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Studies on technology for preparation and quality evaluation of multigrain extruded product chakli

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Abstract

The “multigrain extruded product chakli” was developed so as to obtain value addition to the traditional fried product and ultimately provide healthy food. It consists of varied ingredients, mainly sorghum, rice, finger millet, amaranth, green gram, chickpea, black gram which are rich source of carbohydrate and proteins so, they acts as an energy giving ingredients. Due to presence of diversity of ingredients (involving grains, legumes, oilseeds and spices), it will help in enhancing the gut health as well as help in improving the immunity. The present investigation was undertaken to develop two multigrain chakli sample by replacing traditional flour with varying level of malted finger millet and amaranth flour by the Standardization of recipe and study its effect on nutritional composition, sensory and storage characteristics. The most acceptable fortified Chakli was analysed for shelf life study. The different formulations of finger millet: amaranth in the ratio of 10:10 (T₁), 15:05(T₂) and 05:15 (T₃) and (T₄) 15:15 and the (T₀) control are prepared. The chakli was found significantly improved nutritional value. Hence the prepared chakli may become nutritionally balanced and have nutraceutical properties.

Keywords: Rice, sorghum, finger millet, amaranth, green gram, black gram, chick pea, chakli, chemical composition, sensory evaluation

Introduction

Traditional foods play an important role in local identity, consumer behaviour, the transfer of cultural heritage for future generations, and the interaction of this heritage with the rest of the world. “Chakli” is one of the traditional fried snacks that can be produced using different combination of ingredients. The processing and preparation of the traditional foods not only demonstrate the creativity and treasure of food patrimony of localized people but also their incremental learning to sustain the life and ecosystem as an entire (Singh *et al.*, 2007) [10].

Chakli is a classic south Indian dish, but it's also available in western India under the name chakali, which is cooked with Chana dal and sold in markets (Shakshi Sharma., 2015) [9]. Murukku, or chakli, is a popular snack among the ethnic Indian population in Sri Lanka, Fiji, and other countries. Chakli is made by using extrusion technology so it is also called as extruded snack item. In present investigation multigrain chakli were made by using cereals (rice, sorghum, finger millet, amaranth) and pulses (green gram, chick pea and black gram).

Extrusion is a method of producing and shaping food items by forcing combined ingredients through a narrow aperture known as a die. The words "extrudate" and "trudere" (to shove) are Latin words (Tadmor & Klein, 1970) [11]. The Extrusion is defined as a technique of forcing the mixed ingredients out through a narrow opening, called a die, to make and shape the food materials. Extrusion cooking will comes under the HTST (High temperature short-time) method, established for the development of innovative value added RTE (ready to eat) food products like produced from grains and cereals, during which infant foods, dietary fibres, cereal based products for breakfast, cereal based modified starch food products, pet foods, and traditional food product (Sebio & Chang, 2000) [8].

The rice (*Oryza sativa* L.) Grain is made up of 12% water, 75%–80% carbohydrates, and just 7% protein that contains all of the essential amino acids. Because of the presence of a higher concentration (about 4%) of lysine, its protein is highly digestible (93%) with great biological value (74%) and protein efficiency ratio (2.02–2.04%).

Sorghum (*Sorghum bicolor* L.) is a cheap source of energy and micronutrients for much of the world, generally the second cheapest after pearl millet, and a large portion of the people in Africa and central India rely on it for their dietary energy and micronutrient needs. Sorghum has been used in food goods and various food items in many poor countries for many years.

Finger millet (*Eleusine coracana* L.) is a cereal grown for food in Africa and southern Asia.

The grain of finger millet is commonly ground into flour and used in cakes, breads, and other bakery products, or it is malted and used as a healthy food for infants. The sprouted seeds are also nutrient-dense and simple to digest.

Amaranth (*Amaranthus cruentus* L.) is a gluten-free, easily digestible grain. Amaranth has a number of health benefits, including lowering blood cholesterol levels, protecting the heart, activating the immune system, acting as an anti-cancer agent, lowering blood glucose levels, and relieving hypertension and anaemia.

Green gram (*Vigna radiata* L.) is a legume produced for its protein-rich edible grains throughout Southeast Asia, Africa, South and North America, and Australia. Green gram-based products are easier to digest, they are utilised for diabetic patients, children, and the elderly. Green gram is consumed in the form of dal splits with husk, dehusked splits, papad, and wadi/nuggets made from its flour.

Black gram (*Vigna mungo* L.) is a plant that originated in India. It's a popular crop in India, Pakistan, and other Asian nations. Millions of people in these nations consume it as part of their diet, and it is a low-cost source of protein, containing 17-34% protein. Proteins (23%) carbs (51%), fat (1.7%), ash (3.17%), zinc (3.00mg), iron (5.97mg), and calcium (5.97mg) make up the right mixture of nutrients in black gram (55.64mg).

Chickpea (*Cicer arietinum* L.) is a Fabaceae subfamily Faboideae annual legume. Chickpeas are a low glycaemic index (GI) food, which means that eating an equi-available carbohydrate portion of chickpea results in a lower postprandial blood glucose response than eating white rice. Low-GI foods can be an important part of a "healthy diet" and may help manage chronic conditions including non-insulin-dependent diabetes (NIDDM) and coronary heart disease.

The principle lies behind the "Development of multigrain extruded product (Chakli)" is in fact that each grain has their own nutritional profile, hence combining two or more grains and pulses may add additional nutrients in the final product. In view of nutritional and health benefits of different cereals and pulses are used because sorghum and millet grains can contain substantial levels of a wide range of phenolic compounds. Their health-promoting properties, in particular their antioxidant activity, and their use as nutraceuticals and in functional foods are reviewed in the paper by Dykes & Rooney (2006) [4]. The present research has been planned for preparation of multigrain extruded product chakli to explore its sensory quality, composition and health benefits.

Materials and Methods

The present investigation was carried out in Department of Food Engineering with collaboration of Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani during year 2020-21.

Raw Materials

The selected food grains such as rice, sorghum, finger millet, amaranth, and pulses like green gram, chickpea, black gram, oil and spices of good quality were procured from the local market of Parbhani.

Chemicals and Reagents

Most often chemicals and standard reagents (analytical grade)

utilized in this experimental design were analytical grade which was obtained from the Department of Food Engineering, Department of Food Microbiology and Safety, and Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani.

Standardization of process for multigrain chakli

Recipe of the standardized *Chakli* was as rice flour (30%), sorghum flour (20%), Pulses (green gram malt flour +black gram flour + chick pea flour) (30%), finger millet malt flour (15%), amaranth flour (05%) and spices were added in the flours. Preparation was as follows firstly, cereal + pulse flour mixture was carried out (Sorghum, rice, amaranth, finger millet, chick pea, green, black gram), Salt, cumin seeds, oil and asafetida were mixed to develop firm dough using warm water simultaneously. The dough was allowed to rest for 15min after that dough is filled in the *Chakli* presser and *Chakli* were shaped and simultaneously fried in hot oil on slow flame. After frying and *Chakli* were allowed to cool down and kept in air tight containers for further analysis.

Proximate composition of multigrain chakli

The proximate composition of chakli samples were determined using standard methods. The protein, fat and crude fiber was determined by the method as described in AOAC (1992) [2]. Total carbohydrate was determined by standard procedure using phenol and sulphuric acid AOAC (1990) [1]. Mineral contents of different chakli mix were obtained by calculation using table value (Gopalan *et al.*, 1996) [5].

Sensory and Organoleptic Evaluation of developed product

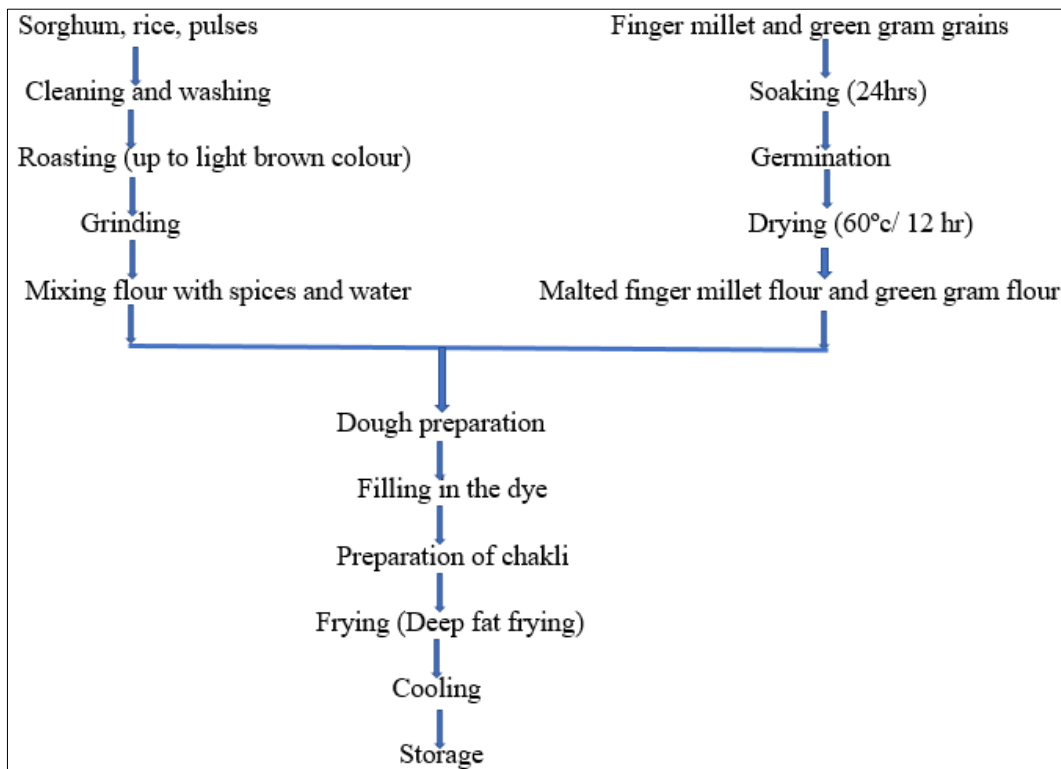
The sensory quality characteristics of the developed products such as colour, taste, texture, flavor and overall acceptability were evaluated by panel of judges using nine-point hedonic scale as described by (Amerine *et al.*, 1965) [3]. Organoleptic evaluation was carried out using 9-point hedonic scale with 10 trained panelists from the Department of Food Trade and Business Management College of Food Technology, VNMKV, Parbhani. According to sensory evaluation best sample was chosen for the further study. Also, the effect of changes in quality of the product during storage on sensorial parameters of multigrain Chakli was evaluated.

Results and Discussion

Standardization of recipe for multigrain chakli

The multigrain chakli was prepared by making flours of all ingredients. All ingredients are at first cleaned and washed properly. After washing sun drying is carried out after drying of ingredients, they are roasted properly to increase the efficiency of milling and making flour of all the cereals and pulses which are selected to prepare the multigrain extruded product chakli. The sorghum and rice were soaked for 12 hrs and then dried for 6 hrs and then milled to make flour. Finger millet and green gram were malted to increase their nutritional value. The desirable quality final product was obtained by taking all ingredient flours in proper and specific proportions.

Preparation of multigrain chakli



Formulation of multigrain chakli

The multigrain extruded product chakli prepared with varying

the proportion of all ingredient flours at different level. The formulation was presented in Table No. 1.

Table 1: Formulation of multigrain chakli

Sample	Ingredients				
	Rice flour (g)	Sorghum flour (g)	Finger millet flour (g)	Amaranth flour (g)	Pulses (C+G+B) (g)
T ₀ (Control)	50	0	0	0	50
T ₁	30	20	10	10	30
T ₂	30	20	15	05	30
T ₃	30	20	05	15	30
T ₄	25	15	15	15	30

- Pulses ((C+G+B) – Chickpea + Green gram + Black gram

1. T₀ (control) – without addition of finger millet and amaranth flour
2. T₁- with 10g finger millet + 10g amaranth flour
3. T₂- with 15g finger millet + 5g amaranth flour
4. T₃- with 5g finger millet + 15g amaranth flour
5. T₄- with 15g finger millet + 15g amaranth flour

Proximate composition of prepared multigrain chakli

The data pertaining to various chemical properties such as moisture, fat, carbohydrate, protein, ash and crude fibre of multigrain chakli were determined and obtained results are illustrated in Table 2.

Table 2: Proximate composition of prepared multigrain chakli

Samples	Moisture (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Crude fibre (%)	Ash (%)
T ₀	4.20	14.2	24.46	52.58	2.40	1.82
T ₂	4.92	12.7	26.53	51.96	1.74	1.94

*Each value represents the average of three determinations.

Results obtained from the Table 2 revealed that the carbohydrate content got higher percentage whereas ash content was having minimal percentage. The moisture content was found to be 4.92% in T₂ Sample and 4.20% in control sample whereas crude fat content was recorded as 26.53% in T₂ and 24.46% in control sample. The average value of total carbohydrate content was found to be 52.58% and 51.96% of control and T₂ sample respectively. The ash content of T₂ Sample and control sample was found to be 1.94% and

1.82%, respectively. The crude fibre content of control chakli was found to be 2.40% and fibre content of T₂ sample was 1.74%. The proximate composition particularly with respect to protein content of T₂ and control sample was 12.7% and 14.2%, respectively. It was narrated that T₀ sample have higher protein content than T₂ sample. The results of proximate composition of multigrain chakli were found nearly in close agreement with the values recorded by (Jagdale & Ghodke, 2020) [6].



Sensory evaluation of multigrain chakli

The organoleptic evaluation of multigrain chakli was carried out by ten members of semi trained panel and the scores were given by evaluating color and appearance, flavor, taste, and overall acceptability which was compared with control sample and presented in Table No. 3.

Table 3: Sensory evaluation of multigrain chakli

Sample	Parameters				
	Colour	Texture	Taste	Flavour	Overall acceptability
T ₀ (Control)	8.0	8.0	8.5	8.0	8.7
T ₁	7.5	8.0	7.5	8.0	8.0
T ₂	8.2	8.3	8.5	8.0	8.5
T ₃	7.8	7.5	7.5	7.6	7.5
T ₄	7.5	7.0	7.0	6.5	7.0

It is revealed that all the samples are having different colour thus got different scores in the range of (7.5 to 8). T₂ sample got highest score in colour and texture i.e. (8.2 and 8.3) respectively. T₁ and T₂ sample got lower scores in colour as (7.5). T₄ sample got least score in flavour and taste (6.5) and (7) respectively. T₄ sample have least overall acceptability scored (7). While control sample got highest score in taste and overall acceptability i.e. (8.5 and 8.7) respectively. The overall acceptability of the multigrain chakli has highest sensory score (8.7) for control (T₁) sample followed by T₂ (8.5).

Selected sample (T₂) scored higher for taste, texture and color followed by T₁ and T₃. Sample T₂ was significantly inferior overall. Thus, increase in proportion of finger millet was acceptable by the panel members due to its acceptable texture. So T₂ sample is selected for further research purpose.

Conclusion

From the above result it could be concluded that chakli prepared with 15g finger millet + 5g amaranth flour scored within the acceptable range. Finger millet and amaranth being the local cereals and available from the household food stuff with its nutrient content can be used for preparation of chakli to increase the nutritive value of chakli and diversification of

the products. This also paves way for the newly designed novel chakli of finger millet and amaranth to be commercially popularized as a nutri-snack in cereals growing areas.

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