DOI: *10.15613/fijrfn/2021/v8i2/210198*
ISSN (Print) : 2349-8897
ISSN (Online) : 2350-1006
***FoodSci*: Indian Journal of Research in Food Science and Nutrition,** *Vol 8(2), 1-6, July-December 2021*

Formulation and Sensory Acceptability of the Formulated Protein Enriched Chapatti

R. Balasharan and M. Thamarai Selvi*

Department of Food Processing Technology, PSG College of Arts and Science, Coimbatore – 641014, Tamil Nadu, India;
balarrk2000@gmail.com, mtsfpt2014@gmail.com

Abstract

Major segment of population use chappati as it is rich in micronutrients. Plant-based protein sources are cheap to meet protein demand and increases the dietary quality at all levels. The main aim of this project is to enrich protein in chapatti with pulse flour at four variations (10, 20, 30 and 40%). The pulse flour was added in the ratio of 1:1 (green gram: cowpea) increased gradually to improve the nutritional value of chapattis. Yield percentage, cost and nutrient content were calculated for the formulated protein chapatti. Sensory evaluation showed that chapattis prepared from 30% incorporated flours were accepted by the panel members. The highly acceptable product (Variation III) provides 3g higher protein than control chapatti. Preparing value added products from inexpensive pulses and legumes which are available in our doorsteps can ensure meaning full utilization of goods to improve health status of the people.

Keywords: Cowpea, Green Gram, Legumes, Protein Enriched Chapatti, Value Added Chapatti

1. Introduction

India with its rich culture and biodiversity varies in traditional meal patterns differ from region to region but all contain a whole or wide range from five food groups. The world's population relies on wheat-based foods as a major source of essential energy. "Wheat based foods are a good source of nutrients. Wheat flour contain the essential source of energy, carbohydrates, protein and fat along with other minor components including lipids, vitamins, minerals and phytochemicals which may contribute to a healthy diet"[1]. "Plant-based protein sources can be a cost-effective way to meet the future demand for protein and improve the overall dietary quality at all levels of income"[2].

"Consumption of legumes relate for curing cardiovascular disease risk factors and other disease like obesity, hypertension, diabetes and metabolic syndrome. Mediterranean diet has emerged as a healthy dietary pattern that protects against cardiovascular disease and other chronic disease"[3]. "Legumes are excellent source of many essential nutrients, including vitamins, minerals, fibres, antioxidant and other bioactive compounds"[4]. "Legume is a low-fat, high-protein and high-fibre pulse crop belonging to the legume family"[5]. "Similar to most legumes, lentils are an excellent source of dietary protein for human nutrition, containing between 20.6 and 31.4% protein on dry weight basis"[6].

"Chapatti and other related flat breads are used as staple diet of a major segment of population globally. It is a source of macro- as well as micro-nutrients for people"[7]. "Consumption of wheat and legumes are very important in human diet. Chapattis are an economical source of protein and contribute to satiety through abundant dietary fiber that reduces constipation and diverticular disease, rates of chronic bowel disease and

*Author for correspondence

diet-related cancers"[8]. Replacing wheat flour with pulse flour not only improves the protein uptake but will also improve the protein quality consumed by vegetarian population. Protein enriched chapatti can serve as a healthy breakfast product. In general, protein is enriched through the addition of whey protein concentrate and soy concentrates. However, locally available green gram flour and cowpea flour can be utilized to enrich protein for easy availability. With the above insights, study was aimed to formulate protein enriched chapatti from green gram and cowpea to determine the sensory acceptability and to calculate the nutritive value of the formulated protein enriched chapatti.

2. Materials and Methods

Selected ingredients such as wheat flour, cowpea flour, green gram flour, butter, salt and sugar were purchased from local market. The ingredients were checked for its purity and cleanliness. Wheat and pulses were cleaned, washed, dried and grounded into fine flour and sieved. The cowpea and green gram dhal were ground into fine powder after dry roasting in a medium flame and mixed in different proportions as per the Figure 1.

The aim of the project is to provide a protein enriched product by replacing wheat flour with legume flour by increasing the substitution gradually. Roasted and milled pulse flour (green gram:cowpea) was mixed in the proportion of 1:1. 100% wheat flour chapatti served as control. The mixed pulse flour was added to the wheat flour in four variations as I, II, III and IV which contained 10, 20, 30 and 40% pulse flour respectively.

Chapattis were prepared by following the method as reported by previous researchers[9,10] with slight modifications. The sensory evaluation of the formulated protein enriched chapatti was conducted among 30 panel of judges using nine-point hedonic scale for the organoleptic attribute such as appearance, color, taste and flavors. This is commonly overlooked as a requirement before a product launched. The scores were analyzed statically to obtain the highly acceptable product. "The nutritional quality of developed products was calculated by taking in consideration the chemical composition of the selected waste leaves of vegetables and value given in the Food Composition Tables" compiled by Gopalan et al., (2011)[11]. The cost of the product was also calculated using the cost of raw materials, packaging materials, overhead charges and profit percentage to obtain the selling cost.

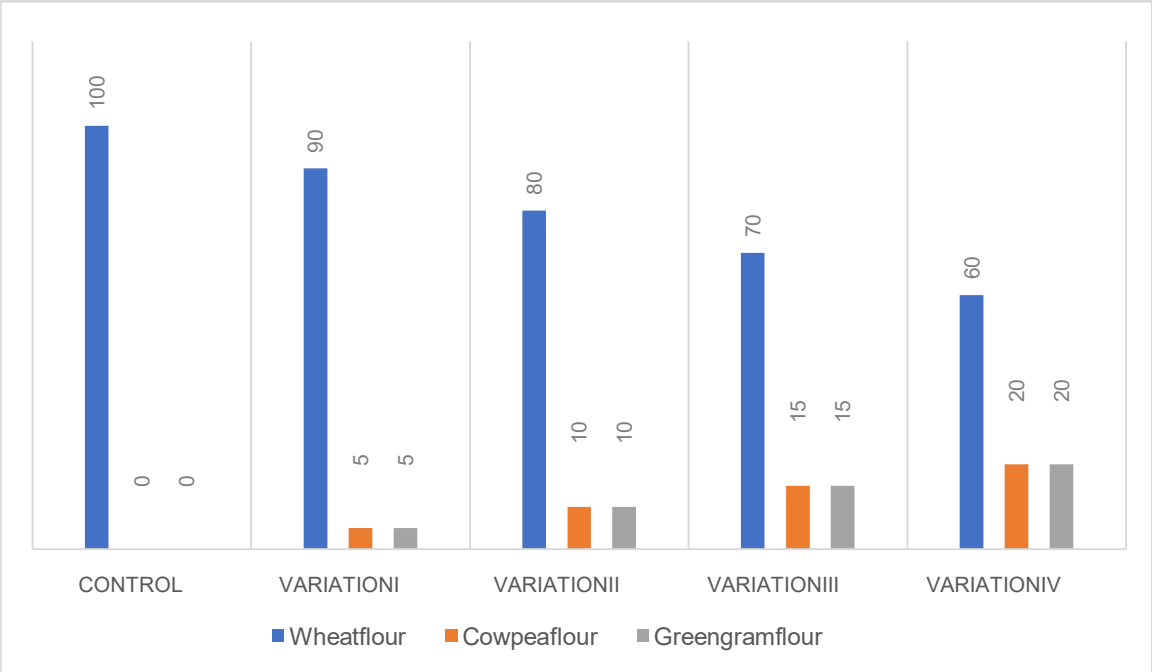

Figure 1. Formulation of protein enriched chapatti.

3. Results and Discussion

3.1 Yield of the Protein Enriched Chapatti

The yield percentage of chapattis increased gradually from 150 to 175%. The results revealed that the yield percentage increased as the proportion of pulse flour increases and this may be due to increased water absorption capacity of the pulse flour than wheat flour. 100g of flour yielded 3 numbers of chapattis with 50g each. The higher water absorption of composite flours might be due to more water absorption of pulse flour due to its higher protein content. The present results are in agreement with the previously reported values[12,13].

3.2 Mean Sensory Scores of the Formulated Chapatti

Table 1 indicates the average score and standard deviation of the protein enriched chapatti. Among the four variations of formulated protein enriched chapatti.

Variation III with 30% of pulse flour was highly acceptable in all the sensory characteristics as compared to control chapatti.

The results revealed that the sensory scores of various attributes color and appearance, flavor, taste, texture and overall acceptability are in between 7.1 to 8.7 which imply that all the formulated products are acceptable. It was found that all the sensory parameters of chapattis of pulse-based variations (except for the appearance, color and flavor), were significantly affected as compared to the control wheat chapattis. The sensory scores of all the parameters decreased correspondingly to the pulse flour substitution levels. However, the scores about the color decreased from 8.7 ± 0.4 (wheat chapatis) to 8.3 ± 0.8 (chapattis substituted with 40% pulse flour). The sensory scores for texture were decreased with increased levels of pulse flour incorporation above 30% due to leathery nature. Taste and flavor of the chapatti was also found to be high in Variation III than other three variations. Mounika et al.,[14] reported "in terms of flavor, a significant decrease in mean scores was noted when more than 30% of millet flour was incorporated into the composite chapathis". Table 1 pertaining to the mean score awarded to the quality attributes of overall acceptability of formulated chapattis reveals that the maximum score of 8.4 ± 0.7 was recordedin Variation III (70:30) (wheat flour: pulse flour) whereas the minimum score of 7.6 ±

Table 1. Mean sensory scores of the formulated chapatti

Criteria	Control	Variation I	Variation II	Variation III	Variation IV
Color and appearance	8.7±0.4	8.7±0.4	8.5±0.7	8.7±0.5	8.3±0.8
Texture	8.5±0.5	8.1±0.9	8.0±1.0	8.3±0.8	7.6±1.0
Taste	8.5±0.6	8.1±1.0	8.0±1.2	8.2±0.9	7.4±1.1
Flavor	8.3±0.8	8.0±0.9	7.8±1.1	8.2±0.9	7.1±1.2
Overall acceptability	8.5±0.5	8.2±0.7	8.1±0.9	8.4±0.7	7.6±0.9

Table 2. ANOVA

Source of Variation	Sum of Squares	Df	MeanSquare	F	P-value	F-crit
Control and formulated variations	1.36	4	0.34	22.18	2.3	3.0

0.9 was recorded in Variation IV (70:40) (wheat flour: pulse flour). Similar results was observed from the study conducted by Parimalavalli et al.,[15] that "35% oats flour and 25% soya flour and 5% fenugreek seed powder could be incorporated in chapatti without adversely affecting sensory quality". As per the study conducted by Idrees et al.[13], "pulse flour (kidney bean and black gram flours) can be incorporated up to 15% in wheat flour to produce acceptable chapattis with comparable overall acceptability compared to whole wheat flour however in the present study, 30% substitution of pulse flour in chapattis was highly acceptable". ANOVA results shows that there was significant difference between the sensory attributes ($p>0.05$) which indicate that the null hypothesis is rejected. Hence the products can used to enrich the protein content in chapattis.

3.3 Nutrient Calculation of the Formulated Protein Enriched Chapatti

The major nutrient content of the protein enriched chapatti was calculated and presented in Table 3. From the results, it is observed that control chapattis were low in protein content. However, it increased from 12.1% to 15.6% as the substitution levels of pulse flour was increased (from 0 to 30%). There is gradual increase in protein content as the incorporation of pulse flour increases. The variation III has excellent sensory quality and highly acceptable by the panel members. The protein content of variation III (3g) was comparatively higher than the control chapatti. There was a slight increase in fibre content of the pulse flour variations than the control.

Comparing the carbohydrate content it is noticed that there is a reduction in the values as pulse flour increases from 10 to 40% due to replacement of cereal–wheat flour. Though there is a reduction in carbohydrate content, energy value was maintained in the range of 353 to 358 Kcal/100 g for all variations. Similarly in the micronutrient, calcium content was recorded wherein it increased from 48.1 to 63.1% which could be attributed due to the incorporation of pulse flour which possesses high protein and calcium content.

3.4 Cost Calculation

The total cost of selected protein enriched chapatti is Rs. 65.00/- for 10 chapattis. Commercially available product costs around Rs. 45/- that contains 10 chapattis. The cost of the product varies and have an increase in price because of the incorporation of pulse flour and the final product have an enriched protein content about 3g and hence the price differs for each product. The cost of the product is comparatively high due to incorporation of pulse flour. The cost of the product is placed in consideration of the incorporation of pulse flour as the theme of enrichment of protein in replacement for wheat flour.

From the results, it could be observed that all the sensory attributes of formulated chapattis were not significantly different. However, the scores revealed that the variation III was highly accepted than variation IV. All the sensory attributes decreased on 40% substitution. Sensory scores for control and variations were found to be 8.7 whereas for variation IV (40% pulse flour substitution) was only 8.3. This result is comparable to the results

Table 3. Nutrient content of the formulated product/100 g

Nutrients	Control Sample	Variation I	Variation II	Variation III	Variation IV
Energy (kcal)	358.4	357.2	355	353.7	353.6
Carbohydrates (g)	70.8	68.4	66.9	65.4	63.9
Protein (g)	12.1	13.4	14.4	15.6	16.8
Fat (g)	3.2	3.1	3.0	3.0	2.9
Fibre (g)	1.9	2.1	2.3	2.5	2.7
Calcium (mg)	48.1	53.1	58.5	63.1	69.1

reported by Khaliduzzaman et al.[16]. As for as the taste and texture was concerned, the mean scores were adversely affected by increasing pulse flour in the chapattis. The control wheat chapattis (100% wheat flour) were rated the highest with 8.7 and 40% pulse flour was lowest with 7.1. The decrease in the mean scores can be attributed to the intense characteristic taste of pulse flour. Hence, the taste of pulse-based chapatti affected when more than 40% pulse flour incorporation was done. The mean values of overall acceptability showed that the highest score (8.4) was found in chapattis prepared from wheat flour supplemented with 30% pulse flour and lowest score (7.6) was found in chapattis prepared from wheat flour supplemented with 40% pulse flour.

The nutritional composition of the wheat pulse composite chapatis substituted with different levels of pulse flour had protein content in the various blended flours ranged from 12.1 to 16.8. The highest protein value was recorded in V-4 and lowest in control. Fat content varied from 2.9 to 3.2% with the lowest in V-4 and highest in control. The highest amount of crude fibre was in control sample and lowest in V-4. Calcium content varied from 48.1 to 68.1%. The lowest value was observed in control and highest in V-4. The maximum amount of carbohydrates was recorded in control (70.8) and lowest in V-4 (63.9%). Since the variation 3 was mostly acceptable in sensory attribute and the nutrients were considerably to the range. Variation 3 was accepted with 30% pulse flour and has an increase in protein content of about 3g. Kadametal[10] concluded that "composite flour having high nutritional quality can be prepared from wheat flour with 10% chickpea and 10% soy flour and/or with 10% soya flour for making good quality of chaptties". The supplementation of 5% methi powder can also be made to enhance the nutritional quality of flour particularly in minerals and fibres.

4. Conclusion

The present study confirms the possibility of formulating chapatti by incorporating green gram and cowpea in place of wheat flour. Overall quality of chapatti prepared from pulse flour with wheat flour scored higher sensory score, imparted a higher desirable aroma and yielded chapatis with better texture, taste and acceptability. Further, the study showed that green gram and cowpea flour can be utilized upto 30% for making highly acceptable chapatti. Variation III (70:15:15) which had 30% of pulse flour (green gram: cowpea) had an additional 3g protein content compared to the control chapatti. These results could be beneficial to the flour millers to further explore the horizons for the production of flour admixed with pulse flour for making desirable chapatti to meet the increasing demand of the lack in nutritional content. Chapattis form an essential component of the daily Indian diet in which a part of wheat flour could be substituted with pulse flour to enrich the essential amino acids lacking in cereals which is an emerging food product into the market.

5. Reference

1. Peter R, Shewry C. Seed Proteins. Journal of Plant Physiology. 2000; 152:4.
2. Aggarwal A, Drewnowski A. Plant and animal-protein diets in relation to socio demographic drivers, quality,and cost: Findings from the Seattle Obesity Study. The American Journal of Clinical Nutrition. 2019; 110(2):451–60. PMid: 31172179 PMCid: PMC6669134. https://doi.org/10.1093/ajcn/nqz064
3. Babio N, Bullo M, Basora J, Martınez-Gonzalez MA, Fernandez-Ballart J, Marquez-Sandoval F, Molina C, Salas-Salvado'J. Nureta-PREDIMED investigators: Adherence to the Mediterranean diet and risk of metabolic syndrome and its components. Nutrition Met Cardiovasc Dis. 2009; 19:563–70. PMid: 19176282. https://doi.org/10.1016/j.numecd.2008.10.007
4. Shimelis AE, Rakshit SK: Anti-nutritional factors and in vitro protein digestibility of improved haricot bean (Phaseolus vulgaris L.) varieties grown in Ethiopia. Inter J Food Sci Nutr. 2005; 56:377-–87. PMid: 16361179. https://doi.org/10.1080/09637480500512930
5. Jarpa-Parra, M. Lentil protein: A review of functional properties and food application. An overview of lentil protein functionality. International Journal of Food Science and Technology. 2018; 53(4):892–903. https://doi.org/10.1111/ijfs.13685
6. Urbano G, Porres JM, Frías J, Vidal-Valverde C. Nutritional Value. S. S. Yadav, D. L. McNeil, P. C. Stevenson (Eds.). Lentil: An Ancient Crop for Modern Times. Dordrecht: Springer Netherlands. 2007. p. 47–93. https://doi.org/10.1007/978-1-4020-6313-8_5
7. Kumar A. Chapatis and related products. Encyclopaedia of Food and Health. 2016.

8. Inglett GE, Carriere CJ, Maneepun S. (2005). Health related fat replacers prepared from grains for improving functional and nutritive values of Asian foods. J. Shi, C.T. Ho, F. Shahidi (Eds.). Asian Functional Foods. New York, NY: Marcel Dekker. 2005. p. 103–27.
9. Rao M, Bharati P. Dough characteristics and chapathi making quality of wheat varieties. Karnataka Journal of Agricultural Science. 1996; 9:562–4.
10. Kadam ML, Salve RV, Mehrajfatema ZM, More SG. Development and evaluation of composite flour for Missi roti/chapatti. Journal of Food Processing and Technology. 2012; 3(1): 134–40.
11. Gopalan C, Ramasastri BV, Balasubramanian SC, Narasinga Rao BS, Deosthale YG, Pant KC. Nutritive value of Indian foods: Indian Council of Medical Research, Hyderabad, National Institute of Nutrition. 2011.
12. Rehman S, Paterson A, Hussain S, Anjum Murtaza M, Mehmood S. (2007). Influence of partial substitution of wheat flour with vetch (Lathyrussativus L.) flouron quality characteristics of doughnuts. LWT-Food Science and Technology. 2007; 40: 73–82. https://10.1016/j.lwt.2005.09.015
13. Wani IA, Sogi DS, Sharma P, Gill BS, Yildiz F. (Reviewing Editor). Physicochemical and pasting properties of unleavened wheat flat bread (Chapatti) as affected by addition of pulse flour. Cogent Food and Agriculture. 2016; 2:1.
14. Mekala M, Hymavathi TV, Aparna K, Sreedhar M. (2020). Development, physical and sensory evaluation of chapathi (Indian flat bread) produced by utilizing legumes, nutricereals and wheat flour. Current Journal of Applied Science and Technology. 2020; 39(18):68–76.
15. Parimalavalli, Ramaprabha PM, Radhai Sri S. Nutrional and organoleptic evaluation of chapati incorporated with Stevia rebaudiana. Asian Journal of Home Science. 2008; 3(2): 202–4.
16. Khaliduzzaman M, Shams-Ud-Din M, Islam MN. Studies on the preparation of chapatti and biscuit supplemented with potato flour. Journal of Bangladesh Agricultural University. 2010; 8(1): 153–60. https://doi.org/10.3329/jbau.v8i1.6413