

Original Research Article

Process Technology for Preparation of Banana Flour Supplemented Biscuit

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ABSTRACT

One of the popular flour-based baked food products “Biscuit” prepared in bakery industries which are typically crisp, flat, and sweet. It is popular in India. In this research investigation the preparation and evaluation biscuit prepared with wheat flour supplemented with Banana flour. Partial replacement of wheat flour at 20, 30 and 40% supplemented with wheat flour for preparation of Biscuits and measured some physical and sensory qualities. In the results of physical quality showed that the mass and density of biscuits were decreased significantly with the increasing level of banana flour replacement. Thickness of biscuit increased slightly with the increasing level of banana flour replacement up to 40%. The spread ratio are decreased as substitution level of banana flour increased in the baked samples and this may be due to the higher water holding capacity of banana flour. The decreases in moisture content of biscuits with increasing the incorporation level of banana flour. The sensory evaluation results of biscuits samples show that 40 percent banana flour incorporation with wheat flour was found to be the most acceptable combination in biscuit making with respect to organoleptic qualities.

Keywords

Ripe banana,
Banana flour,
Banana biscuit,
Physical
characteristics of
banana biscuit,
Sensory evaluation
of banana biscuit

Introduction

Among the different bakery products, biscuits are one of the popular cereal food categories, consumed as breakfast items and as snacks. Biscuits are chemically leavened bakery products containing high percentage of fat and sugar (Nelson’s Navy, 1980; Chavan, 2020). The basic aim of biscuit production is to provide protein requirement with glucose. Due to dry food product they have a longer shelf life, easy marketing and low cost of biscuit production around the world. Among convenience foods biscuits are very convenient and inexpensive but have only about 6 to 7 per cent protein (Agarwal, 1990; Chavan, 2020). Banana production has

significantly increased in recent years in many developing countries. Banana is the second most important fruit crop in India next to Mango. It is popular fruit amongst all communities because of its year round availability, affordability, varietal range, taste, nutritive and medicinal value makes it favorite fruit among all classes of people. Bananas are good source of vitamin C, potassium and dietary fiber. It can help lower blood pressure and reduce the risk of death by strokes by as much as 40%. It stimulates nerve impulses for muscle contraction. It is believed to be helpful in curing diarrhea and dysentery. Among several processed banana products, Banana flour with high dietary fiber, high vitamins and a good amount of

minerals can be substituted for wheat flour in the preparation of biscuits. This helps in lowering the gluten level and prevention of various diseases. Thus addition of banana flour also enhances the sensory characteristics of biscuits and industries also find it economical to use in biscuit manufacture.

Materials and Methods

A leavening agent (baking powder), sweetener (sugar), salt and wheat flour was obtained from local market. The flour was of creamy white colour, free from weevils and any other foreign matter. Banana flour is prepared from mature green bananas, which have high starch content. Sunflower trade hydrogenated vegetable oil were used for biscuit making as a leavening agent, which were purchased in local market.

Hot air oven (chamber size of 30x30x30 cm) was used to determine the moisture content of the different samples. The input power required for the oven was 650 watts. The baking oven is used to bake the biscuits at a temperature of 160 °C for 25 minutes. A digital weighing balance was used to weight sample accurately. 80 mesh sieves were used for sieving dry ingredients such as wheat flour, sugar and banana flour. Grinder was used for grinding the raw material such as dried banana slice and sugar. Tray dryer were used for drying of banana slice.

Drying were carried out at 66 to 71 °C for 24 hours to removed moisture from banana slice up to desired moisture contain to obtain uniform dry banana slice. Polyethylene paper is specially use for packaging of biscuit to maintain the quality of biscuit. It provides gas retention capacity to packaged biscuit extend shelf life of biscuit and sealing machine is used for sealing of LDPE.

Preparation of banana flour

As per (Nouman *et al.*, 2003; Vasantharuba *et al.*, 2012 and Chavan, 2020) procedure for preparation of banana flour is as below,

Preparation of banana biscuit

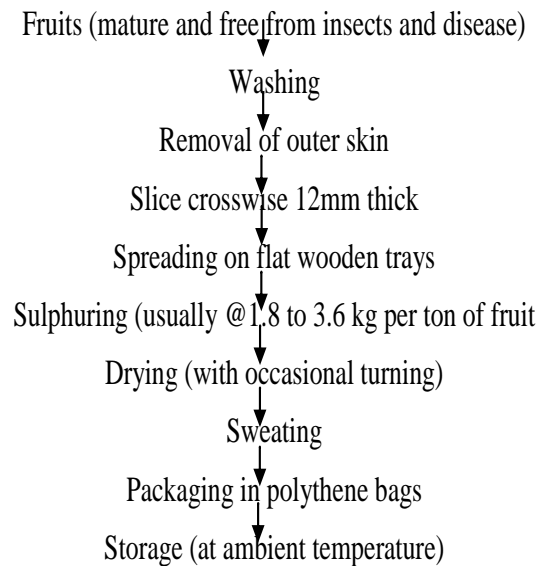


Fig.1 Flow chart for preparation of banana flour

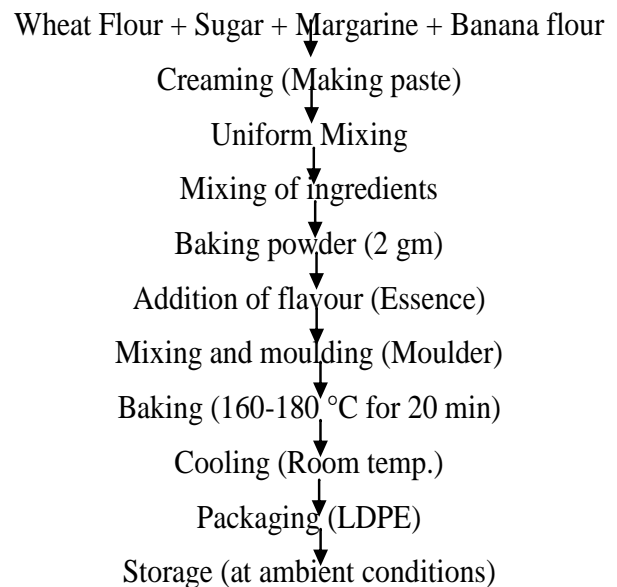


Fig.2 Flow chart for preparation of biscuits

Moisture content of biscuits was calculated by Hot air oven method.

Physical analysis

Physical analysis of flours

$$1) \text{ Bulk density} = \frac{\text{mass}}{\text{volume}} \dots(\text{Eqn. 1})$$

2) Particle size

Physical analysis of biscuit

The measurement of width, thickness and spread factor of biscuit was taken using a vernier caliper. Six biscuits were placed edge to edge and the width measured. They will be rotated 90° and re-measured to obtain average width (W) in mm. The thickness (T) of biscuit will be measured after stacking six biscuits on top of one another, re-stacking in different order and re-measured to get average thickness. These measurements will be read to the nearest 0.5 mm. Some properties were calculated, (AOAC, 2000)

$$\text{Spread factor (SF)} = \frac{W}{T} \dots(\text{Eqn. 2})$$

$$\text{Volume} = \pi r^2 T \dots(\text{Eqn. 3})$$

$$\text{Density} = \frac{\text{Mass}}{\text{volume}} \dots(\text{Eqn. 4})$$

Sensory evaluation

Sensory characteristics of biscuits were evaluated for the different sensory attributes by a panel of ten judges. The nine point hedonic scale was used for evaluation for assigning the numerical values for different quality attributes of biscuits viz., appearance and color, flavor, texture, taste and overall acceptability. In the 9 point hedonic scale 9 represents 'extremely like' and 1 represents 'extremely dislike'.

Results and Discussions

Preparation of biscuits

Banana flour was used for partial replacement of wheat flour at 20, 40 and 60 percent levels, keeping all other ingredients constant. All the ingredients were used for preparation of biscuits according to Table 1.

Samples of a standard biscuit (with no substitution) and biscuit with 20, 40 and 60 % banana flour replaced by the wheat flour were produced by steps of creaming, mixing, kneading, cutting, baking and cooling.

Wheat flour and banana flour were mixed according to the recipe. Cream formation was carried out by mixing hydrogenated vegetable fat, sugar and vanilla essence. Composite flour, salt and baking powder were added to the creamed mixture and dough was prepared by proper kneading with hands. When dough was ready, it was kept for 5-7 min. as it is and then used for sheeting. Sheets were made by rolling balls of dough on wooden platform. These sheets were cut by hand operated metal die. Then these were kept for baking. Biscuits were baked at 160-180°C for 20-25 minutes in the oven. Then they were cooled at room temperature for few minutes.

Physical analysis of flour

Bulk density

The bulk density of banana and wheat flour were measured and shown in table 2. From table 2, banana flour (0.90) was low density than wheat flour (0.88).

Particle size

The flours were passed through the 200 micron sieve having same particle size hence flours were suitable for preparation of biscuit.

The particle sizes of banana and wheat flour were measured and result shown in Table 3.

Physical analysis

The physical properties such as weight, volume, density, thickness, and spread ratio were measured and shown in Table 4.

The weight and density of biscuit decreased with increased in level of banana flour. Minimum value was obtained for sample T₃ (10 g and 0.75 g/cm³). The volume increased with increased in level of banana flour.

The width of biscuit slightly changes with increased in banana flour. Maximum width was obtained for sample T₂ (52 mm). The thickness of biscuit increased with increased in level of banana flour. Minimum thickness was obtained for biscuit samples T₁ and T₂ (7.6 mm). The best spread ratio was obtained for biscuit sample T₂ (7.1).

The results of physical analysis showed that the mass and density of biscuits were decreased significantly with the increasing level of banana flour replacement up to 60%

biscuit increased slightly as substitution level of banana flour increased, also thickness of biscuit increased slightly with the increasing level of banana flour replacement up to 60%. On the other hand spread ratio are decreased as substitution level of banana flour increased in the baked samples and this may be due to the higher water holding capacity of banana flour.

Moisture content

Moisture content of raw material

The moisture content of banana, banana flour and wheat flour was measured and shown in Table 5.

Moisture content of biscuits

The moisture content of biscuit was measured and shown in Table 6

The moisture content of T₁ biscuit sample was 6% so the shelf life of T₁ sample is large as compare to other. The least moisture content was obtained for T₄ biscuit sample (6.60%).

Table.1 Ingredients used in the preparation of biscuits

Ingredients (gm)	Standard biscuits T ₁	Biscuit T ₂	Biscuit T ₃	Biscuit T ₄
Wheat flour	100	80	60	40
Banana flour	-	20	40	60
Sugar	50	50	50	50
Shortening	50	50	50	50
Salt	0.5	0.5	0.5	0.5
Baking powder	2	2	2	2
Vanilla essence	0.5	0.5	0.5	0.5

Table.2 Bulk density of raw product

Raw material	Weight (g)	Volume (cm ³)	Density (g/cm ³)
Banana flour	50	55	0.90
Wheat flour	40	45	0.88

Table.3 Particle size of flours

Flours	Sample taken (g)	Over size (g)	Under size (g)	Particle size (micron)
Banana flour	50	0.80	49.20	200
Wheat flour	40	0.20	39.80	200

Table.4 Physical properties of biscuits

Biscuit	Weight (g)	Volume (cm ³)	Density (g/cm ³)	Width (mm)	Thickness (mm)	Spread ratio
T ₁	13	12.02	1.08	54	7.6	7.1
T ₂	12.1	12.45	0.97	52	7.8	6.3
T ₃	11	12.95	0.84	48	8.0	6.1
T ₄	10.2	13.15	0.77	53	8.3	6.63

Table.5 Moisture content of raw material

Raw material	Banana	Banana flour	Wheat flour
Moisture content (%)	70	14	13

Table.6 Moisture content of biscuits

Biscuit	T ₁	T ₂	T ₃	T ₄
Moisture content (%)	6	6.70	6.65	6.60

Table.7 Organoleptic quality of biscuits supplemented with banana flour

Rep no.	Sample code	Appearance	Flavor	Color	Texture	Taste	Overall Acceptability
Rep 1	T ₁	8	7	8	7	7	7.2
	T ₂	7	7	6	6	6	7.3
	T ₃	9	8	8	8	8	7.8
	T ₄	7	7	8	6	7	7.9
Rep 2	T ₁	7	8	7	7	6	7.4
	T ₂	8	6	6	8	6	7.3
	T ₃	7	8	7	8	9	7.9
	T ₄	8	7	8	7	8	7.7
Rep 3	T ₁	7	8	7	9	7	7.6
	T ₂	7	8	6	6	9	7.5
	T ₃	8	9	8	7	8	7.8
	T ₄	9	7	9	6	7	7.9

Table.8 Statistical analysis of sensory data

ANOVA							
Source of Variation	SS	df	MS	F	P-value	F crit	
Rows	14.18042	11	1.289129	2.056002	0.039884	1.967547	
Columns	2.772917	5	0.554583	0.884492	0.497775	2.382823	
Error	34.48542	55	0.627008				
Total	51.43875	71					

Sensory evaluation of biscuit samples

The biscuits were prepared by partial replacement of wheat flour by banana flour. The sensory evaluation average score of all biscuits samples assigned by judges are shown in Table 7.

The maximum overall acceptability was obtained for the biscuit sample with 40% banana flour T₃ (8.25). Hence from Table 7 the best result obtained for the biscuit with 40% banana flour T₃.

From the results of sensory evaluation it is concluded that appearance and color of biscuit samples was found to be acceptable with increasing the incorporation level of banana flour. Flavor of biscuit samples with 40-60 percent banana flour incorporation was found to be more acceptable as compared to biscuits with 20-60 percent banana flour incorporation. Control sample and biscuits with 20% banana flour incorporation was found to be superior in case of texture.

From Table 8, it was found that F actual is greater than F critical for treated sample. Hence it is significant for provided data to analysis. It means that the provided values are dependent on each other.

In conclusion, the physical analysis concluded that the mass, density of biscuits were decreased significantly and thickness

of biscuit were increased with the increasing level of banana flour replacement up to 60% biscuit increased slightly as substitution level of banana flour increased, hand spread ratio are decreased as substitution level of banana flour increased. The sensory evaluation concluded that, 20% banana flour incorporation with wheat flour was found to be the most acceptable combination in biscuit making with respect to organoleptic and physical qualities of biscuits. 40% banana flour incorporation with wheat flour was found to be the most superior to other treatment biscuits with respect to moisture of biscuits.

References

Agarwal, S. R.1990. Indian Food Industry. 24(9): 19-21.

Aliye Ergin and Emine NurHerken, 2012.Use of various flours in gluten-free biscuits. *Journal of food, Agriculture &Environment*. 10(1): 128-131

AOAC, S.R. 2000. Official methods of analysis, association of official analytical chemists. Washington DC, New York USA.

Chavan S. M. Raviteja and Shivprasad. 2020. Qualities of biscuit prepared with banana flour. 52nd Annual Convention of ISAE and National Symposium on Doubling Farmers' Income through Technological

- Interventions. AAU, Anand. 08-10 Jan, 2018.
- Gayas Bazilla, Shukla, Ramanath Khan Beena Munaza. 2012. Physico-Chemical and Sensory Characteristics of Carrot Pomace Powder Enriched Defatted Soy flour Fortified Biscuits. *International Journal of Scientific and Research Publications*. Vol. 2:1-5.
- Mridula, D. 2011. Physico-chemical and sensory characteristics of b-carotene rich defatted soy fortified biscuits. *African Journal of Food Science*. 5(5): 305-312.
- Nouman. R. Siddiqui, Mehmood-ul-Hassan Saeeda Raza, Tabassum Hameed. 2003. Sensory and physical evaluation of biscuit supplemented with soyflour. *PAK Journal of food science*. 13(1-2): 45-48. 25.
- Singh, Sukhcharn., Rair C.S. and Saxena D.C. 2008. Effect of incorporating sweet potato flour to wheat flour on the quality characteristics of cookies. *African Journal of Food Science*. 2: 65-72.
- The Hindu Business Line: BARC develops tech to make biscuits, baby food from banana.
- Vansanthuruba Seevaratnam, Banumathi. P. and Premamatha, M.R, 2012. Studies on the Preparation of Biscuits Incorporated with Potato Flour World. *Journal of Dairy Food Science* 1:79-84.