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Effect of Raw Banana Flour For The Development Of Bread

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Abstrct -

The effect of the addition of green banana flour as a partial substitute level (0%, 5%, 10%, 15% & 20%) with wheat flour was studied for its effect on bread making. Bread samples were analyzed for their physical , chemical properties (Moisture, Ash, Fat, Protein & Carbohydrate), microbiological characteristics, sensory characteristics study compared with control bread made from 100% whole wheat flour . Bread with 0%, 5%, 10%, 15% & 20% green banana flour level had lower protein content (9.27-7.0 g/100g) , fat (2.81-1.79) but higher moisture (28.94- 37.26), ash (1.68-2.99) and fiber (1.95-3.98). Blending of green banana flour (5%-20%) were increased Fe (27.07-31.13) and Zn (29.19-32.01). The addition of GBF (5%-20%) resulted in a decreased specific volume. The bread volume decreased with increasing amount of green banana flour (5%-20%) and bulk density, swelling capacity & loaf weight was increased by incorporation of (5%-20%) green banana flour. The microbiological characteristics of the product with GBF were similar to those of the control bread . on the basis of sensory score, upto 10% of green banana flour observed non-significant variation after that a significant ($p<0.05$) decrease in variation was found. At the higher level of blending , the acceptability of bread decline.

Keywords: Bread , Raw Banana Flour, Musa Sapientum, Sensory Evaluation , Physicochemical Analysis,

Introduction-

Banana (Musa paradisiaca, Musaceae family) has a high nutrient value and is one of the world's most common fruits. Banana shows high flavonoids, dietary fibre (DF), and stubborn starch (RS) than when ripe at the early stages(Khoozani et al.,2019).Bread is a staple food prepared from dough of flour and water, usually by baking. Throughout recorded history it has been popular around the world and is one of the oldest artificial foods, having been of

importance since the dawn of agriculture. Bananas were originally found in South East Asia, mainly in India. Banana crop is heavy feeder of nutrients. Its roots spread superficially and absorb large amount of nutrients from the soil (Minali Masih et al.,2019).

Bread is a cheap and basic instant food available for consumption. In India it is still a secondary staple food when compared to chapatti, puri or rice. A rough estimate of theregional consumption of bread indicates that southern states lead with 32% consumption with North . West and East zones consumes about 27%, 23% and 18 % respectively of the total bread production.(Uttam Singh Bhadana et al.,2018).

Banana flour is a powder traditionally made of green bananas. Historically, banana flour has been used in Africa and Jamaica as a cheaper alternative to wheat flour.[1] It is now often used as a gluten-free replacement for wheat flours [2] or as a source of resistant starch, which has been promoted by certain dieting trends such as paleo and primal diets and by some recent nutritional research.[3] Banana flour, due to the use of green bananas, has a very mild banana flavor raw, and when cooked, it has an earthy, nonbanana flavor; it also has a texture reminiscent of lighter wheat flours and requires about 25% less volume, making it a good replacement for white and white whole-wheat flour.[4]

Banana flour is generally produced with green bananas that are peeled, chopped, dried, and then ground.[5] This process can be completed traditionally by hand, where the bananas are sun dried, dried in an oven, or a residential food dryer, and then either ground in a mortar and pestle or with a mechanical grinder.[4] The green banana process requires 8–10 kg of raw green bananas to produce 1 kg of banana flour.[1] In recent years, large scale commercial production has begun in Africa and South America using the same basic methodology.[1][6][7]

The objective of this study was to evaluate the effect of raw babana flour with blending ratios on the functional, physical chemical attributes and sensory quality of wheat–banana flour bread. Such information would open up real opportunities for greater use of raw banana flour in bread processing.

Material & Methods

The experiment was carried out in the research laboratory , Department of Food Engineering and Technology , Institute of Engineering and Technology Bundelkhand University Veerangana Laxmibai Jhansi (U.P.).

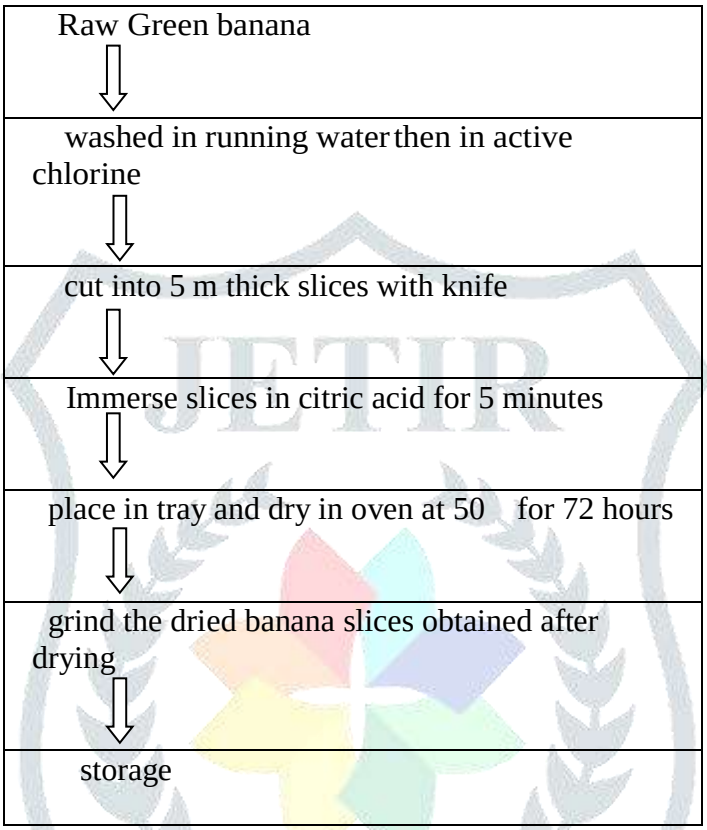
Banana flour/powder

Uniformly green banana were collected from the local market. Then the bananas are washed in running water and sanitized with activated chlorine. Then the banana peels are removed and cut into thin slices of 5 mm thickness with stainless knives. Then the slices are immersed in 1g/mL citric acid solution for 5 minutes.

Then the slices are placed in trays and dried in hot air oven for 72 hours at 50°C .

The banana slices obtained after drying are ground in mixer grinder. Then the flour was placed in glass jars or poly pouches and subjected to analysis and/or preparation of bread.

Figure 4:Flow chart for preparation of banana flour



COLLECTION OF INGREDIENTS

Ripe banana- ripe banana of local variety was purchased from local market of Jhansi.

Wheat flour- wheat flour was also purchased from local market of Jhansi.

Baker's Yeast- Baker's yeast manufactured by Prestige was procured (200 rupees per 250 gms).

Sugar-The powdered sugar was purchased(40 rupees per kg) from local market of Jhansi.

Salt – the common salt under under the brand name "Tata Salt" was purchased from local market of Jhansi.

Butter- the butter under the brand Amul was purchased from local market.

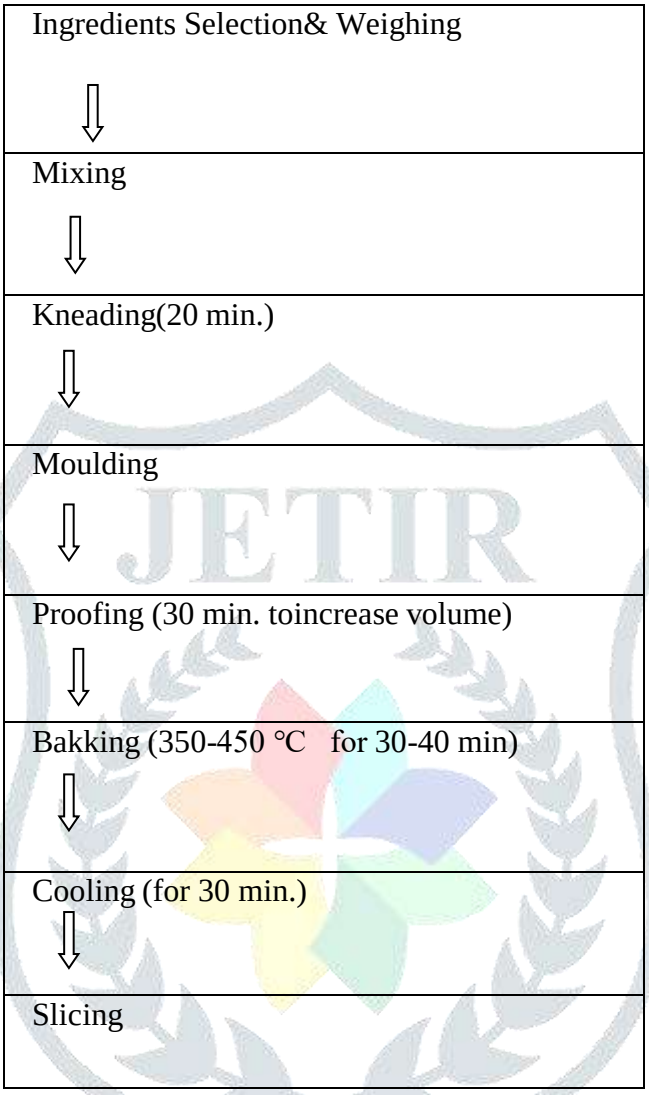
Equipments used in research laboratory are sieve, furnance, electronic weigh machine, mixer , glassware,

Hot air oven, baking oven, etc

Table -1 Formulation scheme for whole wheat- raw banana flour composite flour dough

Ingredients	Control	5% Raw banana flour	10 % Raw banana flour	15% Raw banana flour	20% Raw banana flour
Raw Banana flour , g	0	5	10	15	20
Whole Wheat flour g	100	95	90	85	80
Yeast as baking agent g	5	5	5	5	5
Table salt g	4	4	4	4	4
Sugar g	4	4	4	4	4
Treated water ml	68	68	68	68	68
Fat	8	8	8	8	8
Bread improver	1.0	1.0	1.0	1.0	1.0

Figure 5: Flow chart for Banana bread preparation



PHYSICAL ANALYSIS

Determination of physical properties of bread samples

Bulk density of the flour/ bread samples was determined by the gravimetric method described by Okezie and Bello (1988). Swelling index or swelling power is an indication of the water absorption index of the flour granules during heating (Loos et al. 1981). It is an evidence of non-covalent bonding between molecules within starch granules and also a factor of the ratio of α-amylose and amylopectin ratios (Rasper 1969).

Each loaf was weighed and the volume determined using the AACC (1983) method in which the pinto bean displacement was modified by using soybean. The displaced soybean was used to express the volume of the loaf. Specific loaf volume (SLV) was calculated as the ratio of loaf volume to the weight. Crack formation was determined visually.

Proximate Analysis -

Prepared raw banana flour and whole wheat flour bread were analysed for moisture , protein , ash ,crude fiber and total sugar content by the method described in AOAC (2010). Carbohydrate content was determined by subtraction methods.

Microbiological evaluation of bread – Total coliform , Thermotolerant and yeasts and molds were determined as described by AOAC(2004). The analyses were done on the days 1, 3,5 and 7 of the storage at room temperature of the product.

Organoleptic Evaluation of Bread - A semi-trained panel did the sensory evaluation . A1-9 point hedonic rating test was used to assess the degree of acceptability of crust colour, taste, odour, appearance roundness crumb colour and OAA of raw banana bread containing 5%, 10%, 15% and 20% banana flour. The score was arranged in a frequency table and statistically evaluation for variance analysis.

Statistical analysis – All the analysis were conducted in triplicated , and data were all subjected to ANOVA to determine significant differences among the various samples using statistical software SPSS at the 0.05 level

Result & Discussion

The present study was based to evolve effect of flour on quality of raw banana bread.

Table No-2 Proximate Composition of raw banana flour and whole wheat flour-

Parameter	**Wheat flour**	**Raw Banana flour**
Moisture %	12.25	7.15
Ash %	1.85	4.86
Fibre %	1.9	12.65
Fat %	0.90	1.01
Protein %	10.58	6.25
Carbohydrate %	68.80	75.54

The results of the proximate composition of wheat flour and green flour shown in Table 2 . The chemical composition the green banana flour had higher level ($p<0.05$) of ash (4.86g/100g) carbohydrate (75.54g/100g) and lower moisture 7.15 g/100g, protein content (6.25g/100g)and similar lipid contents (1.01g/100g) when compared with the flour . Wheat flour contain moisture 12.25 %, ash 1.85%, Fibre 1.9 %, protein 10.58% and Carbohydrate 68.80% . Gomes,A. A.B et, al.,(2016) also reported almost similar results .

Physical properties of banana bread-

The physical properties of bread made of banana flour. Among the bread samples, the control bread had the highest volume. The volume of banana bread decreased with the increase banana flour in the formulation due to the absence of gluten content in banana and lower bread volume . further more, with the rising amount of banana flour , the weight of banana bread increased . This is possible because banana flour contained more mineral substances

than wheat. The chemical study of banana bread indicates that the greater quantity of ash in banana bread predicts higher mineral material quantity in banana bread.

As the amount of banana flour in the bread formulation increased, the specific volumes of the various breads gradually dropped, ranging from 1.89cc/gm to 3.07cc/gm. Therefore, it is possible to discern a negative correlation between banana flour and breed-specific bread volume, which is consistent with findings from other studies.16

Table no 3 Effect of various levels of banana flour on physical properties of banana bread

Physical Parameter	Control	5% Raw Banana Flour	10 % Raw Banana Flour	15% Raw Banana Flour	20 % Raw Banana Flour
Volume (% based on control)	100	96.56	87.45	67.84	60.02
Weight (% based on control)	100	101.8	102.4	103.01	104.08
Specific volume of bread (%)	3.07	2.91	2.62	2.02	1.89

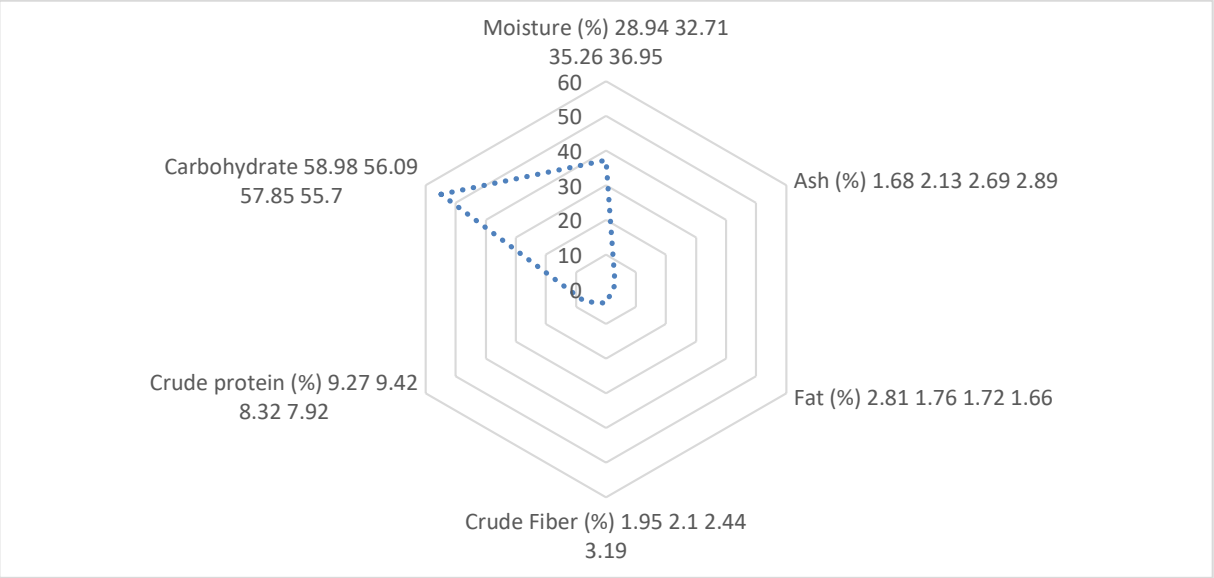
Proximate composition of green banana flour and wheat flour

The proximate composition of composite wheat-composite bread is shown in Table 4. The moisture content ranged from 28.94% to 37.26%, with sample control having the least moisture content and sample 20% raw banana flour having the most. It was shown that the moisture content increased along with the substitution level. The control sample has the lower ash content (1.68), whereas the sample 20% banana flour has the highest ash content (2.99%). similar range found by Mongi et al. (2011). Additionally, it was noted that the crude protein level in the control group was extremely high (9.27), followed by levels for the 5%, 10%, 15%, and 20% at 9.42, 8.32, 7.92, and 7.00, respectively. The sample control, with a mean score of 58.98, has the greatest value of carbohydrates. With more green banana flour being substituted, it was found that the amount of carbohydrates decreased. This is in agreement with Olaoye and Onilude (**2011**) and contrary to the findings of (Mepba et al. **2007**). The results showed significant difference between the proximate compositions of the samples.

Table no 4 a. Proximate composition of green banana flour and wheat flour

Sample	Moisture (%)	Ash (%)	Fat (%)	Crude Fiber (%)	Crude protein (%)	Carbohydrate
Control	28.94	1.68	2.81	1.95	9.27	58.98
5% Raw Banana flour	32.71	2.13	1.76	2.10	9.42	56.09
10% Raw Banana flour	35.26	2.69	1.72	2.44	8.32	57.85
15% Raw Banana flour	36.95	2.89	1.66	3.19	7.92	55.70

20% Raw Banana flour	37.26	2.99	1.79	3.98	7.00	54.89



Mean values with the same letter within the same column are not significantly ($P > 0.05$) different.

Mineral composition of wheat flour blend

Table **4b** shows the mineral composition of flour samples. Minerals are essential nutrients that are needed in the body to facilitate proper functioning of certain organs (Amoakoah et al. **2015**). While some minerals are required in lesser amounts (micro), others are required in greater amounts (macro). Zinc and iron were examined in this study as macro and micronutrients, respectively. The outcome demonstrated that sample 20% green banana flour had a greater iron (Fe) concentration than the other four samples, with a mean value of 31.13 mg/100. Meanwhile, the testing sample of 5% raw banana flour with a value of 29.00 mg/100 has the lowest quantity of iron (Fe). However, the results also revealed that sample control (27.07 mg/100) had less iron than the other samples, which were 10% and 15% banana flour, respectively, at 29.39 and 30.09 mg/100. The Table also revealed that sample 20% had the highest concentration of zinc (Zn), with a mean value of 32.01 mg/100, while sample 5% of green banana flour had the lowest, at 30.24 mg/100. In terms of iron and zinc concentration, it was found that the experimental samples and the control samples differ significantly.

Table 4 b. Mineral composition of wheat flour blend

Samples	**Iron (Fe) mg/100 g**	**Zinc (Zn) mg/100 g**
Control	27.07	29.19
5% Raw Banana Flour	29.00	30.24
10% Raw Banana Flour	29.39	30.61
15% Raw Banana Flour	30.09	31.36

Samples	Iron (Fe) mg/100 g	Zinc (Zn) mg/100 g
20%Raw Banana Flour	31.13	32.01

- Mean values with the different letters within the same column are not significantly different at ($P > 0.05$).

Functional properties of wheat flour & blended flour

Table **5** shows the functional properties of wheat flour blends. The bulk density ranged from 0.77 to 0.89 g/cm^3 with sample 20% green banana flour having the highest value while sample 5% banana flour has the lowest amount. There is non significant difference between the control sample and samples 5%, 10%. Swelling capacity is regarded as the quality criterion in some good formulations such as bakery products (Osungbaro et al. **2010**). The sample 20% exhibited highest the swelling power 69% while sample 5% banana flour exhibited the lowest swelling power with 40%. Fermentation of the unripe banana flour and substitution level was observed to influence progressive increase in the swelling capacity. Fermentation and sun drying had been observed to clearly play a role in obtaining starch with high swelling power and desirable organoleptic properties. This has been found to facilitate production of high-quality cassava-wheat composite flours of which demand exist in bread making and various confectionery industries (Duffour et al. **1996**). Sample 20% banana flour was significantly different from other samples in terms of bulk density while a non significant difference also existed between samples control , 5% and 10 % banana flour, and other samples (15% and 20%), respectively.

Table 5. Functional properties of wheat/plantain flour blend

Samples	Bulk density (%)	Swelling capacity (%)
Control	0.77	40
5% Banana Flour	0.79	40
10% Banana Flour	0.80	53
15% Banana Flour	0.83	64
20% Banana Flour	0.89	69

Mean values with the different letters within the same column are not significantly different at ($P > 0.05$).

Microbiological Evaluation of incorporation of Raw Banana flour in bread

Table 5 shows the results of the microbiological evaluation of the breads . Breads with Green banana Flour , as well as the control bread, showed number of coliforms lower than 3MNP/g during 7 days of storage , which is in accordance with the Brazilian legislation (Gomes,A.A.B 2016) .

A gradual increase in mold and yeast count over the storage period was verified . On the fifth day , the mold and yeast counts were lower than 2.0x10^3 CFU/g for formulation with green Banana flour , without being observed the presence of molds on the surface of the bread. In the seventh day the counts exceeded 5x 10^3 CFU /g, and there was presence of molds on the surface. The same observation was done in the control bread .consumption of breads containing mold in the surface is not recommended, since some of these microorganism can produce mycotoxins, which can cause serious damage to the human body (Gomes,A.A.B 2016) . Therefore , the recommended shelf life for the breads with green banana flour , based on the microbiological results was 7

days.

Table : 6 Microbiological Evaluation of incorporation of Raw Banana flour in bread

Microbiological characteristics	Storage time (Days)	Control	5% Raw Banana Flour	10 % Raw Banana Flour	15% Raw Banana Flour	20 % Raw Banana Flour
Total Coliforms (MNP/g)	1	2.8	2.8	2.8	<3	<3
	3	<3	<4	<4	<4	<4
	5	<3	<4	<4	<4	<4
	7	<3	<4	<4	<4	<4
Thermotolerant Coliforms (MNP/g)	1	<3	<4	<4	<4	<4
	3	<3	<4	<4	<4	<4
	5	<3	<4	<4	<4	<4
	7	<3	<4	<4	<4	<4
Yeasts &Molds (CFU/g)	1	$5.8x10^2$	$1.9x10^3$	$1.4x10^3$	$1.2x10^3$	$1.0x10^3$
	3	$1.3x10^3$	$1.3x10^3$	$1.2x10^3$	$1.4x10^3$	$1.5x10^3$
	5	$3.0x10^3$	$2.0x10^3$	$1.8 x10^3$	$1.3 x10^3$	$1.0x10^3$
	7	$5.8x10^3$	$5.6 x10^3$	$5.3x10^3$	$5.0x10^3$	$5.0x10^3$

- There was no difference in the shelf-life of breads made with green banana flour and the control bread, indicating that although the moisture and water activity of the bread with green banana flour have been higher, they did not affect the microbiological stability of the products. This may be related tho the higher acidity of the products with green banana flour because in more acidic conditions there is a less development of spoilage microorganism. This result is interesting from the marketing point of view , since lower shelf-lives hinder the marketing of highly perishable products, such as bread.
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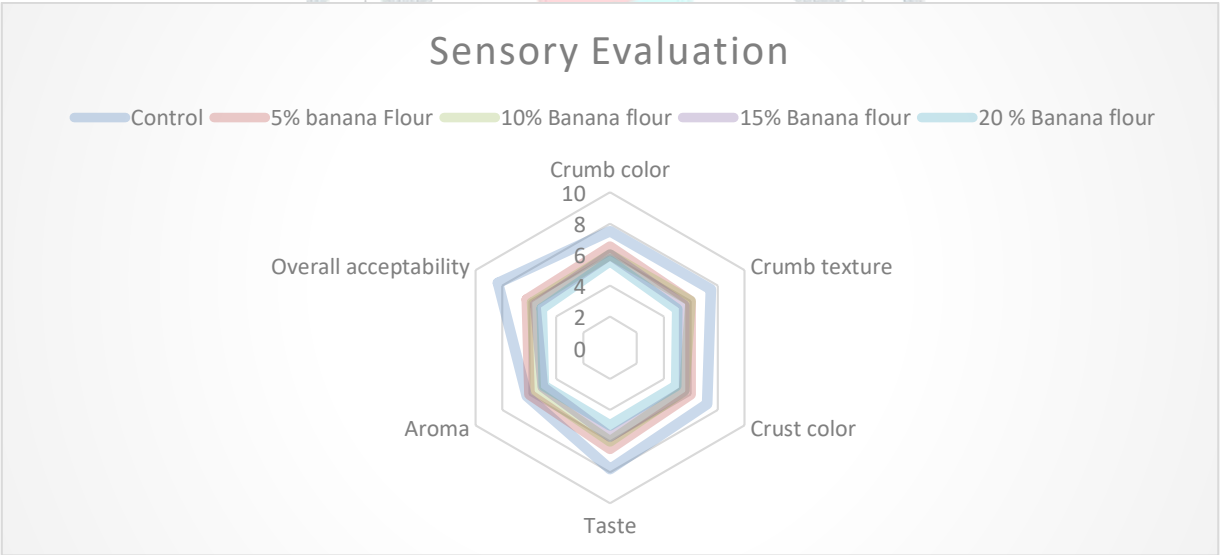
Sensory Evaluation of bread samples-

Sensory Evaluation was done on bread made with varied amounts of banana flour. Table 7 lists the bread's performance in terms of colour, texture, flavour, and general acceptance. Crust colour, crumb colour, crumb texture, taste, scent, and overall acceptability in the control sample are 7.5, 7.5, 7.2, 7.8, 6.2, and 8.34, respectively. In terms of crumb colour, crumb texture, crust colour, taste, aroma, and overall acceptance among the bread sample, a significant ($p<0.05$) difference was seen. The findings indicated that 5% green banana flour is the most preferable in terms of crust colour, crumb colour, and crumb texture. As the replacement degree rises, so does the acceptability of crust and crumb qualities the 5% to 20% sample .The taste of 5 to 20% green banana flour is most noticeable with an average score of 6.5 to 5.6, followed by the crumb texture with a mean of 6.0-5.0 and the taste with an average score of 6.5 to 5.0, respectively. The 10% raw banana flour sample received the highest overall acceptability rating from the panelists, but the 15% and 20% GBF samples received lower ratings since they included wheat flour.

Table 7. Sensory Evaluation of bread samples

Samples	Crumb color	Crumb texture	Crust color	Taste	Aroma	Overall acceptability
Control	7.5	7.5	7.2	7.8	6.2	8.34
5% banana Flour	6.5	6.0	6.0	6.5	6.0	6.2
10% Banana flour	6.0	6.0	5.5	6.0	5.5	5.8
15% Banana flour	6.0	5.5	5.5	5.7	5.0	5.54
20 % Banana flour	5.6	5.0	4.9	5.0	4.9	5.08

- Mean values with the different letters within the same column are not significantly different at ($P > 0.05$).



Conclusion - From the results of present investigation it may concluded that green banana flour upto 5% to 20% prepared nutritionally rich bread at it enhance the level of ash , crude fibre , moisture, Iron , zinc and decrease the level of fat , crude protein , carbohydrate in the bread . The bulk density and swelling capacity were increased by increasing the level of GBF in bread. On the basis of sensory evaluation of green banana flour incorporated bread upto 10% was non significant after that it is significantly acceptable range . The addition of GBF had no influence on the microbiological stability of the bread, therefore , the recommended shelf-life is of 7 days.

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