



Development and standardization of technology for drumstick leaves powder enriched crackers

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Abstract

The potential of drumstick leaves powder are of great value and accepted world-wide but its utilization in locally acceptable recipe is challenge because of bitter taste imparted by the leaves powder. Hence present investigation has been carried out to prepare quality drumstick leaves powder by adopting nutrient efficient processing technique, chemical blanching and cabinet drying and also utilize the prepared drumstick leaves powder in crackers which was analyzed for its proximate, mineral and phytochemical composition. Results revealed that 5% DLP enrichment in crackers yielded good quality product comparable with control in terms of sensory evaluation. 100gm of 5% DLP enriched crackers could satisfy RDA of childrens in terms of protein, calcium and beta carotene and some amount of ascorbic acid while it satisfies 33% of male, 50% of female protein and 100 % beta carotene requirement by lactating and pregnant women.

Keywords: cracker, drumstick leaves powder, RDA

1. Introduction

Snacks available in market are devoid of balanced nutrients e.g. potato chips, extruded products, chocolates etc. These are unhealthy offerings for the consumers especially school going children.

Many teenagers have high calorie needs, especially during growth spurts, and snacks chosen by teenagers often are high in fat and/or sodium, and low in key nutrients such as iron, calcium, vitamin A, vitamin C, and folate ^[1]. Teenagers need to know how to balance low nutrient dense meals with meals and snacks rich in vitamins, minerals, and phytochemicals from whole grains, fruits, vegetables, and legumes ^[2]. There is a variety of food crackers available in the market such as high fiber crackers, healthy cracker, low fat or cholesterol free crackers, multigrain crackers etc. These all offer specific benefits for the target consumers. These are ready to use, thus lure the school going children, office workers and athletes to maintain their energy level and can even be supplied to the target populations in the situation of an emergency. A nutrient dense food cracker is a food article carrying all the major nutrients in good balance.

Wheat is one of the popular cereals that supply the basic nutritional and energy requirements of the population. However, its protein quality is poor. Lysine is the first limiting essential amino acid in wheat flour; threonine and tryptophan are also in major amounts ^[3]. The quality of a product with a big portion of wheat constituents can be improved by fortifying with suitable edible proteinaceous materials such as legumes, relatively rich in lysine, threonine and tryptophan. On the other hand, legumes possess poor digestibility and contain antinutritional factors such as phytates, tannins ^[4], amylase inhibitors ^[5], hem agglutinins ^[6]. These Antinutritional factors are of great concern.

Moringa is said to be the new hope in efforts at minimizing malnutrition and various related ailments. The leaves of this plant have been reported to have high amounts of essential amino acid with the right balance, as well as high amounts of minerals and vitamins ^[7]. Anecdotal evidence from communities that use Moringa as food and herb, suggest that the leaves do not only provide good nutrition, but they are also believed to suppress diabetes and hypertension in adults.

In view of the nutritional, therapeutic and prophylactic properties of drumstick leaves and also to combat protein malnutrition in the children of low income group it is imperative to prepare value added products from drumstick leaves. In the present investigation an efforts have been made to utilize drumstick leaves powder in cracker to increase nutritional profile.

2. Material and methods

2.1 Preparation of drumstick leaves powder

Fresh drumstick (*Moringa olifera*) leaves cultivar variety Coimbatore were procured and processed within 2 hrs after procurement. The *moringa olifera* tops (about 15 cm in length from the tip of the plant) leaflets obtained after harvesting were sorted to eliminate damaged ones and washed. The leaves were given pretreatment of chemical blanching containing 0.5% potassium metabisulphite (KMS), 0.15% Magnesium Oxide (MgO), 0.15% Sodium Carbonate (Na₂CO₃) was prepared in the ratio of 1:3 of leaves: chemical solution at 80°C for 1-2 min. The excess of water was drained and pretreated leaves were dried by using cabinet dryer at 60 °C for 6 hrs. The leaves were allowed to dried until constant weight and further milled to get drumstick leaves powder DLP (mesh size. 150µm) and packaged into polypropylene films to avoid moisture absorption.

2.2 Product development

2.3 Preparation of Drumstick crackers

Crackers were prepared by using formulations given by [8] with some modification and the standardized recipe is given as follows.

Recipe

Ingredients	Quantity (gm)
Maida	= 100 g
Sugar	= 10.0g
Fat	= 15.0g
Salt	= 2.0g
Milk	= 40ml
Baking powder	= 1.0 g
Ammonia	= 1.0g
Drumstick leaf Powder	= 5.0g

All dry ingredients like maida, sugar, salt, baking powder, ammonia and drumstick leaves powder are mixed in large bowl and then butter was cut with 2 knives until it looked like cornmeal. 40 ml of milk was stirred in until the dough formed a stiff ball. Further dough was rolled out until it was about 1/8 of an inch thick. With a cookie cutter dipped in flour, crackers were cut out. These were placed on an ungreased cookie sheet and pricked on the top in several places with a fork. The top of each cracker was brushed with milk. The crackers were baked for 8-10 minutes at 218°C, or until they were light gold, cooled on a rack and stored in polyethylene airtight lock bag at room temperature.

2.4 Sensory Analysis

The sensory evaluation of crackers was carried out by a 10 member trained panel with 9 point hedonic scale with corresponding descriptive terms ranging from 9 'like extremely' to 1 'dislike extremely'.

2.5 Chemical analysis

The prepared drumstick leaves powder was analyzed for its proximate contents using the [9] method. The moisture content was determined by air-oven drying at 130°C for 1 hr, and the crude protein contents by micro Kjeldal method (% protein = N x 6.25). The lipid content was determined using petroleum ether (bp. 60-80°C) in a soxhlet extraction apparatus and crude fiber content by dilute acid and alkali hydrolysis. Five (5) grams of dried powder sample was dissolved in 6 M HCl solution and the resulting solution was made up to a definite volume (20ml) and used for the determination of minerals viz., copper, manganese, iron and zinc were determined by Atomic absorption spectrophotometer (AAS200-Perkin Elmer) while calcium was determined by using method given by [10]. The total phenol content was determined by the method of [11] with some modifications and vitamin C was estimated by the method as described by [12] while beta carotene was calculated by [13].

2.6 Statistical analysis

The analysis of variance of the data obtained was done by using Completely Randomized Design (CRD) for different treatments as per the methods given by [14]. The analysis of variance revealed at significance of $P < 0.05$ level, S.E. and C.D. at 5 % level is mentioned wherever required.

3. Result and discussion

During the present research attempts have been made to utilize DLP prepared by cabinet drying was used for enrichment of crackers. The recipes have been standardized by conducting sensorial evaluation of cracker recipes having different proportion of DLP (5 to 15 %).

Table 1: Standardized recipe for production of cracker

Ingredients	Quantity (gm)
Maida	100
Sugar	10
Fat	15
Salt	2.0
Milk	40 ml
DLP	5,7.5,10,12.5,15
Baking Powder	1.0
Ammonia	1.0

3.1. Sensory Evaluation

A panel of semi-trained judges consisting of eight members were given crackers enriched with different proportion of DLP viz. 5, 7.5, 10, 12.5, 15 % and evaluated for organoleptic characteristics. The color of prepared crackers with different proportion of DLP i.e. 5, 7.5, 10, 12.5 was found to be almost similar. Cracker sample E not liked by panel member and rejected on the basis of dark color imparted by high level of DLP. However there was not much statically difference on the basis of critical difference.

Table 2: Effect of Addition of Different Proportion of Drumstick Leaves Powder on Sensory Properties of Crackers

Samples	Color	Appearance	Aroma	Taste	Texture	Mouth Feel	Over all Acceptability
A	8	8	8	8	8	8	8
B	8	8	8	7	8	7	7.6
C	8	7.5	8	7	6	6.5	7.16
D	7.5	7	6	6.5	6	6	6.5
E	5	5	5	5	5	5	5
SE±	0.166	0.0924	0.1314	0.120	0.1139	0.126	0.0742
CD at 5%	0.522	0.2909	0.4133	0.377	0.358	0.397	0.233

A= 5 percent DLP, B=7.5 percent DLP, C= 10 percent DLP, D= 12.5 percent DLP, E= 15 percent DLP

The mean score values for appearance of prepared crackers with 5 per-cent and 7.5 per-cent DLP were found to be significantly superior over remaining samples. The cracker with 15 per-cent DLP was rated lowest score indicated their least acceptability. As percent addition of DLP increased, the appearance of prepared cracker was found to be decreased may be due to getting rough surface as of high DLP in flour. The aroma character was more acceptable for sample A, B and C (8.0). Further sample D and E were possessing leafy aroma due of high conc. of DLP as commented by judges.

The acceptable taste was observed in case of sample A followed by samples-B and C, whereas sample-D and E rated lower score. The addition of 5 percent DLP in cracker sample A was found to be statistically significant over all other prepared cracker. It is important to note that the taste characters were decisively governed by the level of DLP in crackers as the level of DLP increases there was increase in the bitterness of prepared cracker which forced the judges to offer lower score to the subsequent sample.

The DLP in combinations with flour exhibited wide differences with regard to texture character of final product ranging from 8 to 5. The panel members given maximum score for the sample-A and B (8.0) followed by C and D (6.0). It was also observed that blended ratios of flours and DLP had significant effect on the texture of crackers but its effect is desirable up to 7.5 percent. As the conc. of DLP increases the chewiness is also increased which is not desirable characteristic of cracker and hence the sample A having 5 percent of DLP was more acceptable among all other product while the sample E was neither like nor disliked because of high fiber content of DLP the cracker appeared more chewy. It is seen from the results that variation do exists in overall acceptability score. Highest score was observed in sample A. The overall acceptability of crackers could be attributed to the different characters of appearance, colour, taste, aroma, texture and mouth feel of the final product. It is revealed from the scores of the overall acceptability that the 5% DLP can be successfully mixed to flour to produce a better acceptable product, Moreover the product A was found to be over all acceptable and also statistically significant over other cracker, whereas lower score was reported in the sample E having 15 percent DLP which indicates its least acceptability.

The results of addition of different proportion of DLP in cracker reveals that 5 per cent addition of DLP with standardized recipe of cracker recorded highest score in all the organoleptic qualities and found to be over all acceptable.

Among all the prepared samples of crackers, the sample A with 5 percent DLP was superior and yielded a good quality product especially with reference to taste, mouthfeel and over all acceptability and this formed the basis for the selection of sample A for further analytical studies.

3.2 Proximate composition of crackers

Further sincere efforts have been made to study the retainability of nutrients in the selected crackers (5 percent DLP) after baking at high temperature (218°C) with respect to proximate, minerals, phytochemical composition. The effect of baking on proximate composition of prepared cracker are analyzed and obtained results are tabulated in Table 3.

Table 3: Effect of Drumstick Leaves Powder Addition on Proximate Composition of Crackers

Constituents (%)	EC	Sample A
Moisture content	3.9	4.15
Ash	1.98	3.37
Carbohydrates	67.38	58.12
Protein	12.28	19.32
Fat	12.78	14.78
Crude fiber	0.78	2.82

Where, EC = Experimental Control Crackers Sample A = 5% DLP Enriched Cracker

The proximate composition was increased due to enrichment except carbohydrates (58.12 %) when compared with experimental control sample (67.38 %). The moisture and fat content was found to be satisfactory and in the permissible limit^[15] for both cracker samples i.e. crackers must contain less than 5% moisture and less than 15% fat. The protein content of DLP enriched cracker was also found to be more (19.32%) against control crackers. Enriched cracker showed substantial minerals

retainability interms of ash content (3.37) and high fiber content (2.82%) that could help in micronutrient deficiencies and problem related to digestion, constipation respectively. The high protein content (19.32%) of enriched crackers full fill the RDA of infants (14gm/day), children (16-28gm/day), 33% of male (57 gm/day), 50% female (38gm/day) protein requirement^[16]. The protein content control sample is 12.28% with lack of essential amino acid and some amount of antinutritional factors present in wheat flour but the sample A crackers is devoid of such antinutritional factors and essential amino acid deficiency because it contain DLP which contains almost all essential amino acid in reasonable amount.

3.3. Phytochemical and Mineral Composition

Table 4: Effect of Drumstick Leaves Powder Addition on Mineral Composition of Crackers

Samples	EC	Sample A
Ca %	0.30	0.64
Fe mg/100gm	1.0127	1.1107
Zn mg/100gm	0.5954	0.7782
Cu mg/100gm	0.0645	0.0703
Mn mg/100gm	0.2096	0.295
β Carotene mg/100gm	0.4	5.9
Ascorbic Acid mg/100	2.3	4
Total Phenolic Compound (%)	0.228	0.454

The DLP enriched crackers resulted in high calcium (0.64%) which full fills the RDA of infants, childrens and 50% of male and female RDA. The other minerals also increased to some extent. The beta carotene retained in enriched cracker during processing could provide RDA of lactating and pregnant women while the high amount of total phenolic compound (0.454%) was also found. The ascorbic acid is mostly destroyed during processing and was very low i.e 4mg/100 due to high temperature.

Conclusion

It can concluded that pretreatment of *Moringa olifera* leaves with chemical blanching and subsequent cabinet dying could contributes good quality drumstick leaves powder and which can be enriched at 5% level to obtain comparably good quality crackers interms of its nutritional, mineral and phytochemical composition as compare to control crackers.

Reference

1. Rolfes SR, DeBruyne LK, Whitney EN. Life Span Nutrition. Conception Through Life. Second Edition. Belmont CA: Wadsworth Publishing Company, 1998.
2. Position of the American Dietetic Association (ADA). (2000). Nutrition, aging, and the continuum of care. J Am Diet Assoc. 1998; 100:580-595.
3. Schaafsma G. The protein digestibility-corrected amino acid score (PDCAAS)—a concept for describing protein quality in foods and food ingredients: acritical review. J. Assoc. Off. Anal. Chem. 2005; 88(3):988-994.
4. Yadav S, Khetarpaul N. Indigenous legume fermentation: effect on some antinutrients and in vitro digestibility of starch and protein. Food Chem.50:403-406.York: Chapman & Hall, 1994.

5. Lajolo FM, Filho FF, Menezes EW. Amylase inhibitors in *Phaseolus vulgaris* beans. Food Technol. 1991; 9:119-121.
6. Bressani R. Grain quality of common beans. Foods Rev. Int. 1993; 9:237-297.
7. Fuglie LJ. The Miracle Tree: *Moringa oleifera*: Natural Nutrition for the Tropics. Church World Service, Dakar. 68 pp.; revised in 2001 and published as The Miracle Tree: The Multiple Attributes of Moringa, 1999, 172 pp. http://www.echotech.org/bookstore/advanced_search_result.php?keywords=Miracle+Tree.
8. Hodgman A. Plain Crackers In: Beat That! Cook book. Chapters Publishing, USA, 1995, 46.
9. AOAC. Official methods of analysis of the association of official analytical chemists (15th edition), Washington D.C, 1990, 992-995.
10. Piper CS. Soil and plant and plant analysis. Inter science publisher, Inc., New York, 1950, pp279-280.
11. Makkar HPS, Bluemmel M, Borowy NK, Becker K. Gravimetric determination of tannins and their correlations with chemical and protein precipitation methods. Journal Science Food Agriculture. 1993; 61:161-165.
12. Ranganna S. Methods of analysis of fruits and vegetables products. Tata McGraw-Hill publishing Co. Ltd., New Delhi, 1986.
13. Jensen A. Chlorophylls and carotinoids In: Hellbust, A and J.S.Cargie (eds.) Handbook of phytological methods, Cambridge Uni. Pres, London, 1978, 59-70.
14. Panse, Sukhatme. Panse V.S. and Sukhatme P.V. (1967). Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research. New Delhi, 1967, 70-72.
15. The US. Department of Agriculture. (1998). Commercial Item Description, Crackers.
16. RDA. 10th ed. Washington DC. National Academy Press, 1989.