

A Study on Nutritional and Antioxidant Potential of Multigrain Extruded Snack Food Fortified with Banana Powder

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Abstract

Snacks are becoming more and more popular and have a strong association with nutritional status of the young population. It is important to consider these healthy snacks for the provision of macro and micronutrients especially to the nutritionally vulnerable segment of population. Modern extrusion technologies have paved the way to use various nutrient-rich constituents to make attractive products. The aim is to prepare extruded snack food fortified with red banana powder i.e., murukku and cheval. The main ingredients which were used for the preparation of extruded snacks were multigrain powder (jowar, kodo millet, red rice flakes) and red banana powder. All the ingredients are rich in Energy, protein, vitamins such as vitamin C and beta carotene and Minerals such as iron, calcium, and potassium. A snack was a good evening snack made from multigrain and red banana powder. For the preparation of extruded snacks ingredients used like multigrain flour and red banana flour are mixed together with other ingredients. Then make a smooth dough after that fill it in a hand extruder and frying in oil at the required temperature till reaches golden brownish colour then cool it and packed it for further study. For standardization of recipe 3 samples had done A, B, C for murukku and cheval from that sample B has selected according to sensory evaluation. The proximate composition of extruded snacks such as murukku and cheval were Protein (7.2 and 8.8), Anti-oxidant (63% and 54%), and Vitamin C (18 and 20g). Microbial load has done at an interval of the 1st and 15th day. Qualitative Phytochemicals has done.

Key words: Extruded, Fortified, Sensory evaluation, Phytochemicals

In the context of snack food products, it can be argued that multi-grain and red banana flour are used less frequently in the extrusion process. Cereals, carbohydrates and frying oil are the main sources of calories. The seemingly low protein content of market snacks was reported by several workers. Thus, excessive consumption of such snacks can lead to malnutrition and obesity in children, which in turn causes many diseases in adults. Extrusion is an attractive process because of its versatility (wide range of applications of food products), high productivity, relatively low cost, energy efficiency and lack of waste. The major role of these ingredients is to give structure, texture and mouth feel (Barres *et al.* 2010). Sorghum (*Sorghum vulgare* Pers.), is a crop grown in arid and semi-arid parts of the world. It ranks fifth among the world's most important crops after wheat, rice, maize and barley (Surve *et al.*, 2018). Jowar contains minerals, vitamins, proteins and micronutrients. It is rich in starch and protein. It is a gluten-free grain that helps people with celiac disease. According to a research, peptides such as gliadin and glutenin responsible for dough elasticity are responsible for gluten diseases (Yadav *et al.* 2016).

Kodo millet (*Paspalum scrobiculatum*), is also known as cow grass, rice grass, ditch millet, native Paspalum, or Indian crown grass. Kodo millet contains 66.6 g of carbohydrate and 353 kcal per 100 g of grain, which is comparable to other

millet. It also contains 1.4% fat and 2.6% minerals. The iron content in kodo millet ranges from 25.86 ppm to 39.60 ppm (Chandel *et al.*, 2014). Among millets, it has the lowest phosphorus content (Hegde and Chandra 2005). Red Rice Flakes are unpolished so it is rich in carbohydrates (86.22 g). 100 grams of flakes contain minerals like sodium (763 milligrams), potassium (110 milligrams), protein (6.69 grams), iron (5.5 milligrams) and are also rich in vitamin A and vitamin C. (Rice flakes cited on 2017) Red rice flakes are gluten and cholesterol free so diabetics can consume it as a substitute for wheat. The antioxidants present in the unpolished bran of red rice flakes improve metabolism and prevent colon cancer. (Gani A *et al.*, 2017) Magnesium and other minerals present in red rice improve bone strength, fight asthma and reduce the risk of obesity (Health benefits of red rice 2017).

Banana is one of the most important fruit products consumed worldwide. Among the varieties of bananas that exist, the red banana, whose official botanical name is red dukkah, is one of the varieties that has several names, depending on the region, including Red Spanish, Red Cuban, Colorado or Red Banana (Manikandan *et al.*, 2008). Red banana is a variety of banana, which is not only energy-rich but also contains significant amounts of minerals and vitamins, being one of the tropical fruits grown in more than 122

countries around the world (Ahiyowenguan *et al.* 2014). The objective of the study is to develop extruded snack from multigrain and red banana powder and to determine its proximal composition.

MATERIALS AND METHODS

Preparation of Multigrain Powder

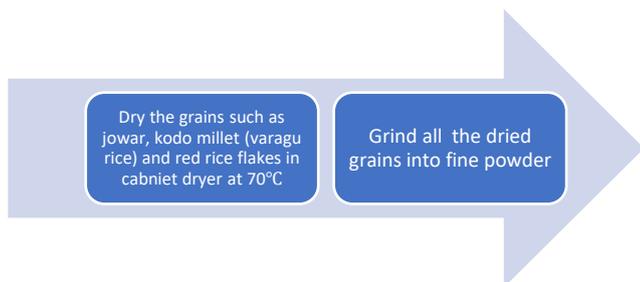


Fig 1 Preparation of Multigrain powder

Preparation of Red Banana Powder



Fig 2 Preparation of red banana powder

Preparation process of Multigrain Murukku

Preparation process of Multigrain Cheval

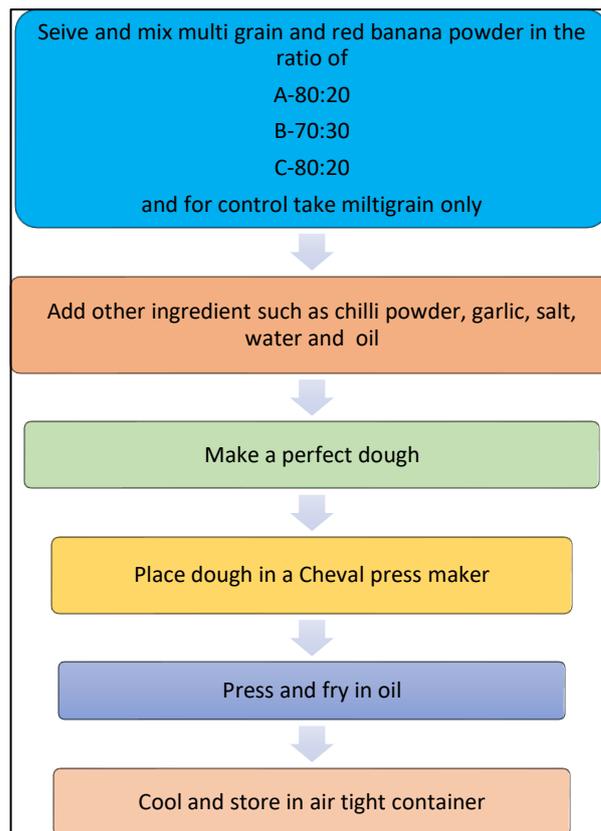


Fig 4 Preparation process of Multigrain Cheval

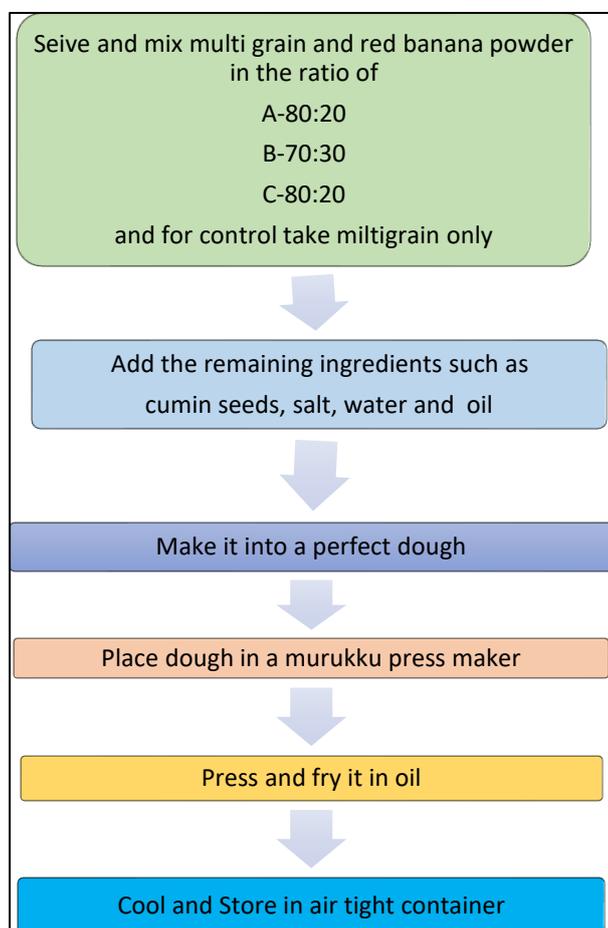


Fig 3 Preparation process of Multigrain Murukku

Standardization of the Extruded Snack

The quality of the food when assessed by humans by the means of sensory organs then it is said to be sensory evaluation. The sensory characteristics of multigrain murukku and cheval were subjected to sensory evaluation with the help of 10 semi-trained panel members by using the 5-point hedonic scale to find out the overall acceptability of the sample. The panellists were asked to give scores for colour, flavour, texture, taste and overall acceptability. The scores of all attributes helped to find the best out of the three samples and control.

Table 1 Ingredients required for the development of extruded snack

Ingredients Required for the Preparation of Murukku	Ingredients required for Preparation of Cheval
Multigrain powder	Multigrain powder
Red banana powder	Red banana powder
Oil	Oil
Salt	Chili powder
Cumin seeds	Garlic cloves
	Salt
	Asafoetida

Statistical Analysis of Developed Extruded Food Products

The extruded snack was analysed statistically by using mean and standard deviation.

Nutrient Analysis

Estimation of Protein

To determine the protein content of the control and standard by using standard procedure.

Estimation of vitamin-C

To determine the vitamin-c content of the control and standard product by using 2,6 dichlorophenol indophenol.

Determination of Anti-oxidant Activity of the Extruded product

To determine the antioxidant activity of the extruded product by determination of DPPH free radicals scavenging activity.

Determination of Microbial load of the Extruded product

Microbial analysis was carried out to find out the shelf life of the Extruded products by using Total Plate Count Method.

Phytochemical Screening of the Extruded Products

Phytochemicals are non-essential nutritive plant material that consists of protective and disease-preventing materials. The presence of phytoconstituents was performed to using the standard procedures.

RESULTS AND DISCUSSION

Sensory evaluation of developed food product

From the above Table-2 and Figure-5 shows that the result of the mean score value of Multigrain Murukku. Sample B had a high value.

Table 2 Sensory Evaluation of Multigrain Murukku

	Control	Sample-A	Sample-B	Sample-C
Colour	4.85±0.24	4.7±0.33	4.75±0.35	4.2±0.82
Taste	4.6±0.39	4.6±0.39	4.85±0.33	4.2±0.63
Texture	4.75±0.35	4.7±0.34	4.9±0.31	4.4±0.51
Flavour	4.7±0.42	4.6±0.39	4.75±0.42	4.45±0.49
Overall acceptability	4.8±0.34	4.6±0.39	4.73±0.41	4.15±0.62

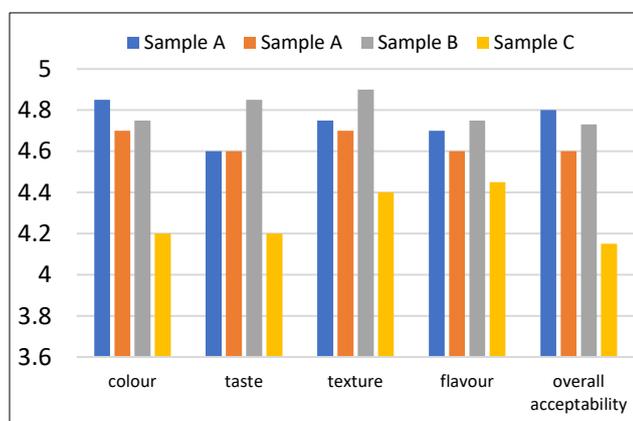


Fig 5 Graphical Representation of the Sensory Evaluation of Multigrain Murukku

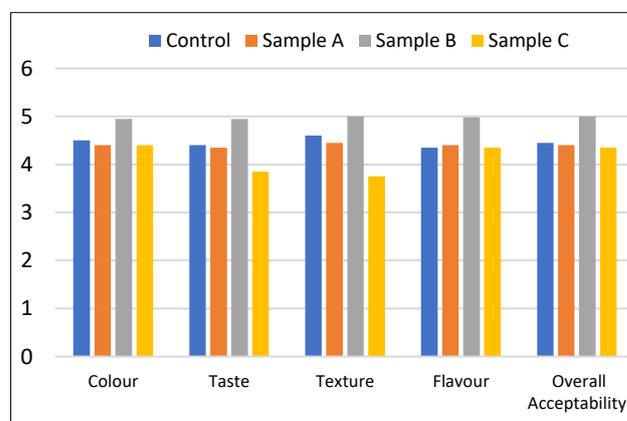


Fig 6 Graphical Representation Mean Score Value of the Sensory Evaluation of Multigrain Cheval

Table 3 Sensory Evaluation of Multigrain cheval

	Control	Sample-A	Sample-B	Sample-C
Colour	4.5±0.33	4.4±0.45	4.95±0.15	4.4±0.61
Taste	4.4±0.56	4.35±0.57	4.95±0.15	3.85±1.05
Texture	4.6±0.31	4.45±0.36	5.0±0	3.75±0.88
Flavour	4.35±0.66	4.4±0.61	4.98±0.06	4.35±0.62
Overall acceptability	4.45±0.55	4.4±0.61	5.0±0	4.35±0.62

From the above Table-3 and Figure-6 shows that the result of the mean score value of Multigrain Cheval. Sample B had the high value.

Estimation of Protein

The results of the protein analysis of the control and extruded snack such as murukku and cheval.

Table 4 Protein Content of the Extruded Product

Product	Protein (g/100g)	
	Control	Sample B
Multigrain Murukku	8.8	14.4
Multigrain Cheval	7.2	8.8

From the above table-4 shows that the results of protein present in the control and extruded snack such as murukku and cheval. The amount protein is high in [14.4g, 8.8g] standardized product when compared to control.

Table 5 Vitamin-C of the Extruded Product

Product	Ascorbic Acid (mg/100g)	
	Control	Sample B
Multigrain Murukku	8	18
Multigrain Cheval	10	20

Estimation of vitamin - C

From the above table-6 shows that the results of Ascorbic acid present in the control and extruded snack such as murukku and cheval. The amount Ascorbic acid is high in [18mg and 20mg] standardized product when compared to control.

Table 6 Anti-Oxidant Activity of the Extruded Product

Product	Anti-Oxidant Activity %	
	Control	Sample B
Multigrain Murukku	27%	63%
Multigrain Cheval	45%	54%

Table 7 Microbial Load of the Extruded Product

Sample	Storage Period	
	Initial	15 Days
Multigrain Murukku (Control)	-	90×10 ⁻⁹
Multigrain Murukku (Standard)	-	60×10 ⁻⁹
Multigrain Cheval (Control)	-	100×10 ⁻⁹
Multigrain Cheval (Standard)	-	70×10 ⁻⁹

Estimation of anti-oxidant

From the above table-5 shows that the results of Anti-oxidant Activity of the control and extruded snack such as murukku and cheval. The amount of antioxidant is high in [63% and 54%] standardized product when compared to control.

Analysis of microbial load

From the above (Table 7) shows that the results of Microbial Load present in the control and extruded snack such as murukku and cheval. It reveals that microbial load present in initial and 15th day.

Phytochemical screening of the extruded product

From the above table-8 shows that the results of Phytochemicals present in the control and extruded snack such as murukku and cheval. It reveals that presence of saponin and alkaloids and absence of tannin.

Table 8 Phytochemical of the Extruded Product

Phytochemicals	Control Murukku	Standard Murukku	Control Cheval	Standard Cheval
Saponin	+	+	+	+
Tannin	-	-	-	-
Alkaloids	+	+	+	+

CONCLUSION

In the present study finally concluded that the production of healthier foods is presently the main focus of the industrial process. The most obvious conclusion from this study is that two extruded products prepared from multigrain such as have

high nutrition quality and rich in Protein. It has high antioxidant level. The phytochemicals such as alkaloids and saponin are present. Furthermore, the extended shelf life of these snacks assures that the product is microbiologically safe. The extruded snacks could make a significant contribution to the field of functional food.

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