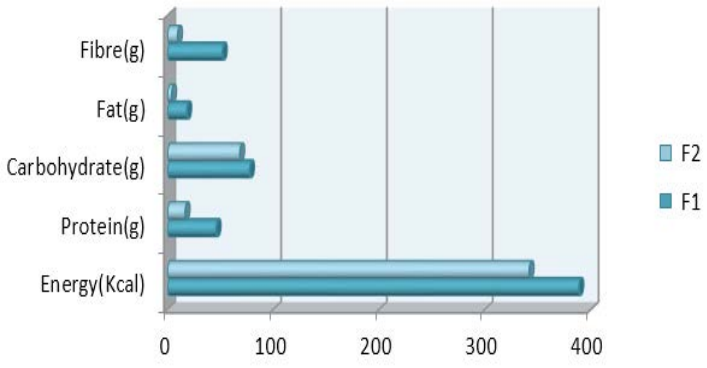
M - Mass in gm of the empty dish.

Results and Discussion

The nutritive value of both fortified dhokla and plain dhokla shown in the result is as below (Table 1,2; Graph 1,2):

Proximate analysis	Fortified dhokla (F1)	Simple dhokla (F2)
Energy (kcal)	389	342
Protein (gram)	46.2	16.85
Carbohydrate (gram)	77.8	68.5
Fat (gram)	18.4	4.1
Fibre (gram)	52	9.67

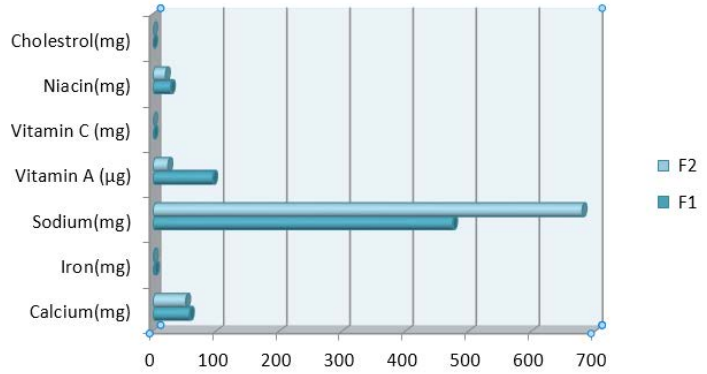
Table 1: Nutritional value of fortified dhokla (F1) and simple dhokla (F2).



Graph 1: Graphical representation of nutrition value (Energy, carbohydrate, protein, fat, and fiber) of both F1 & F2 and differences.

Mineral & Vitamin analysis	Fortified dhokla (F1)	Simple dhokla (F2)
Calcium (mg)	58	52.20
Iron (mg)	2.72	1
Sodium (mg)	475	680
Vitamin A (µg)	95	24
Vitamin C (mg)	0.74	0
Niacin (mg)	28	20
Cholestrol (mg)	0	0

Table 2: Nutritional content in fortified dhokla (F1) and simple dhokla (F2) as per 100 gram (Mineral& Vitamin analysis).



Graph 2: Graphical representation of nutrition value (calcium, sodium, vitamin A, vitamin C niacin, cholesterol, and iron) and differences of both F1 & F2.

Both the graphs are showing, comparison between both the dhokla F1 and F2. There are no T1, T2 &T3 products during experiments because the experiment is based on fortified dhokla (broccoli flour, chickpea flour, and rice flour) and comparison the nutrients of both the products. One is fortified dhokla with broccoli flour (F1) and another is plain dhokla (F2).

Conclusion

Developed the product, with a simple form of dhokla which is fortified with broccoli flour and converted into a healthy and therapeutic diet as compared to the simple form of dhokla. It is available in the market and the concept of getting the micronutrient-rich product. As comparing with simple dhokla mix and fortified dhokla content broccoli flour which highly enhances the rich source of sodium, niacin, calcium, iron, vitamin A and vitamin C (antioxidants). It can be consumed by all the ages because of its work as a therapeutic diet for their nutrition and fulfilling the body requirement. Ready to eat dhokla can be stored easily in the dry and normal place and there is no additional requirement for any more cooking. Containing broccoli flour which is itself powerhouse and full of complete nutrients package. The way of the packaging process to increase the shelf life of the product. So people can easily store, carry, and consume these improvement products.

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References

1. Anwar F, Anwer T, Mahmood Z (2005) Methodical characterization of rice (Oryza sativa) bran oil from Pakistan. Grasas y Aceites 56: 125-134.
2. Abbas A, Murtaza S, Aslam F, Khawar A, Rafique S, et al. (2011) Effect of processing on the nutritional value of rice (*Oryza sativa*). World Journal of Medical Sciences 6: 68-73.
3. Mishra P, Mukherjee V (2012) Broccoli, a rich source of nutrition and medicinal value. Science Research Reporter 2: 291-294.
4. Owis AI (2015) Broccoli; the green beauty: a review. Journal of Pharmaceutical Sciences and Research 7: 696-703.
5. Phillip J (2011) Sulforaphane from broccoli destroys cancer cells. Nutrition and Food Research 45: 57-68.
6. Zia-Ul-Haq M, Iqbal S, Ahmad S, Imran M, Niaz A, et al. (2007) Nutritional and compositional study of desi chickpea (Cicer arietinum L.) cultivars grown in Punjab, Pakistan. Food Chemistry 105: 1357-1363.
7. Jukanti AK, Gaur PM, Gowda CLL, Chibbar RN (2012) Nutritional quality and health benefits of chickpea (*Cicer arietinum* L.): a review. British Journal of Nutrition 108: S11-S26.
8. Hirdyani H (2014) Nutritional composition of Chickpea (*Cicer arietinum*-L) and value-added products-a review. Indian Journal of Community Health 26: 102-106.