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# DEVELOPMENT AND SENSORY OPTIMIZATION OF LOW COST MICRONUTRIENT RICH NUTRITIOUS PRODUCT BY USING LOCALLY AVAILABLE FOOD RESOURCES

Kumari Rosy[1]*, Gupta Alka[2] and Sheikh Sarita[3]

*Corresponding Author: Kumari Rosy, ✉ angelrosy1991@gmail.com

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Food based approaches are recognized as an essential part of an urgently needed more comprehensive strategy for improving nutrition by increasing the availability and consumption to combat iron and other micronutrient deficiencies. The combination of Whole wheat flour, Ragi flour, Green gram flour, Soy flour and Roasted groundnut flour contains high amount of energy, protein with essential amino acids composition along with vitamins and minerals content, will enhance the nutrients value of homemade products which would be consider beneficial for malnourished population. The specific objective of the study was, to develop low cost functional food products with the incorporation of locally available indigenous food especially designed for children and to assess organoleptic quality of the prepared product and nutritional composition were analyzed. Composite flour were prepared using soaked Whole wheat Flour (WF), Ragi Flour (RF) and other soaked flour namely; Green Gram Flour (GGF), Soya Flour (SF), Roasted Groundnut Flour (RGF) to develop homemade product; Chakli. The basic recipes (control $T_0$) have three variations $T_1$, $T_2$, $T_3$ respectively, where the amounts of the ingredients were varied. The organoleptic qualities of chakli were analyzed by a panel of ten judges using 9 point hedonic scales. The results indicate that the processed composite flour based product was significantly accepted. On the basis of findings it was observed Treatment $T_1$ of Chakli was found to be best with regards to color, taste and overall acceptability. Product developed by Composite flour were analyzed it was high in energy, protein, calcium, phosphorous and iron respectively. Nutritional analysis shows that energy, protein, iron, Phosphorous, calcium and carotene content of chakli was higher as compared to control. Thus, it can be concluded that composite flour chakli being good source of proteins, iron, calcium, phosphorous and energy may be incorporated in the daily diets of vulnerable sections of population. Product was containing higher percentage of nutrients in comparison to standard with a cost of Rs. 2.26 to 2.46. The present study concludes that, processed composite flour (Whole wheat flour, Ragi, Green gram dhal, Soy flour and Roasted groundnut) could be used to enhance nutritive quality of home made products with acceptable sensory properties as they deliver for malnourished children.

***Keywords:*** Coarse grains, Storage quality, Product development, Chakli, Sensory evaluation, Chemical composition, Cost analysis

## INTRODUCTION

Malnutrition can be defined as a lack of proper nutrition. The nutritional status of a child, as with any individual, is assessed through dietary, anthropometric, biochemical and physical observation for signs of malnutrition. These methods of measurement are usually done in combination

[1] Research Fellow, Department of Foods and Nutrition, Ethelind School of Home Science, SHIATS Allahabad.

[2] Assistant Professor, Department of Foods and Nutrition, Ethelind School of Home Science, SHIATS Allahabad.

[3] Dean Department of Home Science, Ethelind School of Home Science, SHIATS Allahabad.

for more accurate results. When there is a deficiency in the amount and nutritional value of the food consumed, the growth pattern of a child becomes disrupted owing to nutrient deficiencies (Faber and Wenhold, 2007). The World Health Organization estimates that about 60% of all deaths, occurring among children aged less than five years in developing countries, could be attributed to malnutrition (Faruque *et al.*, 2011). The improvement of nutrition therefore, is the main prerequisite for the reduction of high infant and under five mortality rates, the assurance of physical growth, social and mental development of children as well as academic achievement (Anwar *et al.*, 2011). PEM is also associated with a number of co-morbidities such as lower respiratory tract infections including tuberculosis, diarrhea diseases, malaria and anaemia (Ejaz *et al.*, 2012). These co-morbidities may prolong the duration of hospital stay and death among affected children. Protein Energy Malnutrition (PEM) is the most frequent cause of secondary immune deficiency in children especially in developing countries (UNICEF, 2003). Malnutrition means more than feeling hungry or not having enough food to eat. It is a condition that develops when the body does not get the proper amount of protein, calories, vitamins and other nutrients it needs to maintain healthy tissues and organ function. It occurs in children who are either undernourished or over nourished. Children who are over nourished may become overweight or obese and those who are under nourished are more likely to have severe long term consequences.

## MATERIALS AND METHODS

The present investigation was carried out in the Nutritional Research Laboratory Department of Foods and Nutrition, Ethelind School of Home Science, Sam Higginbottom Institute of Agriculture, Technology & Sciences, (Deemed to be University), (Formerly Allahabad Agricultural Institute), Allahabad UP. The raw materials such as Ragi, Soyabean, Green gram dhal, Whole wheat flour and Groundnut were procured form local market of Allahabad.

### Preparation of Wheat Flour and Ragi Flour

Wheat grains and Ragi were thoroughly cleaned to remove dirt, dust, insect excreta/ feathers and admixture of other food grains. The clean graded materials were ground in the electric grinder to make fine flour and sieved by 80-100 mesh sieves. The flour samples obtained were kept in airtight container before use.

### Preparation of Soya Flour

Soybean grains were thoroughly cleaned to remove the dust and other foreign materials. The clean grains were soaked in water for 4-6 hours and then autoclaved for 5 minutes in a pressure cooker. They were removed and dried directly in the sun for 3-4 days till the material was completely dried having 6-8% moisture content. Soybean was then ground to make fine flour and sieved through 80-100 mesh sieves. The flour samples obtained were kept in airtight container before use.

### Preparation of Moong Dal Flour

Moong dal was thoroughly cleaned to remove the dust and other foreign materials. The clean dal was soaked in water for 4-6 hours. They were removed and dried directly in the sun for 3-4 days till the material was completely dried having 6-8% moisture content. Soybean was then ground to make fine flour and sieved through 80-100 mesh sieves. The flour samples obtained were kept in airtight container before use.

### Preparation of Groundnut Flour

Groundnuts were thoroughly cleaned to remove, dust, insect excreta/ feathers and admixture of other food grains. They were removed and roasted for till the groundnut become brown. The clean graded materials were ground in the electric grinder to make fine flour and sieved by 80-100 mesh sieves. The flour samples obtained were kept in airtight container before use.

### Preparation of Chakli

Chakli was prepared with the help of incorporation all the composite flour. For the product, the basic recipes (control $T_0$) have three variations $T_1$, $T_2$, $T_3$ respectively, where the amount of the product was varied at different levels. The products like Chakli were developed. All control and treatments were replicated three times (Figure 1).

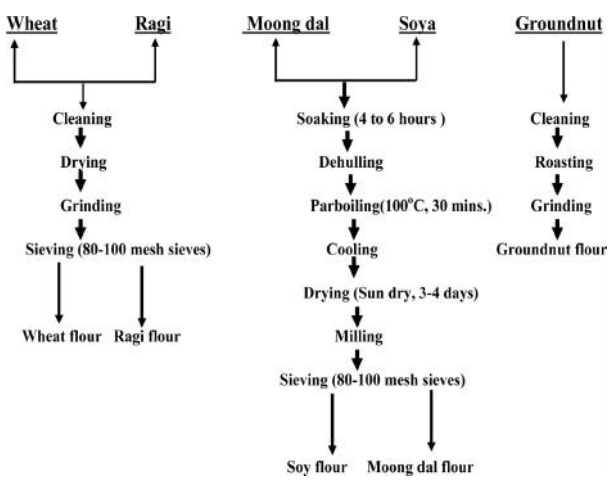
### Storage Studies

The storage quality studies of flour were carried out in polyethylene and tin containers for a period of 3 months at ambient temperature. 100 gm of sample were packed and kept at room temperature for 90 days. Samples were drawn periodically after 0, 30, 60, 90, days and further analysis was carried out.

### Sensory Evaluation of Products

The sensory evaluations of products were made by panel of 10 judges as described by (Amerine *et al.*, 1965) on 9-point hedonic scale.

**Figure 1: Processing Steps of Raw Materials**




*Source: Srivastava and Kumar (2002)*

## Biochemical Analysis of Prepared Chakli

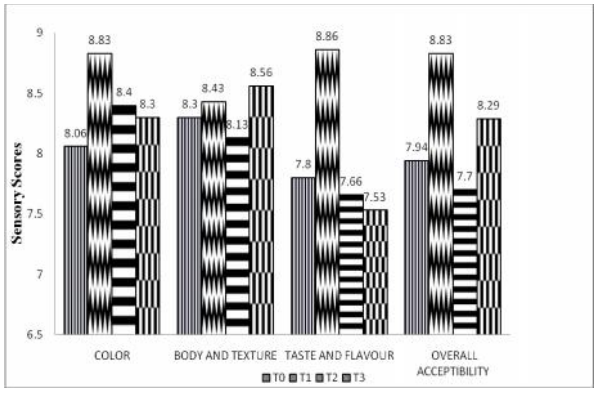
The biochemical analyses of the product i.e. ash content, moisture content, fat content, protein content, crude fiber, total carbohydrate, total energy content, calcium, phosphorus and iron were determined by (A.O.A.C, 2007).

## RESULTS AND DISCUSSION

### Sensory Quality Characteristics of Prepared Product

From Figure 2, it can be observed that different kinds of flour were developed to make Chakli and subjected to sensory evaluation. The results revealed that the sensory scores of various attributes viz; colour and appearance, flavor, taste, texture and overall acceptability (Figure 2) in relation to colour which indicates that $T_1$ (8.83) had the highest score followed by $T_0$ (8.06), $T_2$ (8.4) and $T_3$ (8.3) respectively. Scoring shows that the treatment $T_1$ was liked very much while $T_0$, $T_2$ and $T_3$ were moderately liked by the panel of judges. The texture of chakli clearly indicates that the treatment $T_1$ (8.43) had the highest score for the texture of followed by $T_0$ (8.3), $T_2$ (8.13) and $T_3$ (8.56) respectively. The effect of composite flour on the taste & flavor of laddo indicates that treatment $T_1$ (8.86) held the maximum scores as compared to control $T_0$ (7.8), $T_2$ (7.66), and $T_3$ (7.53). The mean scores of chakli in relation to overall acceptability indicates that the treatment $T_1$ (8.83) scored maximum followed by treatment $T_0$ (7.94), $T_1$ (7.7), $T_3$ (8.29) respectively. It was seen that the addition of 5% in the treatment $T_1$ (8.83) improved overall acceptability of chakli. However, on increasing the level of composite flour, there were a decrease in the textural quality and overall acceptability of the product. This indicates that higher amount of composite flour affected the textural quality characteristics. On the basis of their observations $T_1$ composite flour consisting of 45:5:35:10:5 (Wheat flour: Ragi flour: Soyabean flour: Moong dal flour: Groundnut flour) could be considered the best for preparation of good quality of chakli.

**Figure 2: Average Sensory Score for Different Attributes of Chakli**




Similar results were also reported by (Bisla *et al.*, 2012) the data shows that the mean scores of different sensory parameters of various recipes developed by incorporating rice, wheat, soya, cowpea leaves and Bengal gram leaves. On the basis of overall acceptability scores of different recipe it was found that standard scored highest and among the three variants, variant B (incorporated with malted wheat flour) was most acceptable and variant A (incorporated with unprocessed flour) was least acceptable. It was observed that Vegetable pakodi was most acceptable recipe followed by Pua, Namakpara, Suji ki kheer, Chana murmura premix, Bhakra badi, Bhakri, Rings, Murmura moong dal premix, Suji ka halwa in terms of mean score of overall acceptability. On the basis of sensory evaluation none of the incorporated product was disliked by the panel members. Thus, it can be said that the entire product can be given readily.

### Proximate Composition of Prepared Product

From Table 1 it can be seen that moisture content varied from 2.95 to 5.41 % with the lowest $T_0$ (2.95%) and highest is $T_3$ (5.41%). %). Ash content varied from 3.19 to 3.93%. The lowest value was observed in $T_0$ (3.19%) and highest in $T_3$ (3.93). Energy content varied from 349.31 to 351.12%. The lowest value was observed in $T_0$ (349.31%) and highest in

**Table 1: Proximate Composition of Composite Flour and Prepaired Product**

| Nutrients (Chakli) | $T_0$ | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|---|
| Moisture % *(Mean± S.E)* | 2.95 ± *0.03* | 3.61 ± *0.05* | 4.67 ± *0.03* | 5.41 ± *0.15* |
| Total Ash (g) *(Mean± S.E)* | 3.19 ± *0.00* | 3.52 ± *0.07* | 3.96 ± *0.00* | 3.93 ± *0.02* |
| Energy (kcal) *(Mean± S.E)* | 349.31 ± *0.47* | 359.16 ± *0.01* | 354.11 ± *0.18* | 351.12 ± *0.03* |
| Protein (g) *(Mean± S.E)* | 7.15 ± *0.51* | 19.13 ± *0.25* | *17.16* ± *0.12* | 16.13 ± *0.11* |
| Fat (g) *(Mean± S.E)* | 29.03 ± *0.12* | 32.04 ± *0.32* | 34.06 ± *0.03* | 36.20 ± *0.51* |
| Crude fiber (g) *(Mean± S.E)* | 1.5 ± *0.03* | 2.24 ± *0.05* | 3.28 ± *0.02* | 5.87 ± *0.03* |
| Carbohydrate (g) *(Mean± S.E)* | 64.31 ± *0.03* | 39.72 ± *0.02* | 35.13± *0.19* | 32.24 ± *0.20* |
| Iron (g) *(Mean± S.E)* | 9.55 ± *0.81* | 12.59 ± *0.21* | *15.69*± *0.20* | 19.19 ± *0.11* |
| Phosphorous (mg) *(Mean± S.E)* | 365. 23 ± *0.21* | 371.12 ± *0.71* | *369. 14* ± *0.22* | 364.51 ± *0.12* |
| Calcium (mg) *(Mean± S.E)* | 58.21 ± *1.22* | 62.11 ± *0.12* | *65.12* ± *0.02* | 71. 61 ± *0.23* |

$T_3$ (351.12). Similar results were also reported by (Sunita *et al.*, 1995) the data shows that on the selected cereal based preparation. The protein content in the various ranged from 7.15 to 16.13. The highest protein value was recorded in $T_3$ (16.13) and lowest in $T_0$ (7.15%). Similar results were also reported by (Gopalan *et al.*, 2004) the nutritional of the some common indigenous green leafy vegetables and found protein content about 7% to 32%. Fat content varied from 29.03 to 36.20% with the lowest in $T_0$ (29.03%) and highest in $T_3$ (36.20%). The highest amount of crude fibre was in $T_3$ (5.87) and lowest in $T_0$ (1.5The maximum amount of carbohydrates were recorded in $T_0$ (64.31%) and lowest in $T_3$ (32.24%). These findings were in line as observed by many investigators. Calcium content ranged from 58.21 to 71.61 mg/100 g. The highest value recorded in $T_3$ and lowest in $T_0$. The phosphorus content varied from 365.23 to 364.51 mg/100 g. The highest phosphorus content was recorded in $T_3$ (364.51 mg/100 g) and lowered in $T_0$ (365.23 mg/100 g). The iron content varied from 9.55 to 19.19 mg/100 g. The highest amount was recorded in $T_3$ (19.19 mg/100 g) and lowest in $T_0$ (9.55 mg/100 g). The increase in the nutritive value of flour by supplementation of other composite flour has been reported by many investigators (Macleod and Ames, 1988).

Cost analysis The Cost of the product was within the range of Rs. 2.26 to 2.46 for Chakli. So it can be concluded that the entire developed product was low in cost with a punch of energy and nutrient.

## CONCLUSION

In the present investigations, different kinds of flours were made from wheat flour, moong dal flour, soya flour, ragi flour and groundnut flour and subjected to sensory evaluation in the form of chakli. The value addition enriched the nutritive value of traditional recipe appreciably. There was a substantial increase in the nutritional value of all the products enriched by composite flour. Food product developed with incorporation of composite flour was organoleptically acceptable. Moisture, Ash, Energy, Protein, Fat, Crude Fiber, Carbohydrate, Iron, calcium and phosphorous in food preparations increased significantly ($P < 0.05$) with incorporation of composite flour. Analysis of data further showed that increase of energy, protein and iron was more in food preparations which were prepared with incorporation of composite flour. It may be concluded that composite flour chakli being good source of energy, proteins and micronutrient may be incorporated in the daily diets of vulnerable sections of population. The storage of different kinds of flours in tin boxes and polyethylene bags revealed that there were no changes in the moisture content and fatty acid acidity of the flours during storage periods. This indicates that containers did not influence much on the quality of blended flours. Thus, it was concluded that composite flour having high nutritional quality can be prepared from wheat flour/Soya flour/moong dal flour/ragi flour and groundnut flour for making good quality of chakli. The supplementation of

composite flour enhances the nutritional quality of flour particularly in minerals and fibres.

## REFERENCES


- Faber M and Wenhold F (2007), "Nutrition in Contemporary South Africa", *Water South Africa*, Vol. 33, No. 3, pp. 393-399 (Special Edition).
- Faruque A S G, Ahmed A M S, Ahmed T, Islam M M, Hossain M I, Roy S K, Alam N, Kabir I and Sack D A (2008), "Nutrition: Basis for Healthy Children and Mothers in Bangladesh", *J. Health Popul. Nutr.*, Vol. 26, No. 3, pp. 325-339 (Accessed July 8, 2011).
- Anwar F, Khomsan A, Sukandar D, Riyadi H and Mudjajanto E S (2010), "High Participation in Posyandu Nutrition Program Improved Children Nutritional Status", *Nutr. Res. Pract.*, Vol. 4, No. 3, pp. 208-214 (Accessed July 15, 2011).
- Ejaz M S and Latif N (2010), "Stunting and Micronutrient Deficiencies in Malnourished Children", *J. Pak. Med. Assoc.*, Vol. 60, No. 7, pp. 543-547 (Accessed January 6, 2012).
- UNICEF (2003), "Strategy for Improved Nutrition of Children and Women in Developing Countries", The United Nations Children's, Children's Fund, New Delhi – 110003, The Briefing Paper Series: Innovations, Lessons and Good Practices.
- A.O.A.C. (2007), *Official Methods of Analysis of the Association of Analytical Chemists*, 16th Edition, Washington DC.
- Bisla G, Archana and Pareek S (2012), "Development of Nutrient Dense Supplementary Products for Children by Usinglocally Available Cereals, Soy Flour, Bengal Gram Leaves and Cow Pea Leaves", Department of Food Science and Nutrition, Banasthali University, Rajasthan, India, Pelagia Research Library, *Asian Journal of Plant Science and Research*, Vol. 2, No. 4, pp. 396-402.
- Amerine M A, Pangborn R M and Roessler E B (1965), *Principle of Sensory Evaluation of Food*, Academic Press, New York.
- Gopalan C, Rama Shastri B V and Balasubramanian S C (2000), *Nutritive Value of Indian Foods*, National Institute of Nutrition (ICMR), Hyderabad.
- Sunita, Yazdanparast R and Alavi M (2007), "Whole Grain Phytochemicals and Health", *Journal of Cereal Science*, Vol. 46, pp. 207-219.
- Macleod G and Ames J (1988), "Soy Flour and its Improvements, CRC Critical Review", *Food Sci. Nutr.*, Vol. 27, p. 219.