# The Influence of Adding Banana Peel Powder on the Quality of Pan Bread

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**Abstract.** This study's objective was to show how nutritious banana peel powder. Moreover, to use BPP as a cheap alternative to wheat flour in bread. The results of BPP at different concentrations (0,2 ,6 and 10%), as well as the sensory qualities of bread. The BPP is also regarded as a beneficial protein source (7.6%), ash (9.66%) and..Physical and chemical characteristics of bread made by partially replacing wheat flour with banana peel powder were examined. It has been established that banana peel contains a significant amount of nutrients which should not be disregarded or squandered. banana peel can become a value-added product in the food sector by being processed into powder. The powder's flowability declines. banana peel was discovered to have a high tapped density 0.41 g/ml , and Carr's Index 14.21 % , pH value was 6.15. This powder was high in total dietary fiber 17.99 %. Additionally, functional properties of this powder were high , the water-holding capacity 6g/g, oil-holding capacity 3.4g/g and swelling capacity15.33 ml/g.As a result, this study showed that the ripe banana peel powder has a chance to be used as a functional food ingredient. It is advised that BPP be utilized up to 6 % to complement and enhance the qualitative qualities of bread as a result of this research at a level that has several health advantages. numerous dishes gain nutritional value from the banana peel. banana peels as a cheap and abundant source, utilization, and enrichment of nutrients.

**Keywords.** Fibre, Banana peel powder, Sensory evaluation, Bread, Functional properties.

## 1. Introduction

One of the most popular fresh fruits worldwide and one of the primary commercial crops is the banana, but when bananas are harvested and consumed a lot of garbage and by products are created including stems, leaves, inflorescences, and peels. some of them might be employed in the creation of novel foods. Furthermore, research has revealed that banana by-products contain a variety of bioactive substances with antibacterial, anti-inflammatory, antioxidant, and other properties[1] indigestible polysaccharides, dietary fiber, vitamins, minerals and antioxidants are all present in significant concentrations in banana flour. according to[2]. It might be utilized in various bakery goods such as bread to enhance dietetic value and decrease wastage.

The peel and the pulp are the two components that make up a banana fruit about 40% of the weight of the fruit is made up of the peel which is the fruit's main by-product. banana peels were previously considered waste because they had no use and produced a lot of organic material that needed to be treated. numerous possible uses have emerged since scientists started investigating the chemical make up of banana peels[3].

After rice, wheat and maize, the most important fruit crop in the world is the banana fruit (Musa balbisiana), which is grown in tropical and subtropical climates. banana production has gradually expanded during the previous 20 years, rising 117 million tonnes in 2019 compared to more than 70 million in 1999 [4], 35 to 50 percent of the fruit is made up of the peel of the banana. Regular banana peel waste at grocery stores and residential garbage pollutes the ecosystem [5].
A banana's peel is a fantastic source of macronutrients, micronutrients and a number of bioactive compounds. The banana peel contains significant amounts of dietary fiber overall, , cellulose, crude protein , hemicellulose, lignin and , pectin as well as minerals like ca, mg, P and K, amino acids like leu, thr, val, and phe and particularly linoleic acid are polyunsaturated fatty acids. one of the most significant waste materials that could be used as a useful ingredient in the food industry is banana peel [6].

## 2. Materials

Wheat flour , bananas and kansui reagent which are essential materials for making pan bread were purchased from local supermarket in Basrah city.

### *2.1. Preparation of BPP*

The banana fruit's peels were taken off and before being dried in properly washed with water and then allowed to air dry for 2weeks, ground into a fine powder and separated to have more than or equal to 1.0 mm [2]. Peel powder is kept in plastic bags in the freezer until it is needed.

### *2.2. Chemical Content of BPP*

Banana peels were subjected to a chemical examination. The Association of Official Agricultural Chemists [7] assessed the protein, fat, crude ash, and crude fiber content , Carbohydrate was done using The carbohydrate content was determined by difference.

### *2.3. pH*

A suspension of banana peel powder (8% w/v) was agitated for 5 minutes then let to stand for 30 minutes before being filtered and having the pH of the filtrate determined [8].

### *2.4. Bulk Density*

By adding banana peel powder to a 15 mL measuring cylinder, bulk density was calculated. The bulk density is computed using the mass of banana peel required to fill the measuring cylinder.after it had been filtered and left to stand for 30 minutes. A pH meter is used to measure the filtrate [9].

### *2.5. Calculating the Hausner ratio and the Carr's Index*

Hausner ratio and the Carr's Index were calculated by use following formula [10].

$$Hr = TD/ BD$$

$$Ci = TD - BD / TD \times 100$$

### *2.6. WHC and OHC*

One gram of the dry material was mixed with 25 mL of distilled water or maize oil for 20 minutes before centrifuging at 3000 g. The tubes were left to drain for 10 minutes at a 45° angle while the supernatant was decanting. after the remainder was evaluated, the WHO and OHC were computed as g water or oil per g dry sample [8].

### *2.7. Swelling Capacity*

[4]was used to measure the SC of the BPP, Initially, 0.5 g of the sample and 10 mL of distilled water were mixed and the solids volume was measured(x) , 18 hours were spent letting the mixture sit at room temperature before measuring the bed volume (y). Three duplicates of the experiment were created. Using Eq., the SC was computed and represented as milliliters per gram of mucilaginous sample (mL/g).

$$SC\ (mL/g) = y - x/0.5$$

*2.8. Processing of Pan Bread*

Bread pan was made using the conventional technique recommended by [10]was employed, and the straight dough procedure was applied,100 g Wheat flour, 3 g shortening ,1.5 g dry yeast, , 2g sugar, 2 g salt as well as water agreeing the farinograph test.

Formulations that contained BPP as a partial replacement for WF to varying degrees (0, 2, 6 and 10%) were added to a mixing bowl and mixed for 6 minutes at a temperature of 28± 2.0 °C. The prepared dough was hand rounded after mixing by folding 20 times and after that, the mass dough was given 10 minutes to rest. A baking pan that had been lightly oiled received the prepared dough. 20 minutes were spent baking the dough. at 250 °C in an electrical oven after being proofed for 80 minutes at 85% relative humidity and 30.5°C. The pan bread was baked and then allowed to cool to room temperature (25 °C) for 60 minutes before being placed in polyethylene bags.

*2.9. Pan Bread Physical Characteristics*

After cooling the loaves for three hours, the average weight of the loaves was noted according to [11]. guidelines, the volume was determined using the millet displacement, calculating specific volume ($cm^3/g$) required dividing the loaf's volume by its weight.

*2.10. Sensory Evaluation*

Ten panelists evaluated the volume, crust color , taste, crumb texture, appearance ,crumb grain, , taste, flavor, and and general acceptability of bread were requested for sensory evaluation according to[12]. The panelists used a hedonic 10-point scale to rank the bread formulations.

*2.11. Statistical Analysis*

Using [13], all of the study's data were subjected to an analysis of variance (ANOVA). The least significant difference (LSD) was used to calculate the difference between the means at $p < 0.05$.

## 3. Results and Discussion

*3.1. Chemical Structure of Banana Peel Powder*

The chemical composition's results were displayed in table 1. BPP was found to have moisture7.6 ±66667, fat9.33 ± 88192 , protein 7±57735% , ash9.66±88192%, fiber 17.77±.22169 and carbohydrate 50.89±2.88833.

**Table 1.** Chemical composition(%) of BPP.

| Moisture | Fat | Protein | Ash | Fibre | Carbohydrate |
|---|---|---|---|---|---|
| 7.6 ±66667 | 9.33 ± 88192 | 7±57735 | 9.66±88192 | 17.77±.22169 | 50.89±2.88833 |

The results were higher than repored by [14]who that BPP had moisture 3.56% , protein 6.41%, ash 11.86% and fiber 14.38% BPP is a good source of fiber, by adding this flour to foods, it would be feasible to raise the amount of these nutrients present in those foods.

[15].reported that BPP included10.8% moisture, 6.47% protein , 3.20% crude fiber, 0.37% fat and 74.7% carbohydrate.

*3.2. Flow Properties*

Table 2. lists the flow properties of banana peels powder. BPP had bulk density, 0.35 g/ml ±02887 , tapped density0.40 g/ml±.hausner s ratio1.16 ±05341 and Carr's Index14.21 %±4.12331 ,less space between particles may be the cause of the rise in bulk density (Dom *et al*.,2021) .These results agree with by repored [9] that BPP had bulk density A 0.3878±0.12 g/mL, B 0.4714±0.21, C 0.5660±0.14, , tapped densityA 0.6628±0.0051 g/mL, B 0.6996±0.0061g/mL,C 0.6540± 0.0041 g/mL.

**Table 2.** Flow properties of BPP.

| Bulk density | Tapped density | Hausner ratio | Carr's Index |
|---|---|---|---|
| 0.35 g/ml ±02887 | 0.40 g/ml±.01453 | 1.16 ±05341 | 14.21 %±4.12331 |

The scale of flowability based on the hausner s ratio and Car index the determines how easily the materials flow(Dom *et al*.,2021).

*3.3. Physicochemical Properties*

Table 3. displays the physicochemical properties of BPP (pH ,WHC, SC and OHC). pH was 6.15 ± 01764 which the banana peel had water holding capacity 7 g water/ BPPg ± 57735, swelling index 15.33 ml/g± 1.45297, The banana peel exhibited features of hydration. The findings support a study by [16]that found that when banana powder's particle size increased, it became more capable of retaining water. the high content of pectin and hemicellulose in fruit fiber is also related to high water retaining capacity. The 16.54% pectin yield from unripe Saba banana peels [9] can be used to support this argument.

**Table 3.** Physicochemical properties.

| pH | WHC | WHO | SC |
|---|---|---|---|
| 6.15 ± 01764 | 7 g water/ BPPg ± 57735 | 3.4g oil /BPPg± 05774 | 15.33 ml/g± 1.45297 |

Hydrophobic polysaccharides found in the soluble dietary fibers of plants' cell walls may have an impact on the WHC and SC. The swelling, in which the volume or size of banana peel powder increases, is another factor contributing to its high water holding capacity [4].

OHC of BPP was 3.4g/g, these resuits was found to be substantially higher than that in banana peel dietary fibre , these results are in higher than with those of Zaidan *et al*,(2021) who that BPDF had WHC 0.7 ± 0.14 gwater/ BPDF g , OHC 0.35 ± 0.07 goil / BPDF g and SC 0.73 ± 0.23 ml/g

*3.4. Physical Characteristics of Fortified Pan Bread*

Table 4 showed the effects of pan bread fortification with BPP on physical characteristics weight (g), volume ($cm^3$), and specific volume (cm3/g) according to the findings BPP -enriched pan bread. it is revealed that pan bread supplemented with BPP had higher scroes in volume 393.3333±3.33333and 2.5433±02848 specific volume at 6% BPP compared control

**Table 4.** Influence of adding banana peel powder on the physical properties of pan bread .

| Levels BPP | Weight(g) | Volume($cm^3$) | Specific volume($cm^3$/g) |
|---|---|---|---|
| 0% | 149.4333 ±29627d | 340.0000 ±5.77350c | 2.3300 ±.08622c |
| 2% | 155.0000 ±.28868c | 331.0000 ±1.00000c | 1.7400 ±.03055c |
| 6% | 194.3667 ±31798a | 393.3333 ±3.33333c | 2.5433 ±02848c |
| 10% | 174.0000 ±57735b | 334.0000 ±3.05505c | 1.96 ±0.65667c |

Each number represented the standard deviation of three determinations on average.

Panbread had volume 340.0000±5.77350 and specific volume2.3300±.08622 while the volume and specific volume were only slightly reduced when the level of BPP increased at 2 and 10%, It was explained by the increasing BPP content which improved BPP's capacity to absorb water In comparison to control breads.

[17] showed that adding inulin- to bread causes a reduction in bread volume. this effect could be the result of the gluten diluting action, which causes gas retention without an increase in gas production which destroys structures.

*3.5. Sensory Evaluation*

Table 5 and Fig. 1 exhibit the results for Organoleptic properties of sensory evaluation. all of the formulae could be seen to have a considerable reduction in relations of crumb grain, crust color, odor,which appearance, volume, crumb texture and general acceptability at 2 and 10 % BPP which highest scores was at 6% BPP, increased dough dryness from a higher BPF level made handling tougher. The dough also turned brittle and had a very black color [14].

**Table 5.** Sensory valuation of pan bread with BPP added.

| Levels of BPP | Appearance (10) | Volume (10) | Crumb Texture (10) | Crumb Grain (10) | Crust Color (10) | Taste (10) | Aroma (10) | Overall Appropriateness (10) |
|---|---|---|---|---|---|---|---|---|
| 0% | 7.8510 ±.23405b | 8.5780 ±11942b | 8.4680 ±.19265ab | 8.6680 ±.21420a | 9.4760 ±12325a | 8.9200 ±.21437a | 9.2200 ±.19653a | 8.3700 ±13000b |
| 2% | 6.6710 ±22778c | 7.8010 ±.15855c | 7.9890 ±.15162b | 8.3960 ±.21798ab | 8.2610 ±.23599b | 8.1790 ±.15705b | 9.0500 ±.09574a | 7.1400 ±.18511c |
| 6% | 8.5100 ±17026a | 9.2400 ±.18086a | 8.8420 ±.20973a | 7.7500 ±.31526b | 7.5980 ±.45529b | 8.0740 ±.14472b | 7.6000 ±.18619b | 9.5310 ±.09384a |
| 10% | 7.0520 ±.22928c | 8.2720 ±.09992b | 6.0850 ±.25911c | 6.6410c ±15468 | 6.2800 ±22151c | 7.1000 ±.24676c | 5.3200 ±43507c | 7.4300 ±11930c |

Means in the similar column that change significantly at LSD (p 0.05) include those with differing letter values
Each number represented the standard deviation of an average of ten determinations [12].

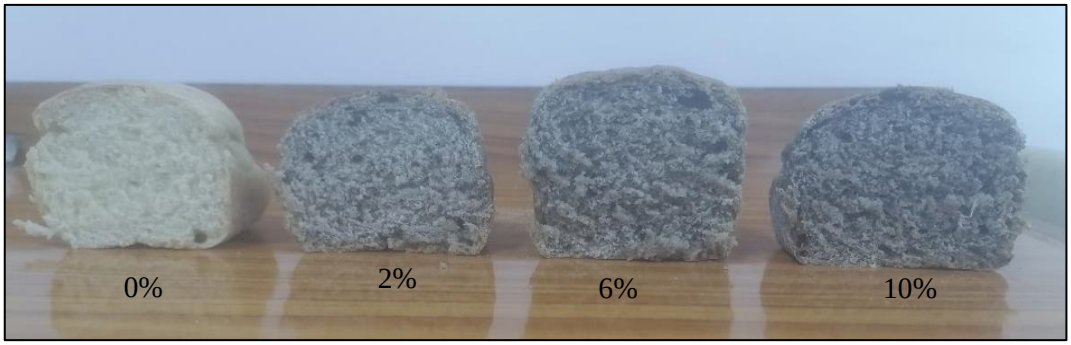


**Figure 1.** Pan bread formulations with BPF added.

The fiber's strong capacity for absorbing water also gives it the ability to limit bread cell gas expansion and hold onto moisture [18]. The quality of bread enhanced with 10% BPP is improved by the application of BPP. The best remedy was the addition of 6% BPP was acceptable by consumers.
In comparison to bread that did not include BPP the crust and crumb color changed due to the presence of BPP becoming darker , The lowest score for colour was at 10%. These results approve with previously described by [14] that the designed products could be supplemented with BPF up to 10%, with an Acceptability index of more than 80% and appreciable increases in fiber and fat.

## Conclusion

The overall findings led to the conclusion that the when wheat flour was partially replaced with BPP, only a slight reduction in pan bread quality, adding BPP to the mix for pan bread will boost its nutritious content. The bread enriched up to 6% BPP was found to have acceptable organoleptic features and it significantly differed from the control in terms of appearance, crumb texture, crumb grain, crust color, taste, odor, and overall acceptability. Despite this, it might manufacture some high-quality baked goods that are suited for patients who are overweight using BPP and wheat flour. according to a study on the topic. In essence, this study was successful in determining the features of banana peel powder that might be used in culinary products.

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