Research Article

Study on Physicochemical Properties of Multigrain Mix Incorporated With Unripe Banana Flour

S Shalini*, T Swathi, S Janani, K Geetha and D Periyar Ramasamy

Department of Social Sciences, Anbil Dharmalingam Agricultural College and Research Institute, Tamil Nadu Agricultural University, Tiruchirappalli, Tamilnadu, India

Abstract

The study was carried out to improve the level of resistant starch (RS) in a multigrain mix using unripe banana flour and to investigate the effect of substitution of unripe banana flour for wheat flour on the nutritional and sensory characteristics of banana based multigrain mix chapatti. While preparing multigrain mix, the wheat flour was replaced with unripe banana flour (Karpuravalli and Red banana) with different levels (10, 15 and 25%). The results indicated that the nutritional quality of the banana based was found to higher in fibre and resistant starch than the control sample. The organoleptic characteristics and consumer preference of banana based product was highly acceptable for various attributes when compared with control.

Keywords: Unripe banana, resistant starch, multigrain mix, fibre

***Correspondence**

Author: S Shalini

Email: shalini12797@gmail.com

Introduction

Banana is the common name of herbaceous plants of the genus Musa and for the fruit they produce. Banana plants are monocotyledons, perennial and important crops in the tropical and subtropical world region. [1]. Banana has high nutritional value and it contains higher flavonoids, dietary fibre (DF), and resistant starch (RS) at its early stage of ripeness than when it is ripe [2]. Carbohydrates constitute the main fraction of unripe fruits, starch and non-starch polysaccharides (dietary fibre) are the major constituents [3, 4]. Dietary fibre plays an important role in the prevention and treatment of obesity, atherosclerosis, coronary heart diseases, colorectal cancer and diabetes [5] and [6]. One of the important features of RS is that of not being digested within 2 hours in the intestine and it enhances the growth of probiotics in the large intestine, which may have a positive indirect effect on colorectal cancer [7].

One of the current tendencies in nutrition and health is to consume low-carbohydrate food products. Consumers are demanding foods for traditionally nutrition content food with additional health benefits for regular ingestion. In a rapidly changing world, with altered food habits and stressful life styles, it is more and more recognized that a healthy digestive system is essential for overall quality of life [8]. In order to deliver additional health benefits using a functional ingredient, a mixture of banana flour and other alternative flours has been proposed in mostly starch-based food products, such as pasta [9], bread [10,11] cake [12, 13] and gluten-free products [14, 15].

Composite or multicereal /grain flour products are prominently focused as the primary carriers of nutrition. Additionally, these composites help to minimize the quantity of wheat flour required and extend the accessibility and availability of wheat flour [16]. There is huge opportunity to utilize the composite or multi-cereal/grain product development to meet customer needs and improve the diet [17].

Now-a-days consumers demand convenience, quality, healthy and innovative food products. Consumers expect the food producers to deliver high quality products for a reasonable price. Increased attention to health along with the unavailability of unique foods plus a strong consumer demands for convenience creates the need for convenience foods [18]. Hence, the current work was carried out with a perspective to improve the nutritional quality of multigrain ready to use convenience food by incorporating unripe banana flour to wheat flour without significantly affecting its sensory attributes.

Materials and Methods

All the ingredients such Banana, Wheat, Ragi, Cumbu, Kuthiraivalli, Sorghum, Bengal gram, Banyard millet, salt, oil were purchased from local market Tiruchirappalli. The standard procedure was adopted for preparing multigrain mixes by using Karpuravalli and Red banana flours at different levels viz., 10 % (K1 and R1), 15 % (K2 and R2) and 25 % (K3 and R3) in combination with composite flour mix (Ragi, Cumbu, Kuthiraivalli, Sorghum, Bengal gram, Banyard millet). The multigrain mix prepared from banana based (10, 15 and 25%) were compared with the control (without banana flour).

The banana based multigrain mix was used for preparation of chapattis were 50.0g banana based multigrain mix flour, oil 3.0g, 3.0g salt and luke water and knead into a soft dough. After preparation of dough in chapattis were rolled to the thickness 3 to 4 inch and cooked on pre heated flat pan and after heating from one side it was turned over and heated from the other side. Chapatti was puffed on open flame for 2 to 4 seconds. The prepared products used for the sensory evaluation.

The sensory characteristics of the product prepared from the multigrain mix were studied. Ten untrained judges were utilized to evaluate the samples by adopting 1-9 point hedonic scale. The sensory evaluation test was repeated thrice to get accurate data. All the treated samples were found to be highly accepted for various quality attributes and resembled like control. For the study, 25 per cent (K3 and R3) levels of banana flour (both varieties) were selectedfor preparing multigrain mixes

Functional quality

Multigrain mix (control and banana based) were analysed for their functional quality such as Bulk density (g/cc), Dispersibility (ml), Swelling index (ml/g) and Swelling capacity (%) by the procedure.

Chemical Analysis

The chemical components such as moisture, protein, fat, calcium, iron and zinc content of the sample was analysed as per the procedure [19].

Organoleptic Evaluation

The product (Chappathi) prepared from banana based multigrain mix and control were evaluated for various quality attributes such as colour, texture, flavour, taste and overall acceptability, by a panel of ten untrained judges using 9 point hedonic scale as per the procedure [20].

Consumer acceptability

The consumer preference test was conducted at the Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli with staff, students product (Chappathi) prepared from banana based multigrain mix and control, and the subjects were asked to evaluate the served products with the help of the scorecard. The average of the consumer preference score was calculated for each sample, for each attribute. The consumer preference for each attribute of each sample was expressed in percentage

Results and Discussion

The multigrain mixwere prepared by replacing banana flour (25%) in the place of wheat flour. The chemical composition, functional qualities and consumer preference of the banana based multigrain mix were analysed and discussed.

Chemical composition of banana based multigrain mix

Among the samples, control had higher starch and protein content than the treated samples (R3 and K3). The starch and protein content of the multigrain mix ranged from 69.55 to 76.12 g/ 100 and 12.58 to 14.61g / 100g respectively. The resistant starch content of banana based multigrain contained 29.82 g/100g in R3 and 29.75g /100g in K3 respectively. The resistant starch content of banana based multigrain samples was found to be higher than the control samples (without banana flour). The fibre content of the banana based multigrain mix samples (14.81 and 14.80g/ 100g) were lesser than control sample (14.27g/100g).The ß Carotene content of the banana based samples were higher than the control sample. The ß Carotene content banana based multigrain mix ranged from 23.94 to 29.85 µg/100g Table 1 [21].

Functional Properties of banana based multigrain mix

The data revealed that the bulk density and swelling index of the banana based multigrain mix was more or less similar to control sample and it ranges from 1.30 – 1.37 g/cc. and 5.1 – 6.0 ml/g respectively. The dispersility and swelling capacity of the banana-based sample was higher than the control sample Table 2 [21].

Table 1 Chemical composition of banana based multigrain mix

SI. No	Chemical composition	Control	R3	K3
1.	Moisture (g/100g)	13.70	11.39	11.44
2.	Resistant starch(g/100g)	10.75	29.82	29.75
3.	Starch (g/100g)	76.12	69.61	69.55
4.	Protein (g/100g)	14.61	12.58	12.60
5.	Fat (g/100g)	2.67	2.45	2.44
6.	Fibre (g/100g)	14.27	14.81	14.80
7.	Ashes (g/100g)	2.12	2.38	2.25
8.	ß Carotene(µg/100g)	17.73	29.85	23.94
9.	Calcium(g/100g)	53.96	46.51	44.32

Table 2 Functional Properties of banana based multigrain mix

Properties	Control	Banana based Multigrain mix	
		R3	K3
Bulk density (g/cc)	1.30	1.32	1.37
Dispersility (ml)	50	52	73
Swelling Index (ml/g)	5.1	6.0	5.3
Swelling capacity (%)	160	178	200

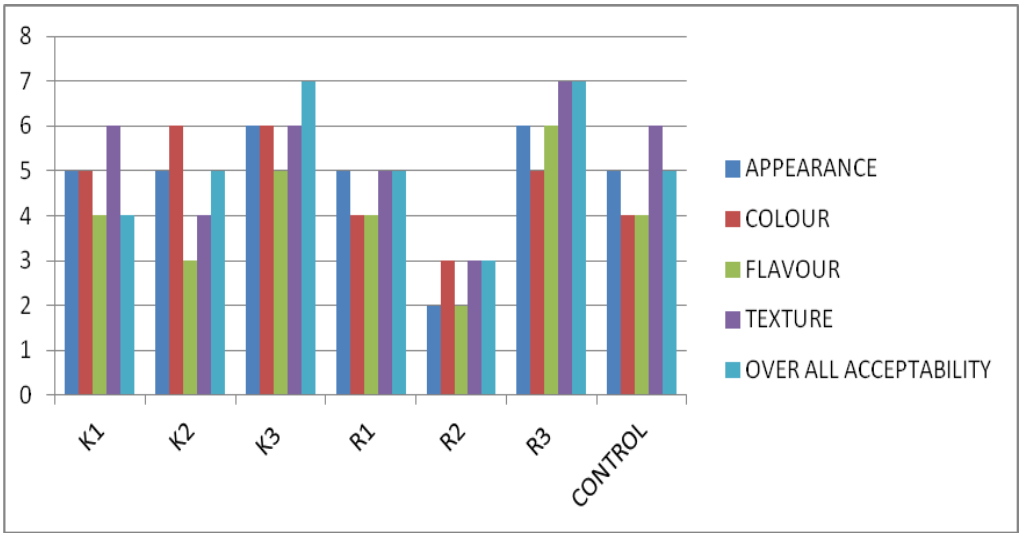

Figure 1 Organoleptic characteristics of the product prepared from banana based multigrain mix

Table 3 Consumer preference of the product prepared from banana based multigrain Mix

Sensory attributes	Control (%)	R3 (%)	K3 (%)
Appearance	76	87	80
Colour	78	82	79
Flavour	85	89	84
Texture	87	90	88
Overall acceptability	80	90	88

Organoleptic characteristics of banana based multigrain mix

Among the treatments (R1, R2, R3, K1, K2, and K3), the data presented in the figure showed that the banana based sample R3 and K3 secured a highest score for all attributes such as appearance, colour, flavour, texture and overall acceptability than the control sample Fig 1 [21].

Consumer preference of the product prepared banana based multi grain mix

From the data on the consumer preference of product prepared from multigrain mix (Chappatti) indicated that the banana based were highly acceptable than control. Among the treatments, banana based R3 had secured the highest score for all the attributes when compared to K3. If the flours are replaced at optimum levels with appropriate quantum of raw ingredients by adopting proper processing techniques will definitely result the highly acceptable product Table 3 [21].

Conclusion

Nutritional quality of banana based multigrain mix was found to be higher than the control, which contain high fibre and resistant starch. The functional quality of the banana based showed better quality characteristics when compared with control. The organoleptic evaluation of the R3 and K3 sample was found to be highly acceptable than the control. Consumer preference test showed that R3 was highly acceptable. It is concluded that by incorporating unripe banana flour up to 25% by replacing wheat flour increases the fibre and resistant starch level.

Reference

[1] Strosse, R.H, H. Schoofs, B. Parries, F. Andre, Reyrersk, R. Swennen. 2006. Development of Embrogenic cell Suspension from Short Meristematic Tissues in Banana and Plantain. Plant Sci, Vol.170: Pp:.104-112.

[2] Vu, H.T. Scarlett, C.J. Vuong, Q.V. 2018. Phenolic compounds within banana peel and their potential uses: A review. J. Funct. Foods. 40, 238–248.

[3] Figuerola F, Hurtado ML, Est´evez AM, Chiffelle I, Asenjo F. 2005. Fibre concentrates from apple pomace and citrus peel as potential fibre sources for food enrichment. Food Chem 91: 395–401.

[4] Gallaher D, Schneeman B.O. 2001. Dietary fiber. In: Bowman B, Russel R (eds). Present knowledge in nutrition. 8th ed. Washington DC. p 805.

[5] Terry P. 2001. Fruit, vegetables dietary fiber, and risk of colorectal cancer. J Natl Cancer Inst 93: 525–533.

[6] Peters U. 2003. Dietary fibre and colorectal adenoma in a colorectal cancer early detection programme. Lancet. 361: 1491–1495.

[7] Amini, A. Khalili, L. Keshtiban, A.K. Homayouni, A. 2016. Resistant Starch as a Bioactive Compound in Colorectal Cancer Prevention. In Probiotics, Prebiotics, and Synbiotics: Bioactive Foods in Health Promotion; Watson, R.R., Preedy, V.R., Eds.; Academic Press: Cambridge, MA, USA, pp. 773–780.

[8] Brouns F, Kettlitz B, Arrigoni E. 2002. Resistant starch and the butyrate revolution. Trends Food Sci Technol 13: 251–261.

[9] Agama-Acevedo, E. Islas-Hernandez, J.J. Osorio-Díaz, P. Rendón-Villalobos, R. Utrilla-Coello, R.G. Angulo, O. Bello-Pérez, L.A. 2009. Pasta with unripe banana flour: Physical, texture, and preference study. J. Food Sci.74, S263–S267.

[10] Gomes, A.A.B.; Ferreira, M.E.; Pimentel, T.C. 2016. Bread with flour obtained from green banana with its peel as partial substitute for wheat flour: Physical, chemical and microbiological characteristics and acceptance. Int. Food Res. J. 23, 2214–2222.

[11] Eshak, N.S. 2016. Sensory evaluation and nutritional value of balady flat bread supplemented with banana peels as a natural source of dietary fiber. Ann. Agric. Sci. 61, 229–235.

[12] Borges, A.M. Pereira, J. Silva Júnior, A. de Lucena, E.M.P. de Sales, J.C. 2010. Stability of cake pre-mixture made with 60% of green banana flour. Cienc. E Agrotecnologia. 34, 173-181.

[13] Oliveira de Souza, N.C. De Lacerda de Oliveira, L. Rodrigues de Alencar, E. Moreira, G.P. Santos Leandro, E.D. Ginani, V.C. Zandonadi, R.P. 2018. Textural, physical and sensory impacts of the use of green banana puree to replace fat in reduced sugar pound cakes. LWT—Food Sci. Technol. 89, 617–623. [CrossRef].

[14] Türker, B. Savlak, N. Ka¸sikci, M.B. 2016. Effect of green banana peel flour substitution on physical characteristics of gluten-free cakes. Curr. Res. Nutr. Food Sci. 4, 197–204.

[15] Seguchi, M. Tabara, A. Iseki, K. Takeuchi, M. Nakamura, C. 2014. Development of gluten-free bread baked with banana (Musa spp.) flour. Food Sci. Technol. Res. 20, 613–619.

[16] Gupta, S., Cox, S. and Abu-Ghannam, N. 2010. Process optimization for the development of a functional beverage based on lactic acid fermentation of oats. Biochemical Engineering Journal, 52: 199–204.
[17] Dnyaneshwar C. Kudake, Amesh V. Pawar, Abhijeet B. Muley, Vishal R. Parate and Mohammed I. Talib. 2017. Enrichment of Wheat Flour Noodles with Oat Flour: Effect on Physical, Nutritional, Antioxidant and Sensory Properties. International Journal of Current Microbiology and Applied Sciences. ISSN: 2319-7706 Volume 6 Number 12 pp. 204-213. Journal homepage: http://www.ijcmas.com.
[18] Shaikh Sarah, Prof. D.T. Bornare, Syed Ayesha. 2017. Process Optimization for Making Unripe Banana Flour and Its Utilization In Vermicelli. International Journal of Advance Scientific Research and Engineering Trends. Volume 2; Issue 10; ISSN (Online) Pp2456-0774.
[19] AOAC. 2000. Official Methods of Analysis of A.O.A.C. International. Published by A.O.A.C, Virginia, USA.
[20] Watts, B.M., G.L. Yelimaki, L.E. Jeferry and L.G. Elias. 1989. Basic sensory methods for food evaluation International Development Research Centre Canada.
[21] Shalini.S, Swathi.T, Janani.S (2018).Development of Banana Flour Incorporated Multigrain Mix Ready to Use Convience Food. Project Work. Anbil Dharmalingam Agricultural College and Research Institute, Tamil Nadu Agricultural University. Tiruchirappalli.

Publication History
Received 16.07.2020
Revised 30.07.2020
Accepted 12.08.2020
Online 30.08.2020