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Popularization of green gram flour incorporated foods among home makers to overcome malnutrition

La popularización de los alimentos con harina de soja verde incorporada entre los amos de casa para vencer la malnutrición

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ABSTRACT

Malnutrition is a life-threatening condition often caused by a diet lacking in essential proteins, fats, vitamins and minerals. It is one of the major health problems faced by the developing countries. It puts the young children puts them at a higher risk of experiencing health problems such as stunted growth, mental retardation, and increased susceptibility to infectious diseases. More than 200 million school age children are affected by malnutrition, if no action is taken and at this rate, about one billion school children will be growing up by 2020 with impaired physical and mental development. Malnutrition, influenced by economic (rising food prices), social (food taboos), environmental (poor sanitation/ hygiene) and individual (inadequate food intake) factors is an important concern in children under 6 years. The dietary approach is more sustainable to alleviate malnutrition. Dietary proteins serves as major protein sources in the diets of the poor in the underdeveloped and developing countries to overcome malnutrition. Among the protein rich foods Mung bean (*Vignaradiata*), also called green gram is a tropical legume, widely grown in Asia, particularly in Thailand, India, Pakistan and Bangladesh. They are grown widely for use as human food (as dry beans or fresh sprouts). They contribute high levels of proteins, amino acids, oligosaccharides, and polyphenols to the antioxidant, antimicrobial, anti-inflammatory, and antitumor activities in food. Keeping these points in mind, the present study was designed to formulate various recipes from nutrient rich green gram flour and popularize it among home makers who care for their children health.

Key words: malnutrition, green gram, protein, iron, mung bean, home makers.

RESUMEN

La malnutrición es una condición de riesgo de vida que a veces se causa por la falta de proteínas, grasas, vitaminas y minerales esenciales en una dieta. Es uno de los principales problemas de salud al que se enfrentan los países en vías de desarrollo. Pues, expone a los niños pequeños a un riesgo más alto de experimentar problemas

de salud, tales como, crecimiento estancado, retraso mental y mayor susceptibilidad a enfermedades infecciosas. Más de 200 millones de niños en edad escolar se encuentran afectados por la malnutrición, por lo que, si no se toma una medida; como consecuencia, más de mil millones de escolares crecerán con un desarrollo físico y mental deteriorado para el 2020. Los factores económicos (el alza de los precios de alimentos), sociales (alimentos tabúes), ambientales (sanidad e higiene malas) e individuales (ingesta inadecuada de alimentos) influyen dentro de la malnutrición, la cuál es una preocupación importante en los niños menores de 6 años. Un enfoque dietético es un método más sustentable para mitigar la malnutrición. Las proteínas dietéticas son la principal fuente de proteínas en la dieta de la gente con bajos recursos de países subdesarrollados y en vías de desarrollo para vencer la malnutrición. Entre las comidas ricas en proteína, el poroto Mung (*Vigna radiata*), también conocida como soja verde, es una legumbre tropical cultivada en Asia generalmente, en especial en países como Tailandia, la India, Pakistán y Bangladesh. Mayoritariamente, se cultivan para consumirlas como alimento humano (como porotos secos o brotes frescos). También, aportan altos niveles de proteínas, aminoácidos, oligosacáridos y polifenoles a la actividad antioxidante, antimicrobiana, antiinflamatoria y antitumoral de los alimentos. Al tener eso en cuenta, el presente estudio fue diseñado para crear varias recetas a base de harina de soja verde rica en nutrientes y popularizarla entre los amos de casa a los que le importan la salud de sus hijos.
Palabras clave: malnutrición, soja verde, proteína, hierro, poroto Mung, amos de casa.

INTRODUCTION

Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients. The term malnutrition addresses 3 broad groups of conditions:

- undernutrition, which includes wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age);
- micronutrient-related malnutrition, which includes micronutrient deficiencies (a lack of important vitamins and minerals) or micronutrient excess; and
- overweight, obesity and diet-related non communicable diseases (such as heart disease, stroke, diabetes and some cancers). (WHO,2018)

A number of approaches can be taken to alleviate malnutrition (Shashank *et al* ,2016). India is facing a major malnutrition crisis as it holds almost a third of the world's burden for stunting, according to a global nutrition report, 2018. Strategies to tackle malnutrition are fortification of food products and distribution of nutrient supplements, but a food-based approach has the advantage that it is within easy reach, as native foods provide variety, are well accepted, frequently consumed and readily available. Legumes are important source of dietary proteins Cooking and sprouting of legumes greatly influence nutritional quality by increasing bioavailability of nutrients as well as enhancing digestibility and utilization of nutrients (Oboh *et al*. 2000).

Among the legumes, Mung bean or green gram (Vigna radiata (L.) has been cultivated in India since prehistoric times. It is one of the major caloric and protein sources in South Asia, especially for the vegetarian population. Many food items can be prepared from mungbean. Mungbean primarily serves as a supplemental source of protein, iron content and main contributors of aminoacids, oligosaccharides and polyphenols. Increased utilization of legumes will depend upon development of appropriate technologies to produce food products with enhanced nutritional quality (Prinyawiwatkul *et al.,* 1996). Keeping these points in mind, the present study was designed to formulate various recipes from protein and iron rich green gram flour and also popularize it among home makers.

OBJECTIVES

The present study has the following objectives:

- Prepare the sprouted and unsprouted Green gram flour.
- Compare the protein and iron contents of the sprouted and unsprouted Green gram flour.
- Formulate the protein and iron rich Green gram flour incorporated food products.
- Assess the acceptability of sprouted Green gram flour food products through sensory evaluation.
- Popularize the sprouted Green gram flour incorporated products through nutrition education.

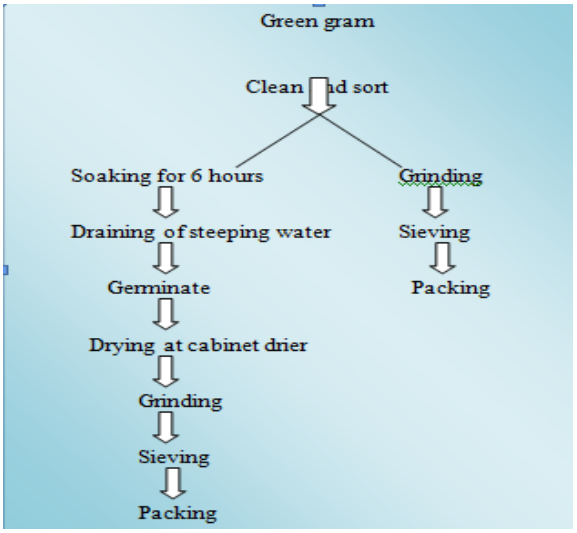
METHODOLODY

Collection of raw materials

Raw material Green gram (*Vignaradiata*) was procured from local market in Virudhunagar.

Preparation of sprouted green gram flour

The sprouted and unsprouted green gram flour was prepared as shown in the flow chart 1.



Comparative study on Protein and iron

The sprouted and unsprouted green gram flour protein and iron contents were analysed by the standard procedure.

Formulation of Sprouted Green gram flour incorporated Foods

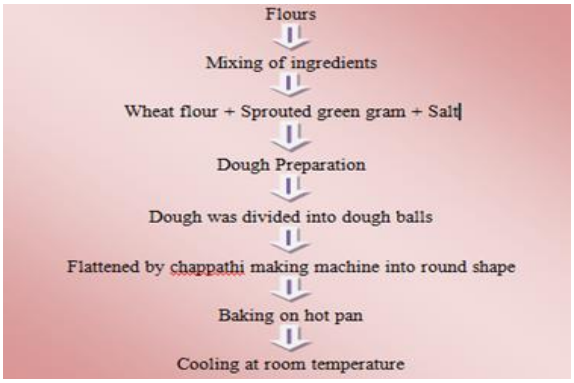
Food processing is the set of methods and techniques used to transform raw ingredients into food for consumption by humans or animals. The food products were formulated using sprouted Green gram flour.

Formulation of Chappathi

The ingredients used for chappathi was given in the table 1. Control sample contains 100g of wheat flour, sample A contains 90g of wheat flour and 10g of sprouted green gram flour, where as in sample B contains 80g of wheat flour and 20g of sprouted green gram flour, was added. In sample C and D 70 and 60g of wheat flour and 30g and 40g of sprouted green gram flour was added respectively. These blends were chosen on the sensory attributes of product prepared from blends.

Table1: Ingredients used for Chapatti

Sample	Wheat flour	Sprouted green gram
Control	100	-
Sample A	90	10
Sample B	80	20
Sample C	70	30
Sample D	60	40



Flowchart for Chapatti making

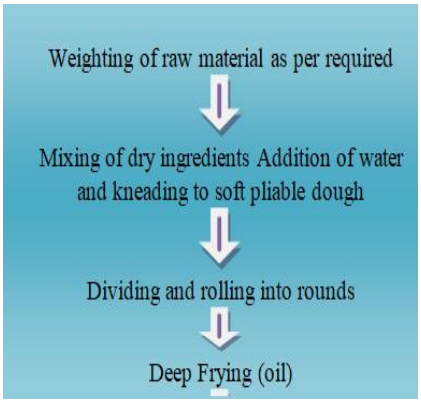
Formulation of Puri

Dry solid content of control and sample A, B,C, D contains 10%, 20%, 30%, 40% of sprouted green gram flour respectively (table 2). 35% water was added to the dry solid content and kneaded to make soft dough. Dough was kept for about 1 min. Dough was divided and rolled to ½ cm thickness. Further this desired shape was deep fried in 300 ml of oil for 3in.

Table 2: Ingredients used for purie

Sample	Wheat flour	Sprouted green gram
Control	100	-
Sample A	90	10
Sample B	80	20
Sample C	70	30
Sample D	60	40

Flow chart for Puri making



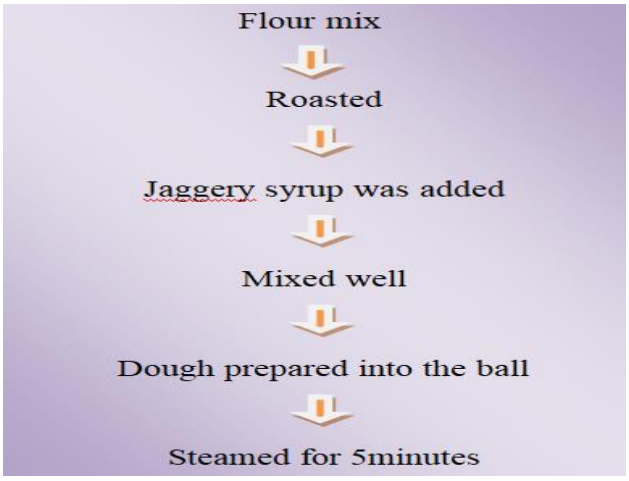
Formulation of Kozhukattai

The sprouted green gram flour was processed into kozhukattai by the flour blended with wheat flour in different variation as given in the table 3.

Table 3: Ingredients used for Kozhkattai

Ingredients	Control	Sample A	Sample B	Sample C
Wheat flour	100	90	80	70
Sprout green gram	-	10	20	30
Black Jaggery syrup	50ml	50ml	50ml	50ml
Dry Ginger	3	3	3	3
Cardamom	3	3	3	3

Flow chart for Kozhukattai

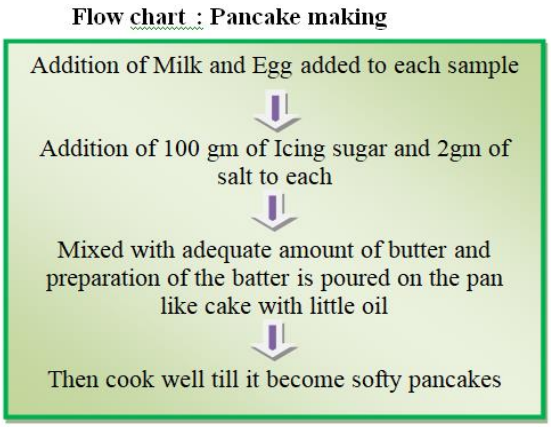


Formulation of Pan Cake

At beginning of pancake preparation, 100% wheat flour was used and then wheat flour was replaced by wheat flour: sprouted green gram flour in the ratio of 90:10, 80:20, 70:30, and 60:40 in sample A, B,C and D respectively.

Table 4: Ingredients used for pan cake

Ingredients	Control	Sample A	Sample B	Sample C
Wheat flour	100g	90g	80g	70g
Sprouted Green gram	-	10	20	30
Sugar	90g	100g	70g	60g
Oil	4tsp	4tsp	4tsp	4tsp
Milk	100ml	100ml	100ml	100ml
Salt	1 pinch	1 pinch	1 pinch	1 pinch
Egg white	1	1	1	1



Formulation of Idli powder

The traditional standard recipe was used prepared using the ingredients such as Blabk gram Dhal, Red Chilli, garlic and curry leaves. Variations were prepared by the addition of 25%, 50%, 75% and 100% of sprouted green gram flour in sample A, B,C and D respectively..

Table 5 :Ingredients used for Idli powder

Ingredients	Control	Sample A	Sample B	Sample C	Sample D
Black gram dhal	100	75	25	50	-
Sprout green gram	-	25	75	50	100
Garlic	2g	2g	2g	2g	2g
Curry leaves	1g	1g	1g	1g	1g
Red chilli	2g	2g	2g	2g	2g

Organoleptic evaluation of prepared samples:

The prepared products acceptability was done by the sensory evaluation.

Nutrient analysis of the Sprouted Green gram incorporated Foods

The nutrient content protein and iron of selected food samples were determined using standard AOAC methods.

Storage stability of Sprouted Green gram incorporated Food Products

The storage stability of the products was determined by the Total Plate Count (TPC). This method is used to determine the changes in the microbial load of the food products during storage.

Popularization of the Sprouted green gram flour incorporated food products among home makers

Sprouted green gram incorporated recipes were popularized among home makers who care for their child health. Questionnaires were prepared to collect the details regarding the awareness about malnutrition. Brochure which contained necessary information about mal nutrition, recipes, nutritional benefits and medicinal uses of sprouted green gram were given to the home makers.

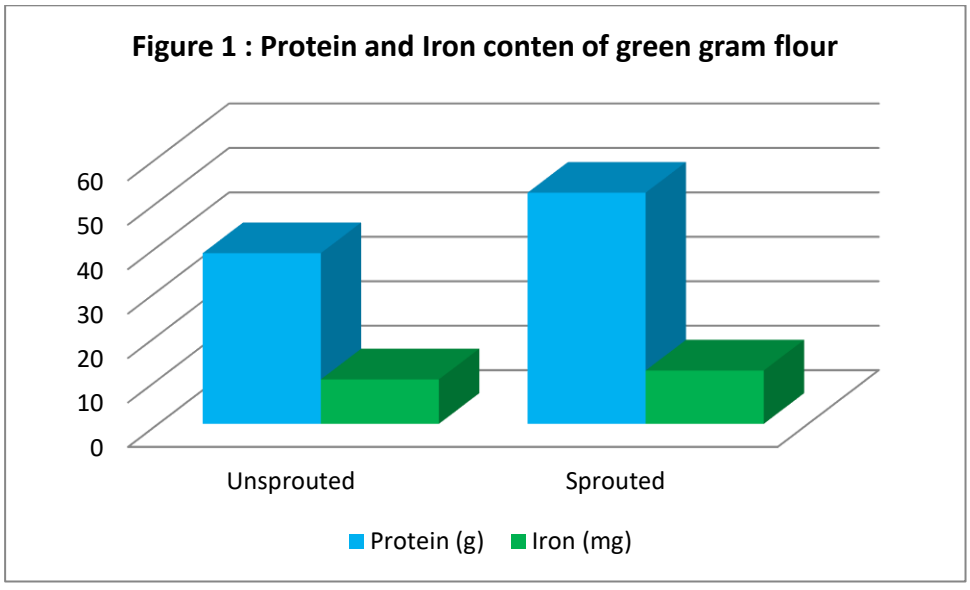
RESULTS AND DISCUSSION

Among all legumes, green gram or Mung bean (*Vigna radiata*) is used extensively in germinated form in many countries. Due to the current lifestyle Food intake has become one of the major work being neglected and least preferred. This situation resulted in Protein deficiency and Anaemia. Present study explored the possibility of green gram to combat malnutrition to meet the nutritional requirement of growing children.

The green gram sprouted and unsprouted flour was prepared. The green gram sprouted and unsprouted flour was analyzed for their protein content. Figure 1 shows the various protein content of flours.

From the data it has been concluded that sprouted green gram flour contains more and iron protein content than the unsprouted green gram flour. So the sprouted green gram flour was selected for further studies.

Evidence of protein synthesis during germination was presented earlier by Kylen and Mccready (1975). They found the protein content of all sprouts was higher than that of the ungerminated seeds.



The various products such as chappathi, purie, kozhukattai, pan cake and idli powder was prepared from sprouted green gram flour. Panel 10 judges evaluated the palatability and acceptability of the products using 5 point Hedonic Scale. The products were accepted in terms of appearance, Colour, Texture, taste and acceptability. The result of organoleptic evaluation is given table from table 6 to 10.

Based on sensory evaluation the sample C the Chapatti sample which contains 30 % of sprouted green gram flour was selected. The sensory score was given in the table 6.

Table 6 : Scores for organoleptic characteristics of Chapatti

Sensory Attributes	Control	Sample A	Sample B	Sample C	Sample D
Colour	4.5±0.1	4.4 ±0.1	4.1±0.1	4.6±0.1	3.5±0.1
Flavour	4.5±0.1	4.1±0.1	4.2±0.12	4.6±0.1	3.2± 0.2
Taste	4.2±0.12	4.1± 0.1	4.3±0.12	4.6±0.1	3.5±0.2
Appearance	4.2±0.1	4.4±0.1	4.3±0.12	4.6 ± 0.1	3.3±0.2
Overall accepatability	4.5±0.1	4.3±0.1	4.2±0.12	4.8 ± 0.12	3.4±0.18

Table 7: Scores for organoleptic characteristics of Puri

Sensory Attributes	Control	Sample A	Sample B	Sample C	Sample D
Colour	4.4± 0.1	3.6±0.18	3.9±0.2	4.8±0.12	3.4±0.29
Flavour	4.2±0.2	3.9±0.29	4±0.15	4.8±0.12	3.2±0.2
Taste	4.5±0.15	3.7±0.2	4.1±0.1	4.7±0.12	3.7±0.25
Appearance	4.3±0.12	3.6±0.2	4.1±0.1	4.6±0.12	3.4±0.18
Overall accepatability	4.6±0.1	3.6±0.2	4.2±0.2	4.9±0.07	3.5±0.15

From the table 7, it was concluded that highest score was obtained for Sample C puri which is incorporated with 30 % sprouted green gram flour.

Mean sensory scores with regard to colour, flavour, texture, and taste and over all acceptability for Kozhukattai was given in the table 8. The sample C the Kozhukattai sample which contains 30 % of sprouted green gram flour has scored maximum than the other samples.

Table 8: Scores for organoleptic characteristics of Kozhukattai

Sensory attributes	Control	Sample A	Sample B	Sample C
Color	4.2±0.2	4.0±0.3	3.3±0.2	4.5±0.3
Flavor	4.0±0.2	4.1±0.3	3.8±0.3	4.2±0.4
Taste	4.5±0.2	3.1±0.3	3.9±0.2	4.5±0.2
Texture	4.3±0.1	4.1±0.2	3.3±0.4	4.5±0.1
Overall acceptability	4.3±0.1	2.9±0.3	3.5±0.2	4.8±0.2

In the case of pancake, the best variation was sample B. It was prepared with 20 per cent of sprouted green gram flour and 80 per cent of wheat flour. It got the highest overall acceptability score of 4.7.

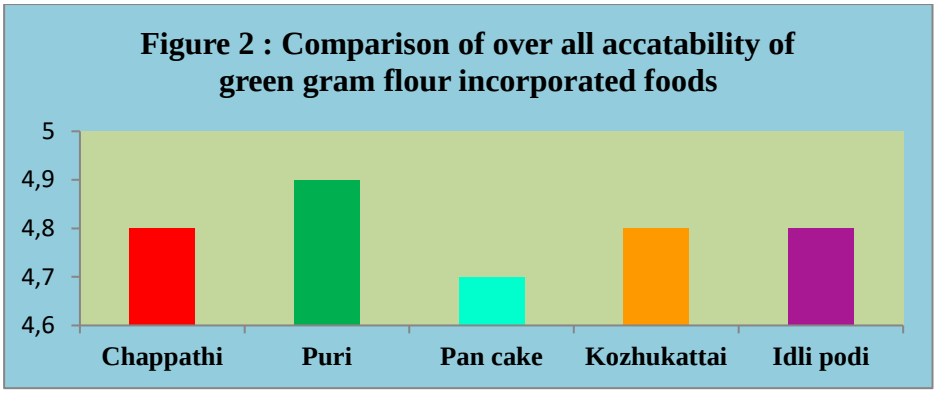
Table 9: Scores for organoleptic characteristics of Pan Cake

Sensory Attributes	Control	Sample A	Sample B	Sample C
Colour	4.4± 0.1	3.6±0.1	4.8±0.12	3.4±0.29
Flavour	4.2±0.2	3.9±0.29	4.8±0.12	3.2±0.2
Taste	4.5±0.15	3.7±0.2	4.7±0.12	3.7±0.25
Appearance	4.3±0.12	3.6±0.2	4.6±0.12	3.4±0.18
Overall accepatability	4.6±0.1	3.6±0.2	4.7±0.1	3.5±0.15

The sensory profile for idli powder (Table 4) shows that the best variation is sample C with a score of (4.8) for over all acceptability. It was made by incorporating 50 per cent of sprouted green gram flour with 80 per cent of other constituents.

Table 10: Scores for organoleptic characteristics of Idli powder

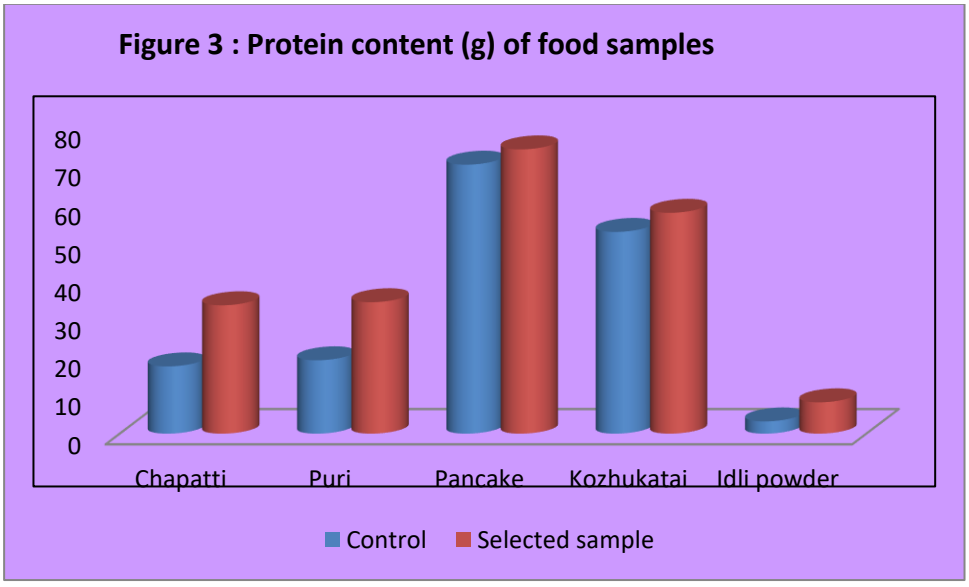
Sensory Attributes	Control	Sample A	Sample B	Sample C
Colour	4.5±0.15	4.1±0.15	4.4 ±0.21	4.6±0.13
Flavour	4.5±0.25	4.2±0.27	4.1±0.13	4.6±0.15
Taste	4.2±0.35	4.3±0.12	4.1± 0.30	4.6±0.21
Appearance	4.2±0.37	4.3±0.33	4.4±0.01	4.6 ± 0.32
Overall accepatability	4.5±0.40	4.2±0.56	4.3±0.32	4.8 ± 0.36



From the above sensory evaluation results, it concluded that the sample which contain 30% of sprouted green gram flour was selected for the Chappathi, puri and Koahukattai. The sample which contained 20% and 50% sprouted green gram flour was selected for the pancake and idli powder.

Analysis of Protein

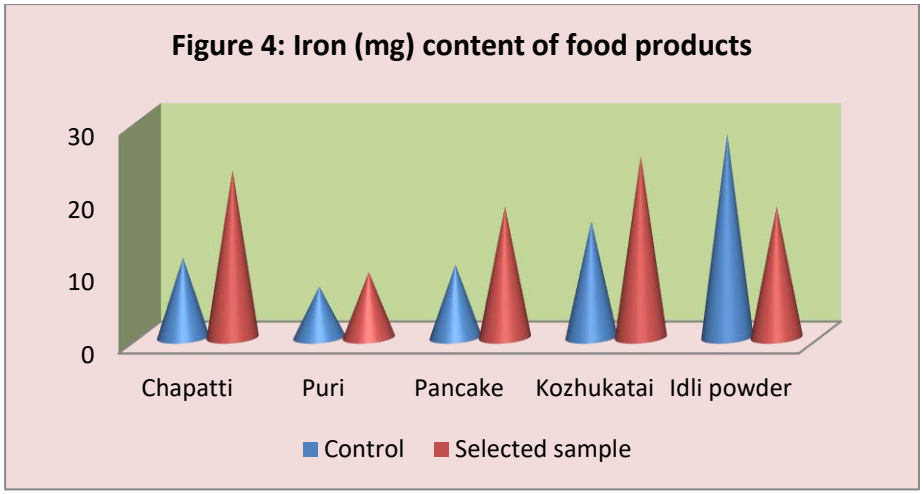
The protein content of selected samples were compared with the control samples.The result was given in the figure 3.



The crude protein content of selected samples was higher when compared with control samples. Among five samples, pan cake sample B was found to be higher (74g) amount of protein when compared to other samples such as chappathi, puri, kozhukattai and idli powder.

Analysis of iron

The iron content determined in the control and Sprouted green gram incorporated food samples shown in Figure 4.



All sprouted incorporated food samples, except idli powder had higher amount of iron content than the control samples. Among the five food products, the Kozhukattai was observed to contain the maximum iron content. Chapatti, pan cake and puri were found to contain exceptionally appreciable amount of iron, 17, 18 and 9 mg/ 100 g of food sample, respectively.

Table 11: Microbial load for green gram incorporated products

S.no	Product name	Sample	Storage condition	
			Room	Refrigerator
1		Control	53×10^{7}	48×10^{7}
	Chapatti	Sample C	nil	32×10^{7}
2	Puri	Control	50×10^{7}	44×10^{7}
		Sample C	43×10^{7}	29×10^{7}
3	Kozhkattai	Control	64×10^{7}	40×10^{7}
		Sample C	26×10^{7}	32×10^{7}
4	Pan Cake	Control	31×10^{7}	28×10^{7}
		Sample B	21×10^{7}	24×10^{7}
5	Idli powder	Control	23×10^{7}	nil
		Sample C	19×10^{7}	nil

Microbial analyses of the developed products were confirmed by the Total plate count. The result given in table 11 confirmed that prepared products were prepared in good hygienic condition.

Name of the products	Control	Sample
Chapatti	10	17
Puri	7	9
Kozhukattai	16	25
pan cake	10	18
Idli powder	28	18

The cost of formulated sprouted green gram flour incorporated products varied according to the ingredients added in each product. The cost of sprouted green gram flour incorporated chapatti was Rs.4.00. The cost of sprouted green gram flour incorporated Puri and kozhukattai were Rs.6.00. The cost of sprouted green gram flour incorporated Pan cake was Rs.4.00. The cost of 100g idli powder was Rs. 20. As the percentage of sprouted green gram flour increases, the cost of the product is also increased, this might also increase the nutritive value of the products.

Popularization of information about awareness of Sprouted green gram flour

The questionnaire to check the awareness about malnutrition was distributed among the Home makers in Thanthi Mara Street at Virudhunagar and filled by them. The questionnaire revealed that majority of members was not aware about malnutrition hence the brochures were given to them regarding the effect of malnutrition and need for prevention of malnutrition were explained to them. The sprouted green gram flour incorporated recipe booklet was also distributed to them. The importance of sprouted green gram flour in preventing malnutrition was also enlightened. A few members were interested to incorporate sprouted green Gram flour in their diet.

CONCLUSION

The present study was carried to popularize protein and iron rich green gram incorporated flour food products among home makers to tackle malnutrition. In order to meet the objectives of the study, five products were prepared by incorporating sprouted green gram flour. Among the prepared, Sample C of Chapatti (4.8), Puri (4.9) and Kozhukattai (4.8) which contain 30% of sprouted green gram flour were selected. The sprouted green gram flour incorporated products had rich protein and iron content than the control products. From the result it has been discovered that the sprouted green gram incorporated food products are quite nutritious. Sprouting not only improved protein content but also enhanced protein digestibility thus it can be used as a promising tool for improving the nutritional profile and enhancing bioavailability of nutrients. Consumption of Sprouted green gram

flour is the one of the easiest way to deal with the malnutrition. The products were popularized among home makers. By this way the consumption of green gram has been encouraged, in children and women who are severely affected by Malnutrition and Anaemia. Sprouting of mung beans and their incorporation in food formulations can help in countering protein energy malnutrition in developing countries.

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