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Formulation and Acceptability Study of Micronutrient Rich Composite Flour Cookies

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Abstract

The use of composite flour with little millet and locally available ingredients in cookie formulation was investigated in the present study. Two composite mixes were formulated by mixing the ingredients in different proportions. The formulated products were subjected to organoleptic evaluation along with the standard. The formulations with 30% little millet obtained the highest scores in sensory evaluation. The two proportions along with the standard was analysed for nutrient content and shelf life study. Addition of the composite flour improved the nutrient content especially the iron and zinc content. The iron content and zinc content of the composite flour incorporated cookies was 15.8 mg, 12.2 mg and 3.46, 4.56 mg respectively. The product had a shelf life of one month at room temperature when evaluated using sensory evaluation and microbial analysis.

Keywords: Composite Flour, Cookies, Iron Zinc and Nutrient Analysis, Little Millet

1. Introduction

Composite flour technology initially referred to the process of mixing wheat flour with cereal and legume flour for making bread and biscuits. However, the term can also be used with regard to mixing of non-wheat flours, roots and tubers or other raw materials [1]. Composite flour technology makes it possible to blend, mix or fortify one food material with others so that the resulting fortified mix has not only better nutritional quality but also the necessary attributes for consumer acceptance [2]. Composite mixes often serve as supplementary foods for infants, senior citizens or vulnerable population. Supplementary foods based on commonly consumed, inexpensive locally available ingredients involve no additional burden and possess the protein quality comparable to that of commercial formulae. Being cost effective and nutria-dense, these formulations could form a sustainable strategy for combating the widespread malnutrition [3].

The products made from composite flours were nutritionally superior to their respective controls and can be successfully used for supplementary feeding programs [4]. Among the food grains, millets are the cheapest and nutritious wholesome food grains for people of all ages. They have certain specialties which yields products of superior nutritional and technological characteristics than the major millets. The millet grains offer many opportunities for diversified utilization and in adding value [5]. Supplementation of cereal based products with millets has become increasingly popular due to nutritional and economic advantages. With proper preparation, 30 per cent of minor millets can be gainfully substituted in value added foods belonging to the categories of traditional foods, bakery products, extruded foods and allied mixes for the convenient preparation by rural and town folk at low cost[6].Little millet, one of the minor millets exhibits diversified use as food, feed and fodder.

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The grain compares well with other cereals. It has been utilized for production of various value added products apart from the traditional food preparations. Utilization of this grain for various values added and therapeutic products can increase the demand for this grain, the production of which is declining [7]. So the present study was undertaken to incorporate composite mixes in cookies to enhance the nutrient content.

2. Methodology

Two composite flour mixes were prepared by adding iron and zinc rich ingredients in different proportions for the preparation of cookies. In the composite flour I little millet (Panicum sumatrense), rice flakes, wheat germ and coconut meal were added in different levels. Along with Little millet, wheat germ, coconut meal and sesame seeds were used at different levels in the preparation of composite flour II mix.

The ingredients were obtained from the local market and cleaned and stored in air tight containers at room temperature. Little millet was roasted before it was made into flour. All the ingredients were powdered. Cookie dough was prepared according to the following formula: 100 g composite flour (contain different proportions of flour as given in Table 1.), 30 g sugar, 35 g shortening, 1 g sodium chloride, 0.5 g sodium bicarbonate, 1 g ammonium bicarbonate, 0.5 g baking powder, and various proportion of water and milk to make required consistency of dough [8].

A total of nine cookies were formulated including the standard cookies. Cookies were evaluated organoleptically for different quality attributes using a nine point hedonic scale by 30 semi trained panel which included the staff and students of the Department of Foods and Nutrition RVS College of Arts and Science, Coimbatore.

The nutrient content of the best cookies obtained by sensory analysis was analyzed along with the standard cookies. The energy content was determined using bomb calorimeter; the nitrogen content of moisture free samples was estimated using kjel plus method. Crude fat was extracted in moisture free samples by refluxing with petroleum ether in socs plus apparatus, Iron content by Spectrophotometric method and Zinc content by atomic absorption Spectrophotometry.

Adequate number of cookies were wrapped in butter paper and packed in stainless steel containers, and stored at room temperature for shelf life study. The sensory analysis was carried on the first, 15th and 30th day of storage.

Microbial load was done on the first and 30th day of storage. Total plate counts were recorded as per APHA procedure using nutrient agar to determine the microbial load [9].

Table 1. Proportion of ingredients in composite mix

Composite Mix	Name of the Ingredient	Proportion of Ingredients (g)			
		A	B	C	D
Composite Mix I (CM I)	Little Millet	30	25	20	15
	Coconut meal	10	10	10	10
	Rice flakes	10	10	10	10
	Wheat germ	10	15	20	25
	Wheat flour	40	40	40	40
Composite Mix II (CM II)	Little Millet	30	25	20	15
	Wheat germ	10	15	20	25
	Sesame seed	10	10	10	10
	Coconut meal	10	10	10	10
	Wheat flour	40	40	40	40

3. Results and Discussion

3.1 Sensory Analysis

Sensory analysis can be considered to be an interdisciplinary science that uses human panellists since there is no one instrument that can replicate or replace the human psychological and emotional response.

The results of the sensory analysis show that the appearance of CFM I A cookies was the highest with a score of 8.86±0.61. CFM II Cookies obtained the lowest score for the criteria colour among the various cookies prepared. The taste of CFM I A was better than the standard as it obtained a higher score than the standard. The acceptability of composite mix I cookies was better than the composite mix II cookies in all the criteria. The scores obtained for the composite mix IA cookies were on par with the values obtained for the standard cookies. The cookies developed with 30% of little millet (CFM I A AND CEM II A) scored the highest in both the composite mix developed with regard to the taste criteria. The results of a previous study carried out by Vijayakumar and Mohankumar [10] showed that the Millet flour blend prepared by mixing equal proportion of kodo Millet flour and barnyard Millet flour improved the quality of composite flour in terms of increasing nutrient density, thinned the gruel by lowering viscosity and increased in the level of syneresis which may improve the resistant starch content on storage The mean sensory analysis scores of the present study also show that millets based composite flour improved the quality of cookies which is in accordance with the above mentioned study..

Table 2. Mean sensory scores of standard and composite flour mixes incorporated cookies

Cookies	Appearance	Colour	Flavour	Texture	Taste
STANDARD	8.83±0.42	8.86±0.34	8.60±0.28	8.68±0.24	8.56±0.33
CM I A	8.86±0.61	8.76±0.62	8.90±0.66	8.86±0.62	8.68±0.56
CM I B	8.13±0.57	7.63±0.58	7.56±0.48	8.40±0.61	8.40±0.60
CM I C	8.83±0.76	8.33±0.65	8.43±0.62	8.13±0.56	7.73±0.78
CM I D	8.43±0.86	8.26±0.88	8.50±0.62	8.00±0.84	8.03±0.81
CM II A	7.96±0.61	7.96±0.61	8.43±0.67	8.63±0.61	8.26 ±0.69
CM II B	7.36±0.92	7.36±0.92	7.53±1.07	7.53±0.94	7.60± 1.03
CM II C	7.43±0.89	7.29±1.73	7.16±1.20	7.20±0.98	7.36 ±1.15
CM II D	7.06±1.11	7.96±0.61	6.90±1.18	6.96±0.99	7.06 ±1.26

3.2 Nutrient Analysis

Nutrition properties of the Composite flours mix incorporated cookies were analysed along with the standard cookies to find out the efficacy of the composite flour in terms of nutrient content.

Table 3. Nutrient content of cookies (100g)

S. No	Nutrient	Standard	CFM I A	CFM II A
1.	Energy(Kcal)	485	517	541
2.	Protein(g)	4.8	11.8	8.0
3.	Fat(g	20.2	22.5	20.3
4.	Carbohydrates(g)	53.7	68.8	67.8
5	Calcium (mg)	236.0	242.0	230.0
6.	Iron(mg)	6. 8	15.8	12.2
7	Zinc(mg)	0.52	3.5	4.6

The energy content of 100g of the standard cookie and the CFM I A and CFM II A was 485 kcal, 517 kcal and 540 kcal respectively. The protein content was double and increased up to three times in CFM II A and CFM I A when compared with the standard cookies. The iron content and zinc content of CFM IA and CFM II A was 15.8mg, 3.5mg and12.2mg, 4.6mg respectively In a study conducted by Sivakumar and Sarojini [11] Coconut meal available as thin flakes was shade dried for 5-7 days and finally powdered using micropulverizer. Rice flakes were powdered separately to a fine texture. By changing the proportion of the ingredients, ten variations were finally selected for acceptability trials. Processing improved the texture of the biscuits. The biscuits from the variation V with 20 g coconut meal scored highest level (4.10±0.74). The general acceptability of the value added biscuits were influenced by processing the ratio of ingredients in the flour mixture and, organoleptic attributes of flavour, texture and colour.. In terms of overall acceptability, the panel list preferred the product of the variation V (4.05±0.74), this could be attributed to the beneficial of processing which improved colour, flavour and texture of the products. All the biscuits sample variation had acceptability scores except variation VII due to incorporation of garden cress seed at 2.5 g. The acceptability of the products, particularly those from incorporation of high amount of deoiled coconut meal and rice flakes mixture indicates possible opportunity for further use of the biscuits in confectionery products and formulation of complementary foods. Iron content of the baked biscuits was about 14 mg, in addition it provide 35 g of fat, 8.56 g of protein and 29 g of carbohydrate, totally 100 g of value added biscuits provide 464 kcal energy.

Addition of the composite mixture improved the nutrient content of cookies as in the present study as indicated in Table 3. So it can be concluded that the results of the present study shows similar result as that of the above mentioned study.

3.3 Sensory Analysis on Storage

The standard cookies and developed cookies were wrapped in butter paper and stored in stainless steel containers to analyse the acceptability of the product on storage for a period of one month. The acceptability of the products was assessed by using a nine point hedonic score card.

The sensory analysis was carried out to show the acceptability of the products. CFM I A cookies had better acceptability than Standard Cookie on storage. The total acceptability of the CFM II A was slightly less than 7.0 on the 30th day analysis as given in Figure 1.

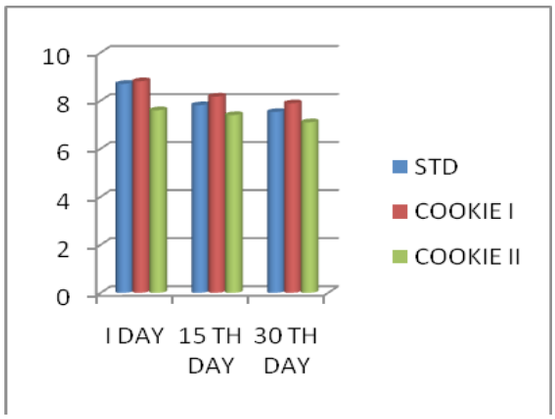

Figure 1. Mean scores for sensory analysis of cookies on storage..

In a previous study conducted by Pasha and co-workers [12], cookies were prepared from different sweeteners and were subjected to sensory evaluation for colour, taste, flavour, texture and overall acceptability at 0, 15, 30, 45 and 60 days interval of storage. The results showed that T3 (50% sucrose + 50% fructose) improved the sensory characteristics i.e. colour, taste, texture etc. of the cookies. While T4 (25% sucrose + 75% fructose) was at second position. T8 (fructose 60% + sorbitol 20% + mannitol 20%) was least accepted by the judges. Analysis of variance disclosed a highly significant difference among treatments and storage means, but the interaction was non-significant. There was a gradual decrease in the overall acceptability of the cookies during storage days but cookies remain acceptable even after 60 days storage. The result from the present study also shows that the cookies had a shelf life of one month.

3.4 Microbial Analysis on Storage

The total plate count on nutrient agar medium did not show any colonies for fresh cookies before storage. The microbial analysis of the standard cookies and formulated cookies CEM A I was found to be 1x103cfu/g and for CFM IIA was 2x103cfu/g after one month of storage when the total bacterial count was estimated.

Nagi et al., [13] studied the microbial quality of full fat cereal bran biscuits of different cereal bran biscuits under ambient conditions. Oat bran biscuits had least bacterial count (11.15x102 cfu g-1) whereas rice bran biscuits had maximum bacterial count (21.68x102 cfu g-1).Microbiological studies indicated that the cereal bran biscuits packaged in HDPE and laminates and placed at room temperature upto 3 months had better stability as the microbial load remained within the permissible limits. According to Indian standards, total bacterial count/g should not be more than 50,000 in high protein biscuits. So it can be stated that the cookies had a shelf stability of one month.

3.5 Conclusion

The formulated composite mix cookies had similar sensory attributes as that of the standard cookies. The nutrient content of the developed cookies were higher than the standard cookies. The developed products for shelf life study had a storage period of one month. Use of millets and locally available ingredients can be used to increase the nutrient content of diets and can be used as an effective tool to bridge the iron and zinc content of nutritionally poor diets.

4. References

1. Dendy D. A. V., "Composite flour past, present and the future: a review with special emphasis on the place of composite flour in the semi-arid zones". In: Gomez M. I., House L. R., Rooney L. W., Dendy D. A. V. (eds), *Utilization of sorghum and millets*. Oxford, C.A.B. International. p. 67–73, 1992.
2. Lupien J. R., "Sorghum and millets in human nutrition". FAO, ICRISAT. At: Fao.org. p. 86, 1990.
3. Gahlawat P., Sehgal S., "Protein and starch digestibility and iron availability in developed weaning foods as affected by roasting". *J. Hum. Nutr. Dietet.*, vol. 7(2), p. 121–126, 1994.
4. Singh P and Raghuvanshi, "Finger millet for food and nutritional security", *Afr. J. Food Sci.*, vol. 6(4), p. 77–84, 29 February, 2012 Available: http://www.academicjournals.org/AJFS DOI: 10.5897/AJFSX11.010, ISSN 1996-0794 ©2012 Academic Journals.
5. Yenagi N. B., "Value adding strategies for production and sustainable use of indigenous small millets". In: Krishne Gowda K. T. and Seetharam A. (Eds.), *Food uses of small millets and avenues for further processing and value addition*. p. 40–47, 2007.
6. TNAU AGRITECH PORTAL, 2005-Post Harvest Technology :: Agriculture :: Millets Availaible: http://agritech.tnau.ac.in/postharvest/pht_millets_littlemillets.html
7. Roopa U., Kasturiba B., Naik R., Malagi U., Shanthakumar G., Hemalatha S., and Mirajkar K., "Comparison of physico –chemical and functional properties of little millet genotypes", *IJFANS*, vol. 1(1), Oct-Dec 2012, ISSN 2319–1775. Availaible: www.ijfans.com
8. Singh S, Riar C. S. and Saxena D. C., "Effect of incorporating sweetpotato flour to wheat flour on the quality characteristics of cookies". *Afr. J. Food Sci.*, vol. (2), p. 065–072, 2008.

9. American Public Health Association (APHA). *Compendium of Methods for the Microbiological Examination of Foods*, 2nd Edition. APHA, Washington, D.C., 1984.
10. Vijayakumar and Mohankumar. "Formulation and characterization of Millet flour blend incorporated composite flour", *Int. J. Agr. Sci*., vol. 1(2), p. 46–54, 2009, ISSN: 0975-3710.
11. Sivakumar S. and Sarojini K. S., "Formulation of Value added biscuits using defatted coconut flour", *Am. J. Food Tech*., vol. 8(3), p. 207–212, 2013. ISSN 1557-4571/ DOI:10.3923/ajft.2013.207.212.
12. Pasha I., Butt M. S., Anjum F. M. and Shehzadi N., "Effect of Dietetic Sweeteners on the Quality of Cookies", *Int. J. Agr. Biol*., 1560–8530/2002/04–2–245–248, 2002.
13. Nagi H. P. S., Kaur J., Dar B. N. and Sharma S., "Effect of Storage Period and Packaging on the Shelf Life of Cereal Bran Incorporated Biscuits". *Am. J. Food Tech*., vol. 7, p. 301–31, 2012.