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Quality attributes of cookies from banana centre core flour incorporated in wheat and refined flour

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Banana centre core which is a by product and a waste in banana plantations is high in fibre content and has various health benefits. In this study, an attempt was made to incorporate banana centre core flour with wheat and refined flour at 5, 10 and 15 per cent levels for preparation of cookies. Effect of banana centre core flour incorporated was evaluated based on the physical properties and sensory evaluation of cookies prepared. In the case of cookies prepared with banana flour blended with refined flour, there was no much difference in taste and texture as revealed by sensory scores. However, in the case of cookies prepared with banana centre core flour and wheat flour, the overall acceptability of 10 and 15 per cent incorporation of banana centre core flour was at par. It was seen that there is a decline in spread factor of cookies with increase in levels of incorporation of banana centre core flour.

Key Words : Banana centre core flour, Cookies, Physical attributes, Sensory evaluation

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INTRODUCTION

Banana is the leading tropical fruit in the world market with a highly organized and developed industry. It is the fourth largest fruit crop in the world after grapes, citrus fruits and apples. India is the largest producer of banana in the world, contributing 19.71 per cent to the global production of banana, with a total production of 19.19 million tones from an area of 0.565 million hectare (Mustaffa and Sathiamoorthy, 2002). The major banana growing states are Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Tamil Nadu, Madhya Pradesh, Maharashtra, Orissa and West Bengal. In India Tamil Nadu leads in total area and production with 2514729 T from 71088 ha (Singh, 2014). In addition to fruit production, huge quantity of biomass (pseudostem, leaves, suckers etc.) is generated.

Banana pseudo stem has been known as a potential cellulose source. Presently, this biomass is discarded as waste in many countries (Khan *et al*., 2013). In past, some researchers have successfully demonstrated use of banana pseudostem and leaves for extraction of fibres on a small scale. In India, the fibres are being used for preparing handicrafts, ropes etc., which otherwise can be used for making fabrics, home furnishings and good quality papers. At present, the banana pseudostem are dumped on road side or burnt which causes environmental pollution. The centre core of banana is edible and used to prepare dish in the southern states of India. It is also used to prepare candies and pickles. Banana centre core is normally consumed because of its fibre content which aids to avoid constipation. Banana stem is a rich source of fibre and helps in weight loss (Chandrasekaran, 2012). Pseudo stem have low glycemic index and have a high content of dietary fibre and antioxidant which is good

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for diabetes (Bhaskar *et al*., 2011). Its high fibre content creates a feeling of satiation and hence, reduces the intake of food. It also helps ease constipation. Banana stem is rich in potassium and vitamin B6 just like the fruit. Vitamin B6 helps in production of haemoglobin and insulin. Again, it improves the ability of the body to fight infection. Potassium helps in the proper functioning of muscles, including the cardiac muscles. It also helps prevent high blood pressure, and maintain fluid balance within the body. Banana stem is said to be a diuretic and helps detoxify the body. It is used prevent and treat kidney stones. It has been reported that a high dietary fibre intake has beneficial effects on human health (Kaddumukasa *et al.,* 2005). The importance of food fibres has led to the development of a large and potential market for fibre-rich products and ingredients and in recent years, there is a trend to find new sources of dietary fibre that can be used in the food industry. Supplementation has been used to enhance fibre content of foods and has been focused on cookies, crackers and other cereal-based products, enhancement of fibre content in snack foods, beverages etc. (Dhingra, 2012).

Flour blends with high-dietary fibre flour have been commonly applied in the bakery industry to reduce the utilisation of large quantities of flour as well as to increase the dietary fibre intake of the consumer. The substitution of dietary flour into food may also contribute to the reduction of malnutrition. Cookies hold an important position in snack foods due to variety in taste, crispiness and digestibility. These are popular among all age groups especially in children. Commercially available cookies are prepared from white flour that is nutrionally inferior to whole wheat flour (Shahzad Hussain *et al*., 2006). Traditional biscuits are claimed to lack other essential nutritional components such as dietary fibre, vitamins and minerals which are lost during wheat flour refinement. Thus, biscuits which represent a major end-use of wheat is suitable for enhancing health after incorporating sources of fibre and essential nutrients (Asif-Ul-Alam *et al.*, 2014).

In this present study, an attempt was made to incorporate banana centre core flour in the preparation of cookies.

METHODOLOGY

Raw material :

Banana Pseudo stem, of the variety Nendran was purchased from the local vegetable mandi at Coimbatore, Tamil Nadu for the study. The other materials *i.e.*, sugar, wheat flour and refined flour for cookies preparation were purchased from local food store.

Banana centre core flour process:

In order to arrest the browning, the samples were pretreated in 0.2 per cent Potassium meta bisulphate for 10 minutes. Before pretreatment, the outer sheath of the banana pseudo stem was peeled off manually using a knife and the central core was size reduced into dices using a stainless steel knife. The diced banana centre core was dried in a cabinet dryer at 60°C. After drying, the sample was ground in a mini pulveriser to a fineness of 400 micron.

Preparation of cookies from banana centre core flour:

Banana centre core flour at various levels of incorporation *viz.*, 5, 10 and 15 per cent was used in the preparation of cookies. Cookies were prepared with both refined and wheat flour at various levels of incorporation of banana centre core flour under the study. Flow chart for preparation of cookies (Fig. A).

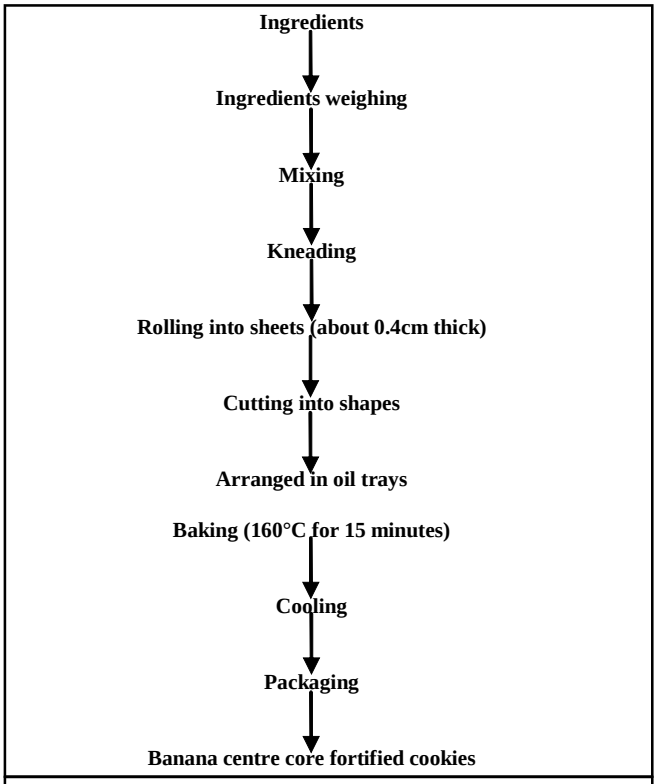

Fig. A : Flow chart for the production of banana centre core fortified cookies

Pre-weighed quantity of sugar and margarine were mixed in a mixer for about 12 minutes. Then the desired amount of egg and milk were added while mixing and then mixed for a total of approximately 30 minutes. Sifted flour of predetermined quantity wheat flour and banana centre core flour along with baking powder was slowly added into the mixture. The mixture was kneaded until dough formation. It was then rolled on a flat rolling board sprinkled with flour to a uniform thickness of about 0.4cm using wooden rolling pin and guiding stick. Circular cookies of 5.8 cm to 6 cm diameter were cut, placed on oiled trays and baked at 22^0C for 10-15 minutes, cooled to ambient temperature and packed in high density polyethylene bags.

Physical analysis of cookies :

The weight of the cookies was measured by weighing on an electronic balance with an accuracy of 0.01 mg.

Diameter :

To determine the diameter (D), six cookies were placed edge to edge. The total diameter of the six cookies was measured in mm by using a ruler. The cookies were rotated at an angle of 90 degree for duplicate reading. This was repeated once more and average diameter was reported in millimeters.

Thickness :

To determine 4 the thickness (T), six cookies were placed on top of one another. The total height was measured in millimeters with the help of ruler. This process was repeated thrice to get an average value and results were reported in mm.

Spread factor :

The spread factor was determined using Ayo *et al.* (2007) method. Three rows of the two well-formed cookies were made and the thickness was measured as well as arranging the same cookies horizontally edge and the sum of the diameter was measured.

Spread factor (SF) was determined from the diameter and thickness, with the help of following formula:

$$SF = \frac{D}{T} \times CF \times 10$$

where CF is a correction factor at constant atmospheric pressure. Its value was 1.0 in this case.

Sensory evaluation :

Sensory evaluation of cookies prepared by incorporation of banana centre core flour was carried using 9-point hedonic scale to measure the degree of preference of the samples by a group of ten semi trained panelists. Sensory attributes like appearance and colour, texture, odour, flavour and taste and overall acceptability for all biscuit samples were assessed in the following sequence: like extremely - 9, like very much - 8, like moderately -7, like slightly - 6, neither like nor dislike - 5, dislike slightly 4, dislike moderately - 3, dislike very much - 2, dislike extremely – 1 (Ranganna, 1986).

Statistical analysis :

Statistical analysis was carried out to study the effect of different parameters and independent variables. Analysis of variance (ANOVA) was conducted with Completely Randomized block Design (CRD) using the statistical software AGRES.

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Physical properties of cookies prepared from banana centre core flour incorporated in wheat and refined flour :

Diameter:

Results disclosed that the thickness of the cookies prepared from the composite flour containing banana centre core flour varied significantly between the treatments. T_1 which was control comprising of only refined flour showed the highest value as seen in Fig. 1. As the level of incorporation of banana centre core flour increased the diameter of cookies decreased. At 10 per cent and 15 per cent incorporation of banana centre core flour, the diameter was seem to be at par.

In the case of wheat and banana centre core flour incorporated cookies, highest value was found in the control sample followed by T_3 (10% banana centre core flour incorporation) (Fig. 2).

Thickness :

Mean thickness of the cookies (Fig. 3) prepared from

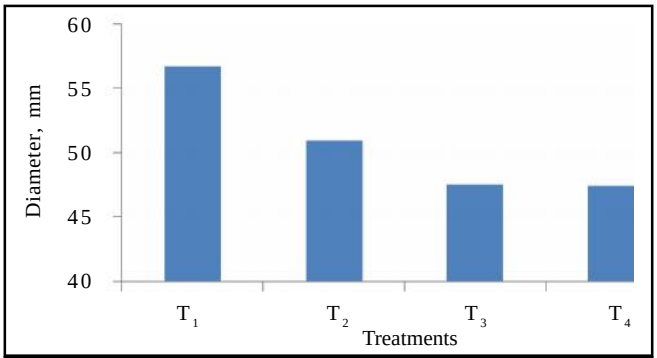

Fig. 1 : Diameter of cookies at different treatments of refined flour

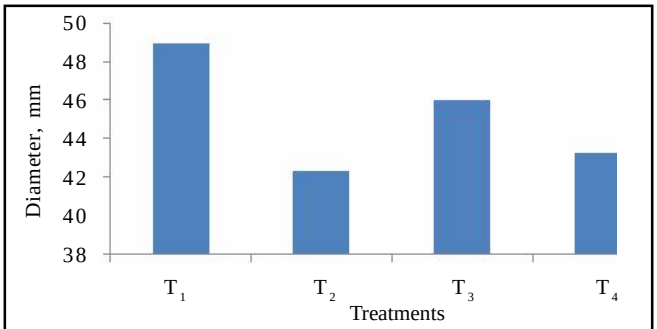

Fig. 2 : Diameter of cookies at different treatments of refined flour

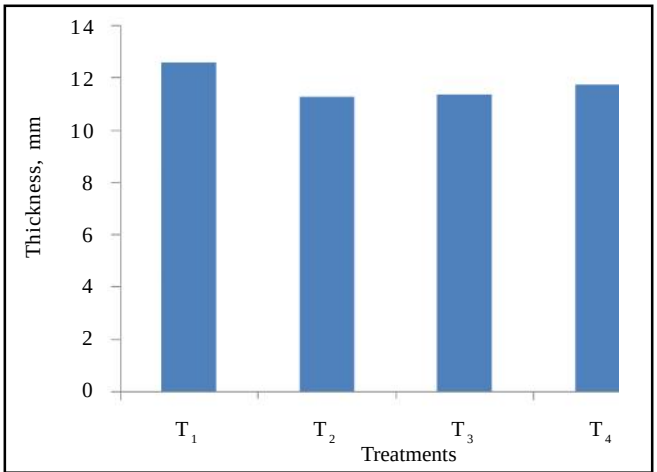

Fig. 3 : Thickness of cookies at different treatments of refined flour

the different treatments of the refined flour revealed that highest significant value (12.57 mm) was observed for the cookies prepared from control followed by T_4, Banana centre core flour incorporation at 15 per cent. However, there was not much changes in the thickness of cookies prepared with banana centre core flour incorporation at 5 and 10 per cent levels.

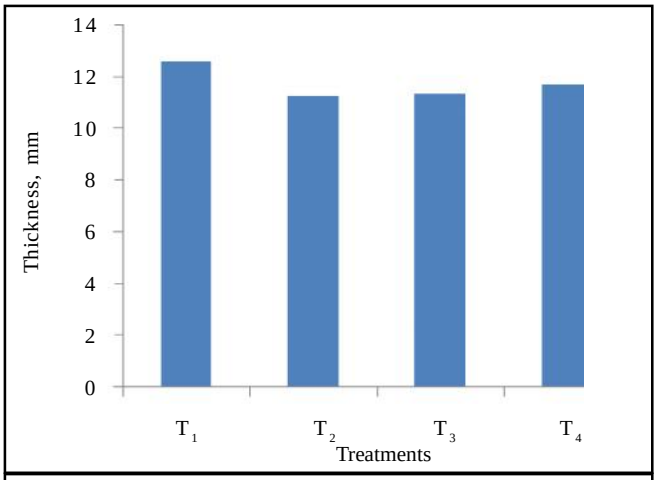

Fig. 4 : Thickness of cookies at different treatments of wheat flour

For the cookies prepared from wheat flour at different treatments (Fig. 4), T_1 showed the highest value followed by T_2 and T_4.

The thickness of the biscuits was affected positively. Thickness of the biscuits showed gradual increase as the level of Bambara groundnut flour replacement from T_1 (5%) to T_6 (30%) based on the studies reported by Ferial and Azza (2011).

Spread factor :

Spread factor is the ratio that depends on the values of the thickness and diameter of the cookies. Highest spread factor (Fig. 5) was observed in the cookies prepared from control. The spread factor at 5 per cent incorporation level was also high. The spread factor started declining with higher levels of incorporation of banana centre core flour. Cookies spread rate depend on dough viscosity. If the dough viscosity is higher, the

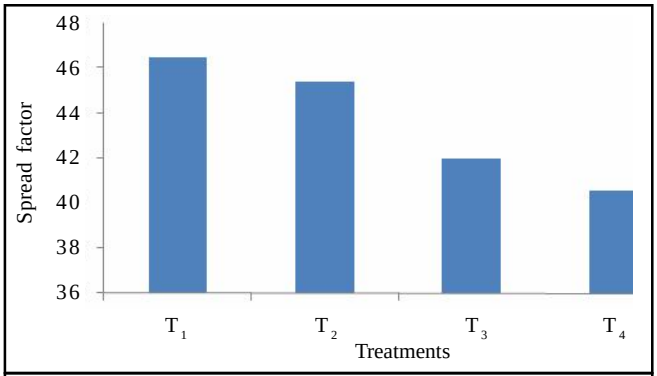

Fig. 5 : Spread Factor of cookies at different treatments of refined flour

cookies spread less during baking (Hoseney and Rogers, 1994).

Results regarding the physical evaluation of the cookies are in line with Tsen *et al*. (1973) who reported that fortified wheat flour with soy flour isolate upto the level of 50 per cent drastically reduced spread factor and increased cookie thickness. Hoojjat and Zebik (1984) also showed that 20 and 30 per cent replacement of navy bean, sesame seed flour reduced the spread factor of the whole wheat flour cookies. The results showed that incorporation of wheat bran decreased the spread of the biscuits from 41.79 to 41.30 mm without much change in the thickness of the cookies. Similar findings was reported for sorghum flour by Mridula *et al.* (2007) where spread factor decreased significantly with increase in proportion of sorghum flour incorporated in wheat flour. For the treatments with wheat flour, spread factor was highest at 5 per cent level incorporation of BCCF and reduced with the levels of incorporation (Fig. 6). This was in accordance with the results observed for sweet potato incorporated with wheat flour where the spread factor decreased with higher levels of incorporation of sweet potato flour (Sukhcharn *et al*., 2008).

The spread factor was more for 10 per cent incorporated citrus peel flour as revealed by Hanan and Rasha (2012).

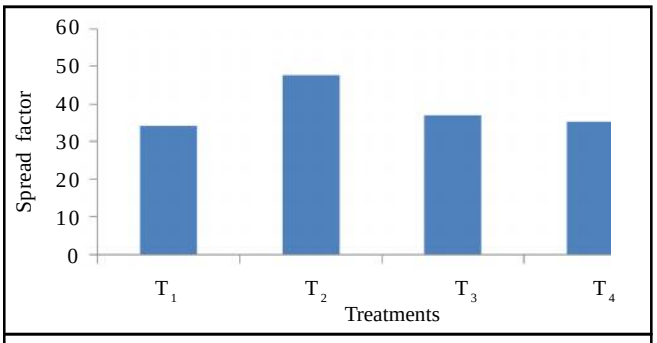

Fig. 6 : Spread factor of cookies at different treatments of wheat flour

The physical attributes of cookies from banana centre core flour incorporated refined flour and wheat flour is presented in Tables 1 and 2.

From the Table 1, it could be seen that the per cent yield of the cookie was more at higher level of incorporation of BCCF. For the wheat flour + BCCF incorporated cookie, weight was more at 5 per cent BCCF incorporation. There was no much difference in the yield percentage at all levels of incorporation of banana centre core flour (Table 2).

Sensory evaluation :

The sensory scores for the cookies prepared from

Table 1: Physical attributes of cookies from BCCF mixed with refined flour

Treatments	Weight of cookie (g)	Thickness (mm)	Diameter (mm)	Spread factor	% Yield
Control	182	12.57	56.8	46.5	9
Flour + 5g BCCF	193	11.23	51.0	45.4	12
Flour + 10g BCCF	188	11.34	47.6	41.97	13
Flour + 15g BCCF	190	11.7	47.5	40.59	16
S.E.±	-	0.0549	0.0895		-
C.D. (P=0.01)	-	0.2306	0.3318		-
C.D. (P=0.05)	-	0.1344	0.2190		-
CV%	-	0.58	2.17		-

Table 2 : Physical attributes of cookies from BCCF mixed with wheat flour

Type	Weight of cookie (g)	Thickness (mm)	Diameter (cm)	Spread factor	% Yield
Control	193	14.38	49.0	34.07	11
Flour + 5g BCCF	212	8.86	42.3	47.74	14
Flour + 10g BCCF	208	12.43	46.0	37.0	13
Flour + 15g BCCF	200	12.3	43.3	35.2	14
S.E.±	-	0.1789	0.1656		-
C.D. (P=0.01)	-	0.6635	0.6138		-
C.D. (P=0.05)	-	0.4379	0.4051		-
CV%	-	1.84	4.49		-

Table 3 : Sensory evaluation of cookies from BCCF incorporated in refined flour

Treatments	Colour	Taste	Texture	Overall acceptability
T_1	8	8	8	8
T_2	9	9	8	8
T_3	7	8	7	8
T_4	8	8	7	8
S.E.±	0.7234	0.7234	0.7916	0.7280
C.D. (P=0.01)	2.2098	2.2098	2.4182	2.2238
C.D. (P=0.05)	1.5762	1.5762	1.7248	1.5862
CV %	15.89	15.89	18.01	16.44

Table 4 : Sensory evaluation of cookies from BCCF incorporated in wheat flour

Treatments	Colour	Taste	Texture	Overall acceptability
T_1	8	7	8	8
T_2	7	7	6	6
T_3	8	7	7	7
T_4	7	7	7	7
S.E.±	0.5164	0.5888	0.4726	0.5323
C.D. (P=0.01)	1.5774	1.7986	1.4436	1.6260
C.D. (P=0.05)	1.1251	1.2829	1.0297	1.1598
CV %	11.34	13.59	11.77	12.38

refined flour and composite flour (wheat + banana centre core flour) is presented in Table 3 and 4. Analysis of variance showed there was no much significant effect on the colour scores of the cookies prepared with refined flour and banana flour incorporation at different levels. The colour score was maximum for the treatment T_2. Similarly there was no much significant difference in the taste and texture of cookies as revealed by ANOVA. Banana flour incorporation at 5 per cent was found to be the best in terms of colour, taste and texture among other treatments. Texture of cookies decreased with the increase in banana centre core flour incorporation. However, the overall acceptability was found to be good for the control and all the treatments, based on the sensory scores. This was in agreement with the findings of Nouman *et al.* (2003) for soy incorporated biscuits.

In the case of cookies prepared from banana centre core incorporated in wheat flour, there was not much significant difference among the treatments in the case of colour, taste and texture. The overall acceptability of 10 and 15 per cent incorporation of BCCF was at par and next to the control.

Conclusion :

The investigation resulted in preparation of cookies from banana centre core flour incorporated with refined flour and wheat flour. Based on sensory scores, the overall acceptability of cookies with banana centre core flour blend with refined flour was at par with the control and in the case of wheat flour incorporated with banana centre core was found to be acceptable at higher level of incorporation.

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