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# STANDARDIZATION AND STORAGE EVALUATION OF COOKIES PREPARED FROM BANANA FLOUR AND REFINED WHEAT FLOUR BLENDS

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**ABSTRACT**

An experimental study was designed to formulate ready to eat cookies by incorporating banana flour, but banana flour contains excellent amount of nutrients especially dietary fiber, essential vitamins and minerals. The proximate analysis of those cookies were compared with control cookies where no banana flour was added and designated as normal cookies (0% substitution). The present study entitled "standardization and storage evaluation of cookies prepared from premature ripe banana (*Musa accuminata*) flour and refined wheat flour blends" was conducted using a completely randomized design (CRD) with 9 main treatments *viz.*, $T_1$ 00:100 (BF:WF), $T_2$ 100:00 (BF:WF), $T_3$ 80: 20 (BF:WF), $T_4$ 70:30 (BF:WF), $T_5$ 60:40 (BF:WF), $T_6$: 50:50 (BF:WF), $T_7$ 40:60(BF:WF), $T_8$ 30:70(BF:WF), $T_9$ 20:80 (BF:WF). The cookies were stored under ambient condition for 30 days and were analyzed for changes in proximate composition. *i.e,* moisture, TSS, reducing and non-reducing sugars. It was observed that samples of cookies with 60:40 (Banana flour: Wheat flour) were opted best treatment during ambient condition storage of 30 days.

***Keywords*:** Banana flour, wheat flour, Cookies, Proximate composition.

## Introduction

Bananas are known by the scientific name *Musa acuminata* (Musa sps.), a very popular fruit in the world market. It can be eaten as raw or processed as well as flour is used as a functional ingredient in various food products (Singh *et al.*, 2016). Bananas are cultivated in over 130 countries as the second leading fruit in the world after citrus. Banana pulp is rich in phenol compounds such as carotenoids, flavonoids, and vitamins ($B_3$, $B_6$, $B_{12}$, C and E). Phenolic compounds and natural antioxidants in banana contribute to the storage stability and exerting health benefits as well furthermore, banana is richest with potassium, magnesium and other nutrient contents were observed by Aurore *et al.* (2009)

Bananas are not only consumed as fresh fruits but also cooked, like plantains. In different methods, they are processed to make chips, flour, fries, fritters, purees, jams, ketchup, and alcohol. Drying is the best processing method for perishable food products. Because of the high perishability, banana needs drying during processing for preserving a longer period. As banana flour is prepared by drying, this flour has a high storability and a long shelf life. Banana flour is prepared and it is used in bakery and confectionery industries. Banana flour is currently used in the food industry for making bread, cake, pasta and cookies, biscuits, cookies and baby food ware studied by Aurore *et al.* (2009).

Cookies are consumed as snacks because of the crispiness, taste and digestibility. Most of the time, cookies are prepared using refined wheat flour (Pérez-Carrillo *et al.* 2017). Composite flour is healthier because it improves the nutritional value of bakery products when blended with other types of flour. The development of banana flour-incorporated cookies is healthy due to the nutrition content in banana such as carbohydrate, mineral and antioxidant capacity as well as using banana flour in bakery products also reduced the postharvest loss of banana was reported by Adeola and Ohizua (2018).

However, there is no scientific and methodological investigation, so far been reported regarding the methods for amelioration of *in situ* pre mature fruit ripening in banana cv. Grand Naine. Hence, it is necessary to standardize the process for value added product from the premature ripened banana fruit pulp through proximate composition of cookies.

## Material and Methods

Premature ripe banana fruits were procured from the research field in Fruit Science block, Dr. Y.S.R.H.U. College of Horticulture, Anantharajupeta, Annamayya district, Andhra Pradesh during the year 2024-25 for research work.

Then the flour was prepared from the banana fruits with the series of different methods i.e. blanching, peeling, cutting into slice, tray drying, grinding and packaging. Wheat flour was procured from the local market. As per the concentration of banana and wheat flour the 6 treatments as $T_1$, $T_2$, $T_3$, $T_4$, $T_5$, $T_6$, $T_7$, $T_8$ and $T_9$. The treatments according to the different concentrations of banana and wheat are T1 00:100 (BF:WF), T2 100:00 (BF:WF), T3 80: 20 (BF:WF), T4 70:30 (BF:WF), T5 60:40 (BF:WF), T6: 50:50 (BF:WF), T7 40:60 (BF:WF), T8 30:70(BF:WF), T9 20:80 (BF:WF) cookies were packed in a 400 gauge LDPE (low density polyethylene) bag and stored at ambient temperature.

**Standardization of cookies recipe:** Cookies were first prepared by using nine different combinations by using banana and wheat flour, along with sugar, butter and baking powder.

### Preparation of banana flour

First take premature ripe banana fruit by washing and cleaning with tap water than dipping in hot water at temperature of 65-75°C for 10 minutes until tender. After that peeling of the banana and cutting into slices. These slices were dried in tray dryer at 60°C to 8-10% moisture content. Grinding the dehydrated slices into powder form than sieving banana flour and packaging in 400 gauge LDPE bags.

### Preparation of banana flour cookies

Taking dry ingredients according to set formulation (wheat + banana flour (100g)) based on treatment wise and baking powder (1g). Mixing all dry ingredients and sieving it. Sugar was ground to a fine powder and mixed with butter for 5 min to make the cream (powder sugar 40 g and butter 50 g). Baking powder were thoroughly mixed and added to the cream mixture to form the dough. The dough was covered with a polythene and kept in the freezer for 30 min to rest. It was kneaded to a uniform thickness (5mm) and cut into a uniform diameter (6 cm) using a cutter then kept on a tray. The tray was kept in the oven and baked at 160° C for 15 min. Baked cookies were cooled at ambient temperature, packed in high-density polythene, and labelled and stored at ambient temperature. Allowing the cookies to cool at room temperature.

**Proximate composition of banana cookies:** The cookies proximate composition analysis for moisture, total soluble solids (TSS), reducing sugar, non-reducing sugars.

**Packaging and storage of cookies:** The cookies were packed in high-density polythene, and labelled and stored at ambient temperature. The storage cookies were evaluated for chemical composition immediately after preparation and after 30 days.

**Statistical analysis:** The data obtained in the present investigation was analysed using Completely Randomized Design (CRD) with three replications for statistical significance.

## Results and Discussion

### Effect of banana flour and refined wheat flour blends on proximate composition of cookies during storage

The moisture content, total soluble solids (TSS), reducing sugar, non-reducing sugars content of cookies prepared using different proportions of banana flour and refined wheat flour was determined at 0 day and 30 days after preparation and the results are presented in the table 1.

### Moisture (%)

An increase in moisture content was observed in all treatments during the storage period. On the day of preparation, moisture content values ranged from 3.00 to 4.60%. The highest moisture content 4.6% was recorded in $T_5$ (60% banana flour + 40% refined wheat flour), followed by $T_4$ (70% banana flour + 30%

refined wheat flour) with 4.45%. The lowest initial moisture content with 3.30% was observed in $T_1$ (100% refined wheat flour), closely followed by $T_9$ (20% banana flour + 80% refined wheat flour) with 3.90%. After 30 days of storage, moisture content increased in all formulations, with values ranging from 3.46 to 4.85 per cent. Cookies prepared under treatment $T_5$ continued to found the highest moisture content of 4.85%, followed by $T_4$ with 4.71% indicating better moisture stability. In contrast, the lowest moisture content of 3.46% was observed in $T_1$.

Overall 30 days of storage, cookies formulated with moderate proportions of banana flour $T_1$ (100% refined wheat flour) exhibited lowest moisture uptake 3.30% and 3.46% during storage at 0 and 30 DAP respectively whereas the highest increase was observed in 100% banana flour ($T_2$) at 0 and 30 DAP respectively with 4.33% and 4.69%.

Moisture content (%) increased with the incorporation of banana flour. These findings are in close agreement with those of Bertagnolli *et al.* (2014), who reported that cookies prepared from composite flour containing guava peel flour had moisture contents ranging from 2.7% to 4.9%. Similar results were reported by Akubor *et al.* (2003) in cowpea and plantain flour blends cookies and banana and banana peel flour incorporated cookies reported by Alam *et al*. (2020), Maskey *et al*. (2020) in jackfruit seed flour incorporated cookies. The increase in moisture during storage may be attributed to ambient humidity absorption and hygroscopic nature of cookie constituents, leading to gradual moisture migration within the product. Ajila *et al.* (2008) also recorded the similar pattern in moisture content of biscuits with increasing level of supplementation of mango peel powder and also 30 days of storage period.

**Total Soluble Solids (TSS) (°Brix)**

TSS gradual inclined in values across all treatments during 30 days of storage period. At the time of freshly prepared cookies, TSS values ranged from 19.52 °B to 22.93 °B. Cookies prepared under $T_5$ (60% banana flour + 40% refined wheat flour) maintained the highest TSS (°B) value as 22.93 °B, on par with $T_4$ have 22.62 °B followed by $T_2$ with 22.12 °B. The lowest TSS (°B) was recorded in $T_1$ (100% refined wheat flour) with 19.52 °B indicating a lower soluble solid contribution from refined wheat flour alone. After 30 days of storage, TSS (°B) content increase in all cookie formulations, with values ranging between 20.06 °B to 23.34 °B. Despite the increase, the highest TSS (°B) 23.75 was found in $T_5$ and on par with $T_4$ had 23.07 °B, which was followed by 100% banana flour ($T_2$) with 22.82°B. The lowest TSS (°B) 20.06 was found in treatment $T_1$ (100% refined wheat flour).

Throughout the storage period, $T_5$ (60% banana flour + 40% refined wheat flour) recorded the lowest increase in TSS (ºB) as 22.89 °B and 23.34 °B at fresh and 30 DAS respectively, while $T_1$ (100% refined wheat flour), showed the highest increase as (19.52 °B and 20.06 °B at fresh and 30 DAP respectively).

Treatments containing higher proportions of banana flour consistently exhibited elevated TSS levels. These results matched with Maskey *et al.* (2020) in jackfruit seed flour incorporated cookies. The TSS in wheat flour was significantly lower than that of jackfruit seed flour. The increase in TSS during storage may be attributed to the conversion of starch and polysaccharides into sugars, as well as to moisture loss, which tends to enhance the total soluble solids.

**Reducing Sugars (%)**

The results presented in the table 1. indicate a gradual increase in reducing sugar content in all treatments during the storage period.

At first day after preparation, reducing sugar values ranged from 11.67% to 14.33%. The highest reducing sugar content 14.23% was observed in $T_5$ (60% banana flour + 40% refined wheat flour), followed by treatment $T_4$ (70% banana flour + 30% refined wheat flour) with 13.97%. The lowest reducing sugar content 11.67% was recorded in $T_1$ (100% refined wheat flour with). At 30 days after storage, reducing sugar content increased in all cookie formulations, with values ranging from 12.23 to 14.64%. Cookies prepared under treatment $T_5$ recorded the maximum reducing sugar content of 14.54% on par with 14.33% reducing sugars observed in treatment $T_4$ followed by $T_2$ with 13.37%. The lowest value after storage was recorded in $T_1$ with 12.23%. During the storage period of 30 days, $T_5$ noted the minimum increased in reducing sugar content with values of 14.23% and 14.54% at fresh and 30 DAS respectively. Whereas $T_1$ showed the maximum increased with values of 11.67% and 12.23% at same intervals.

In general, treatments with higher banana flour inclusion exhibited elevated reducing sugar levels. The observed increase in reducing sugars during storage may be attributed to the breakdown of complex carbohydrates and starch components into simpler sugars over time by Loza *et al.* (2017). Similarly, Khapre *et al.* (2015) reported comparable results in fig fruit powder-enriched cookies, suggesting that the rise in non-reducing sugars during storage was due to

changes in carbohydrate composition and the inter conversion of different sugar fractions.

**Non-Reducing Sugars**

The data presented in the table.1 indicate an increase in non-reducing sugar content in all treatments during the storage period.

At the time of preparation(fresh), non-reducing sugar values ranged from 6.51% to 8.08 mg $100g^{-1}$. The highest non-reducing sugar content 8.08% was recorded in $T_5$ (60% banana flour + 40% refined wheat flour), followed by $T_4$ (70% banana flour + 30% refined wheat flour) with 7.56%. The lowest value 6.51% was observed in $T_1$ (100% refined wheat flour). After 30 days of storage, non-reducing sugar content increased in all cookie formulations, with values ranging between 7.22% and 8.38%. Cookies prepared under $T_5$ recorded the highest non-reducing sugar content of 8.38% followed by $T_4$ with 7.84%. The lowest non-reducing sugar content of 7.22% after storage was observed in treatment ($T_1$) prepared with 100% refined wheat flour. During the storage period of 30 days, $T_5$ showed the minimum incline of non-reducing sugars with values of 8.08% and 8.38 % at fresh and 30 DAS respectively. Whereas treatment $T_1$ was recorded the maximum incline with values of 6.51% and 7.22% at fresh and 30 days storage.

Cookies formulated exclusively with refined wheat flour tend to exhibit lower levels of non-reducing sugar compared with banana flour incorporated cookies. Similar findings were reported by Khapre *et al.* (2015) in fig fruit powder-enriched cookies, who attributed the increase in non-reducing sugars during storage to alterations in carbohydrate composition and possible inter conversion of sugars over time.

## Conclusion

The present investigation entitled "standardization and storage evaluation of cookies prepared from banana cv. Grand Naine flour and refined wheat flour blends". The findings showed that during 30 days of storage, gradual increased the proximate composition of cookies was considerably impacted by the addition of banana flour. Moisture content, total soluble solids (TSS), reducing sugars, and non-reducing sugars all showed gradual changes between treatments. Regarding overall quality features and storage stability for 30 days, $T_5$ (60:40, BF:WF) was determined to be the most acceptable formulation out of all the treatments. In addition to increasing nutritional value, using banana flour in baked goods provides a value-added strategy for lowering post-harvest banana losses.

**Table1 :** Effect of banana flour and refined wheat flour blends on Moisture content (%), Total soluble solids (°Brix), reducing sugars (%), non-reducing sugars (%) of cookies during storage.

| Treatments | Days after storage | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Moisture content (%) | | Total soluble solids (°Brix) | | Reducing sugars (%) | | Non reducing sugars (%) | |
| | 0 | 30 | 0 | 30 | 0 | 30 | 0 | 30 |
| **$T_1$** | 3.30 | 3.46 | 19.52 | 20.06 | 11.67 | 12.23 | 6.51 | 7.22 |
| **$T_2$** | 4.33 | 4.69 | 22.12 | 22.82 | 12.99 | 13.47 | 7.49 | 7.77 |
| **$T_3$** | 4.36 | 4.67 | 21.91 | 22.37 | 12.87 | 13.37 | 7.38 | 7.55 |
| **$T_4$** | 4.45 | 4.71 | 22.62 | 23.07 | 13.97 | 14.33 | 7.56 | 7.84 |
| **$T_5$** | 4.60 | 4.85 | 22.93 | 23.75 | 14.33 | 14.64 | 8.08 | 8.38 |
| **$T_6$** | 4.27 | 4.53 | 21.60 | 22.07 | 12.97 | 13.45 | 7.36 | 7.53 |
| **$T_7$** | 4.11 | 4.36 | 21.08 | 21.53 | 12.26 | 12.75 | 7.25 | 7.76 |
| **$T_8$** | 3.93 | 4.15 | 21.29 | 21.78 | 12.70 | 13.18 | 7.25 | 7.73 |
| **$T_9$** | 3.90 | 4.09 | 20.41 | 20.92 | 12.03 | 12.55 | 6.94 | 7.47 |
| S.Em ± | 0.05 | 0.04 | 0.22 | 0.28 | 0.11 | 0.39 | 0.17 | 0.14 |
| CD at 5% | 0.14 | 0.13 | 0.64 | 0.82 | 0.34 | 1.16 | 0.51 | 0.43 |


**Plate 1 :** Above cookies prepared with 60% banana flour + 40% refined wheat flour($T_5$) was recorded height proximate composition of cookies during storage.


**Plate 2 :** Above cookies prepared with 100% refined wheat flour ($T_1$) was recorded lowest proximate composition of cookies during storage.

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