

Formulation, Organoleptic Evaluation and Nutritional Composition of Value-Added Products from Germinated Chickpea Flour

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ABSTRACT **Background:** Pulses are a very important part of the human diet and offer all the nutritional and health benefits. (*Cicer arietinum* L.) is an important pulse that is cultivated and consumed around the world, especially in Afroasiatic countries. It is an excellent source of carbohydrates and protein, and the quality of protein is considered to be superior to other legumes. Chickpeas were also focused as a good source of proteins, a macronutrient which helps to reduce malnutrition during childhood. Malnutrition in childhood is one of the reasons behind the high child mortality rates observed in developing countries. **Aim:** The present study was undertaken with the aim to formulate and standardize the germinated chickpea flour products to combat malnutrition in children. **Methods and Material:** The chickpeas were washed and germinated at a period of 2 to 3 days. The germinated sprouts were sundried and then milled into fine flour. This germinated chickpea flour is utilized in the development of food products such as chappathi, cakes and halwa at different variations. All the developed products were subjected to organoleptic evaluation. Based on results of organoleptic evaluation, highly accepted variation was analysed for its nutrient profile. **Results and Discussion:** The incorporation of 10% of the germinated chickpea flour to wheat flour in the preparation of chapatti, cakes and halwa showed better sensory acceptability and also it has got good nutritive value. With their good nutrition profile, cheap price and availability, the value-added products developed from germinated chickpea flour can definitely be an answer to eradicate global hunger and malnutrition in Children.

Keywords: Germinated chickpea flour, Malnutrition, Organoleptic evaluation, Nutritional composition

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INTRODUCTION

Pulses are a very important part of the human diet and offer all the nutritional and health benefits. Pulses are an excellent source of dietary fiber and are low in fat, which helps maintain weight and reduce the risk of cardiovascular disease^[1]. Pulses are especially beneficial for diabetics because they are high in fiber and have a low glycaemic index, which help to maintain healthy blood sugar and insulin levels^[2]. Bengal Gram (Desi Chickpea / Desi Chana), Pigeon Peas (Arhar / Toor / Red Gram), Green Beans (Moong Beans), Chickpeas (Kabuli Chana), Black Matpe (Urad / Mah / Black Gram), Red Kidney Beans (Rajma), Black Eyed Peas (Lobiya), Lentils (Masoor), White Peas (Matar) are major pulses grown and consumed in

India^[9]. Chickpea (*Cicer arietinum* L.) is an important pulse that is cultivated and consumed around the world, especially in Afroasiatic countries. Chickpea is a cheap and important source of protein for those people who cannot afford animal protein or who are largely vegetarian. On the basis of seed colour and geographical distribution, chickpea is grouped into two types: desi (Indian origin) and kabuli (Mediterranean and Middle Eastern origin). It is an excellent source of carbohydrates and protein, and the quality of protein is considered to be superior to other legumes. Chickpea has

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significant amounts of all the essential amino acids except sulphur-containing amino acids, which can be complemented by adding cereals to the daily diet. Although lipids are present in low amounts, chickpea is rich in nutritionally important unsaturated fatty acids such as linoleic and oleic acids. β -Sitosterol, campesterol and stigmasterol are important sterols present in chickpea oil. Ca, Mg, P and especially, K are also present in chickpea seeds. Chickpea is a good source of important vitamins such as riboflavin, niacin, thiamine, folate and the vitamin A precursor β -carotene. Like other pulses, chickpeas contain anti-nutrient factors that can be reduced or eliminated by a variety of cooking techniques. Chickpeas have some potential health benefits, and when combined with other legumes and grains, they are important for humans such as cardiovascular disease, type 2 diabetes, digestive disorders, and some cancers. Chickpeas were also focused as a good source of proteins, a macronutrient which helps to reduce malnutrition during childhood.

Malnutrition in childhood was and is one of the reasons behind the high child mortality rates observed in developing countries. Chronic malnutrition in childhood is linked to slower cognitive development and serious health impairments later in life that reduce the quality of life of individuals. In this respect, understanding the nutritional status of children has far-reaching implications for the better development of future generations [9].

At the household level, the common methods of food processing include germinating, sun drying and dry heat treatment like roasting and grinding are used. These processing methods alter the nutritive value of foods. The nutrient composition and technological properties of chickpeas offer a number of opportunities for processing and value addition to use as next generation to satisfy the consumers of different culture, location and society. Value addition of germinated chickpea flour is an important strategy to improve its utilization and the method of processing determines the quality characteristics of the value-added products. Wheat has a unique property of forming an extensible, elastic and cohesive mass when mixed with water. Germinated chickpea flour lacks these properties when used alone [2]. Hence replacement of wheat flour with germinated desi chickpea flour in wheat composite flours brings lot of innovative Ready-to-eat or Ready-to-serve germinated chickpea flour products.

Chappathi, cakes and halwa are commonly used food items in day-to-day life of children. They are easily prepared and served and less time consuming. Chickpea flour is inexpensive and effortlessly prepared. Hence, the present study was undertaken with the aim to formulate and standardize the germinated chickpea flour products to combat malnutrition among children.

METHODS AND MATERIALS

Procurement of Raw Ingredients

Chickpeas was procured from local market of Redhills, Tiruvallur District, Tamil Nadu, India. The chickpeas were cleaned properly and stored in sealed containers until it was used for germination. Germinated foods are usually less susceptible to early spoilage than fresh foods. It is widely accepted that simple and inexpensive traditional processing techniques are effective methods of achieving desirable changes in the composition of pulses.

Preparation of Germinated Chickpea Flour

Germination for 72 hours was the best treatment in improving all antioxidant properties and removing antinutritional properties of chickpeas. The chickpeas were washed and soaked for 12 hours at 30°C and 80% relative humidity. The water was changed thrice and chickpeas were placed in glass trays covered with wet muslin cloth and allowed to germinate for the period of 2 to 3 days [2]. The germinated chickpeas were washed and solar dried for 8 hrs. The solar dried sprouts were then milled into fine flour. The fine flour was roasted in hot pan before the preparation of each value-added products.

Preparation of the Value-Added Products

The germinated chickpea flour was used for the preparation of the most acceptable products such as chappathi, cakes and halwa. Four variations with help of germinated chickpea flour (10%, 20%, 30% and 50%) and one standard product was prepared with help of wheat flour. All the raw materials for value added products are procured from local market of Redhills, Tiruvallur District, Tamil Nadu, India.

Preparation of Chapatis

The wheat flour, germinated chickpea flour, salt, and oil were used at different levels according to the variation required. Pour all ingredients into a bowl and mix it together. Knead the dough well for 3 to 4 minutes until it smoothens. Then, take small lumps from the dough. Roll the lump into a round dough ball and flatten it a little. Now dust the dough ball with some dry wheat flour and start rolling out the chapatti thinly with 6-to-7-inch diameter. Once the tawa is sufficiently hot then put the roti on a hot tawa/griddle. First cook one side. It should be less than half cooked or about one-fourth cooked. Turn and cook the other side. This should be a little bit more cooked [4].

Preparation of Cakes

The ingredients used were wheat flour, germinated chickpea flour, egg, sugar, milk powder, butter, baking soda and water at different levels according to the variation required. All ingredients except for the flour and milk were mixed using a Professional mixer. After addition of the milk and flour, the mixing process was continued. The butter-coated pans were filled with cake batter and baked in an electric oven at 200°C for 25 min [7].

After baking, the cakes were removed from the pans, left for 1 hour at room temperature to cool and subjected to sensory characteristics test.

Preparation of Halwa

The basic ingredients used were wheat flour, germinated chickpea flour, sugar, ghee and almonds, cashewnuts and dry grapes at different levels according to the variation required. Almond, cashew nuts and dry grapes was roasted in a pan with the ghee. In another thick bottomed pan, sugar syrup was prepared. Wheat flour and germinated chickpea flour were added and continuous stirring was done to avoid lump formation. When the mixture become thick, ghee and roasted nuts were added. Halwa was removed from the pan, left for 1 hour at room temperature to cool and subjected to sensory characteristics test.

Organoleptic Evaluation of the Germinated Chickpea Products

Organoleptic quality evaluation of the product plays an important role in the acceptance and preference of foods. The consumer acceptability of each product was carried out by panel of members through organoleptic evaluation using 9-point hedonic scale with score card of scores ranging from 9 to 1, where 1 = dislike extremely, 5 = neither like nor dislike and 9 = like extremely was used. The parameters like appearance, colour, flavour, taste, texture and over all acceptability were assessed by a panel of judges. A ballot sheet

was prepared to evaluate sensory attributes of various developed value-added products.

Nutritive Analysis of the Germinated Chickpea Products

Among 4 variations developed, based on the organoleptic evaluation results, the best and highly accepted variation was analysed for its nutrient profile. The major nutrients such as energy, protein, carbohydrates, fat and fibre were calculated using the standard food tables [3].

STATISTICAL ANALYSIS

The final data was compiled and analysed by using statistical method of Duncan's multiple comparison tests. p-values <0.05 were considered significant.

RESULTS AND DISCUSSION

Organoleptic Evaluation of the Germinated Chickpea Products

The sensory characteristics of each product at different variation were presented in Tables 2, 3 and 4.

The pooled score of all standard products of chappathi, cake and halwa in all the attributes such as colour, flavour, taste, texture, appearance and overall acceptability was 8.6. Among the four variations developed, the variation 1(V1) of all the germinated chickpea flour value-added products at 10% level has got highest mean score of 8 in all the attributes respectively. As the level of incorporation of germinated chickpea flour increases, the acceptability range of the developed product decreases. Results of the Duncan's test revealed that there was significant difference for all the variations in response to all the organoleptic parameters evaluated for acceptability.

Nutritive Analysis of the Germinated Chickpea Products

The nutrient analysis for best and highly accepted variation (V1) of all products were tabulated in Table 5. It's clear that

Variation	Wheat Flour (g)	Germinated Chickpea Flour (g)
Standard	100	-
V1	90	10
V2	80	20
V3	70	30
V4	50	50

Table 2: Organoleptic Evaluation of Chapatti

Variations	Colour	Flavour	Taste	Texture	Foldability	Breakability	Overall Acceptability
Standard	8.8±0.56 ^d	8.7±0.56 ^d	8.6±0.56 ^d	8.5±0.56 ^d	8.6±0.56 ^e	8.6±0.56 ^d	8.6±0.56 ^d
V1	8.6±0.45 ^d	8.6±0.45 ^d	8.3±0.45 ^d	8.5±0.48 ^d	8.3±0.45 ^d	8.6±0.48 ^d	8.5±0.46 ^d
V2	6.2±0.52 ^c	6.1±0.52 ^c	6.1±0.52 ^c	6.2±0.52 ^c	6.2±0.52 ^c	6.3±0.52 ^c	6.2±0.52 ^c
V3	4.5±0.48 ^b	4.5±0.48 ^b	3.8±0.52 ^b	4.1±0.52 ^b	4±0.48 ^b	3.9±0.52 ^b	4.1±0.50 ^b
V4	2.2±0.52 ^a	2.2±0.52 ^a	2.2±0.52 ^a	1.8±0.52 ^a	1.9±0.48 ^a	1.8±0.48 ^a	2±0.50 ^a

Note: a-d values in the same column with different superscripts are significantly different at ($p<0.05$) in Duncan's multiple range test.

Table 3: Organoleptic Evaluation of Cake

Variations	Colour	Flavour	Taste	Texture	Appearancecy	Overall Acceptability
Standard	8.8±0.56 ^d	8.6±0.56 ^d				
V1	8.2±0.52 ^d	8.3±0.52 ^d	8.2±0.5 ^d	8.2±0.5 ^d	8.3±0.52 ^d	8.2±0.51 ^d
V2	6.2±0.52 ^c	6.2±0.52 ^c	5.8±0.56 ^c	6.1±0.52 ^c	5.8±0.56 ^c	6±0.53 ^c
V3	3.5±0.52 ^b	3.5±0.52 ^b	3.5±0.52 ^b	3.5±0.52 ^b	3.6±0.52 ^b	3.5±0.52 ^b
V4	2.3±0.48 ^a	2.2±0.48 ^a	2.0±0.52 ^a	1.6±0.52 ^a	1.6±0.52 ^a	1.9±0.50 ^a

Note: a-d values in the same column with different superscripts are significantly different at ($p<0.05$) in Duncan's multiple range test.

Table 4: Organoleptic Evaluation of Halwa

Variations	Colour	Flavour	Taste	Texture	Appearancecy	Overall Acceptability
Standard	8.6±0.56 ^d	8.7±0.56 ^d	8.6±0.56 ^d	8.6±0.56 ^d	8.6±0.56 ^d	8.6±0.56 ^d
V1	8.6±0.56 ^d	8.5±0.56 ^d	8.6±0.56 ^d	8.6±0.56 ^d	8.4±0.56 ^d	8.5±0.56 ^d
V2	6.2±0.56 ^c	6.2±0.56 ^c	6.1±0.52 ^c	6.1±0.48 ^c	6.0±0.48 ^c	6.1±0.52 ^c
V3	3.4±0.48 ^b	3.4±0.48 ^b	3.6±0.48 ^b	3.6±0.52 ^b	3.4±0.52 ^b	3.5±0.50 ^b
V4	1.9±0.56 ^a	1.9±0.56 ^a	1.7±0.52 ^a	1.7±0.52 ^a	1.7±0.52 ^a	1.8±0.53 ^a

Note: a-d values in the same column with different superscripts are significantly different at ($p<0.05$) in Duncan's multiple range test.

Table 5: Nutritive Analysis of the Best Variation

Name of the Product	Variations	Energy (Kcals)	Protein (g)	Carbohydrate (g)	Fat (g)	Fibre (g)
Chapati	Standard	383.9±2.6	12.9±0.41	63.1±1.05	6.3±0.1	2.23±0.30
	V1	379±3.45	13.5±0.58	65.4±1.45	6.4±0.1	2.5±0.1
Cake	Standard	472.26±0.95	12.26±0.95	88.36±1.00	7.43±0.80	2.46±0.76
	V1	465.36±0.90	13.36±1.00	93.4±1.01	8.23±1.10	2.66±1.30
Halwa	Standard	876.3±0.90	12.63±0.41	116.3±1.11	40.6±0.60	2.73±0.51
	V1	865.53±0.92	13.7±0.72	111.56±0.83	41.26±1.00	2.43±0.50

Note: a-d values in the same column with different superscripts are significantly different at ($p<0.05$) in Duncan's multiple range test.

the variations of chappathi, cake and halwa prepared from germinated chickpea flour contains good amounts of energy, protein and fibre which in turn helps in prevention of chronic malnutrition among children.

CONCLUSION

The incorporation of 10% of the germinated chickpea flour to wheat flour in the preparation of chapatti, cakes and halwa showed better sensory acceptability. This indicates that value added products of good sensory qualities could be produced from 10% incorporation of germinated chickpea flour. With their good nutrition profile, cheap price and availability, the value-added products developed from germinated chickpea flour can definitely be an answer to eradicate global hunger and malnutrition in Children.

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