



Plant Archives

Journal homepage: <http://www.plantarchives.org>

DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.1.076>

EFFECT OF BANANA FLOUR AND REFINED WHEAT FLOUR BLENDS ON SENSORY AND STORAGE QUALITY OF COOKIES

Siriki Anusha^{1*}, VNP Sivarama Krishna², M. Siva Prasad³, I. Ravi⁴ and Y. Sireesha⁵

¹Department of Fruit Science, Dr. YSRHU- College of Horticulture, Anantharajupeta, Annamayya (D)-516105, A.P., India

²Department of Fruit Science, Dr.Y.S.R. Horticulture University -BRS, Pulivendula, YSR Kadapa(D)-516390, A.P., India

³Department of Horticulture, Dr.Y.S.R. Horticulture University-College of Horticulture, Anantharajupeta, Annamayya (D), 516105, A.P., India

⁴Department of Plant Physiology, ICAR-National Research Centre for Banana, Tiruchirapalli, Tamil Nadu, India

⁵Department of Plant Pathology, Dr. Y.S.R. Horticulture university-BRS, Pulivendula, YSR Kadapa(D)-516390, A.P., India

*Corresponding author E-mail: anushasiriki18@gmail.com

(Date of Receiving : 25-12-2025; Date of Revision : 04-02-2026; Date of Acceptance : 28-02-2026)

ABSTRACT

Banana (*Musa acuminata*) is grown abundantly in tropical and subtropical countries and it is consumed as raw or processed. Banana is a significant source of nutrients and it has been found to contain carbohydrates and other nutritional components. The present study was conducted to evaluate the effect of banana flour (BF) and refined wheat flour (WF) blends on sensory and storage quality of cookies was carried out using a completely randomized design (CRD). Several sets of cookie samples were prepared separately by incorporating wheat flour and banana flour combinations of nine treatments viz, 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) stored at ambient condition for 30 days. These samples were evaluated for sensory attributes, *i.e.*, appearance, colour, flavour, taste and overall acceptability. 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, sensory evaluation.

Introduction

Banana (*Musa paradisiaca* L.) is the most important world's tropical fruit plant, having very high heritage and culture. It is an herbaceous perennial crop belong to the family musaceae with chromosome number $2n=22$ and originated in Indo-Malayan (South East Asia) region. Globally, India stands first in both area and production of banana and contributes more than 20 percent of global production but has very less contribution to the international banana market.

Banana is an important fruit crop contributing significantly to human nutrition due to its rich content of essential vitamins and minerals. It is a good source of vitamin B₆ and vitamin C, high potassium content,

which play vital roles in energy metabolism, immune function and antioxidant activity and essential for maintaining electrolyte balance and normal muscle and nerve function. The presence of dietary fibre and natural sugars further enhances its nutritional value and digestibility. Owing to these attributes, banana is widely recommended as a nutritious and energy rich fruit across all age groups (Nakasone, 1999).

Banana is a climacteric perennial fruit grown and harvested year-round and is generally harvested in a mature, green state. It has higher consumer demand throughout the world (Wasala *et al.*, 2021). Despite good yield potential and profitability, farmers experience considerable losses due to the climacteric nature of the fruit, which makes it highly perishable

with a short shelf life. Banana fruits are therefore highly vulnerable to postharvest losses caused by premature ripening, weight loss, mechanical damage, diseases and rotting.

Here we prepared banana flour from banana because there is a lot of promise for banana flour. Due to its high nutritional content, for commercial purposes, it may be used in place of fresh bananas to make cookies that are packed with fibre and minerals was observed by Alam *et al.*, 2021. The banana fruits make up an alternate source of indigestible carbs due to a number of variables, including their high cellulose, lignin and hemicellulose content as well as their inexpensive price. Cookies can be categorized as convenient and ready-to-eat foods. Making cookies is often a very easy procedure and the fundamental components are flour and sugar. Cookies are normally considered of being flat, firm and crunchy foods. Because they are regarded as a practical snack with a crisp texture, sweet flavour and reasonable price, cookies are widely consumed across the world. They are regarded as bakery items made with sugar, fat and wheat flour that are lacking in several crucial components for human nutrition. As a result, adding ingredients is an alternate way to increase the nutritional content and functional appeal of foods observed by Silva and Conti-Silva (2018).

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

Material and Methods

Premature ripe banana fruits were procured from the research field in Fruit Science block, Dr.YSRHU-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. washing, 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 9 treatments as T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈ and T₉. The treatments according to the different concentrations of banana and refine wheat flour were 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) observed in the plate.1. 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, baking powder.

Preparation of banana flour: First take premature ripe banana fruit 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 (1gm). 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). Flour, 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 (5 mm) 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.

Sensory Analysis: Sensory quality attributes (appearance, texture, odour, taste, aftertaste, and overall acceptability) were evaluated by a sensory panel member using a 5-point hedonic scale.

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 analyzed using Completely Randomized Design (CRD) with three replications for statistical significance.

Results

Appearance

The results pertaining to the effect of different proportions of banana flour and refined wheat flour on the appearance of cookies at fresh and 30 days after

preparation was presented in the table 1. The Appearance of cookies showed a declining trend during storage across all treatments.

On the 1st day after preparation (fresh), cookies appearance score recorded from 7.53 to 8.84. Treatment T₅ comprising 60% banana flour + 40% refined wheat flour was recorded highest score of 8.84 followed by T₆ (50% banana flour + 50% refined wheat flour) with score of 8.70. The lowest appearance score of 7.53 was observed in T₁ (100% refined wheat flour). After 30 days of storage, a reduction in appearance was observed in all treatments. The appearance score ranged from 6.82 to 8.67. The maximum appearance score of 8.67 was noted in T₅, followed by T₆ with score of 8.52. The minimum appearance score of 6.82 was recorded in T₁, indicating a greater decline during storage. Over 30 days the storage period, T₅ the minimum decline in appearance score with value of 8.84 and 8.67 at fresh and 30 DAS respectively. Whereas T₁ (100% refined wheat flour) showed the maximum decline with score of 7.52 and 6.82 at same intervals.

Colour

The influence of varying levels of banana flour and refined wheat flour on the colour score of cookies was assessed at 0 day and 30 days after preparation and the results are summarized in the table 1. A gradual reduction in colour score was noticed in all treatments as storage progressed.

On the day of preparation (fresh), the colour scores varied between 7.48 to 8.96. Cookies formulated with 60% banana flour + 40% refined wheat flour (T₅) recorded the highest colour score (8.96), indicating superior colour appearance. This was followed by treatment T₆ with values of 8.77. The lowest colour score 7.48 was observed in T₁ (100% refined wheat flour), reflecting comparatively poorer colour development. After 30 days of storage, a slight decline in colour score was evident across all treatments. The scores ranged from 7.17 to 8.82. Among the treatments, T₅ continued to retain the highest colour score was 8.82, followed by T₆ with 8.60. The lowest colour value of 7.17 was again associated with T₁, indicating greater colour deterioration during storage. Overall, cookies formulated with moderate proportions of banana flour T₅ exhibited minimum decrease colour with score of 8.96 and 8.82 during storage at 0 and 30 DAPS respectively. whereas the maximum decrease was observed in T₁ (at 0 and 30 DAP respectively) with 7.48 and 7.17.

Taste

The sensory evaluation of cookies prepared with varying proportions of banana flour and refined wheat flour was carried out to assess their taste score at fresh and 30 days after preparation, and the results are presented in the table 1. A reduction in taste scores was observed in all treatments as the storage period progressed.

The day of preparation (fresh), taste scores ranged from 7.58 to 9.11. The highest taste score of 9.11 was obtained in T₅ (60% banana flour + 40% refined wheat flour), indicating superior palatability. This was followed by T₆ (50% banana flour + 50% refined wheat flour) with 8.87 score. The lowest taste score 7.58 was recorded in T₁ (100% refined wheat flour), reflecting comparatively lower acceptability of the treatment. After 30 days of storage, a decline in taste scores was evident in all treatments, with values ranging from 7.01 to 8.96. The highest taste score of 8.96 was observed in T₅, cookies prepared with 60% banana flour + 40% refined wheat flour, on par with 8.71 score in T₆ which was followed by cookies prepared under treatment T₄ with score of 8.57. The minimum taste scores of 7.01 was observed in T₁, indicating a greater reduction in taste quality during storage.

Flavour

The flavour of cookies prepared using different blends of banana flour and refined wheat flour were evaluated on fresh and after 30 days of storage and the findings are presented in the table 4.74. A general decline in flavour scores was observed in all treatments during storage.

At the days after preparation (fresh), flavour scores ranged from 7.57 to 8.79. T₅ (60% banana flour + 40% refined wheat flour) received the highest flavor score of 8.79 indicating superior sensory acceptability. This was followed by T₄ (60% banana flour + 40% refined wheat flour) with score of 8.64. The lowest flavour score of 7.573 was noted in T₁ (100% refined wheat flour). After 30 days of storage, all treatments exhibited a reduction in flavour scores, which ranged from 6.87 to 8.60. Cookies prepared under T₅ retained the highest flavour score of 8.60, followed by T₄ with 8.46. The minimum flavour score of 6.87 was again associated with T₁, indicating a greater loss of flavour during storage. During the storage period of 30 days, T₅ showed the minimum decrease of flavour with score of 8.79 and 8.60 at fresh and 30 DAS respectively. Whereas T₁ was recorded the maximum decline with values of 7.57 and 6.87 at fresh and 30 day after preparation respectively.

Overall acceptability

The overall acceptability of cookies prepared using different ratios of banana flour and refined wheat flour was evaluated on the day of preparation (fresh) and after 30 days of storage, and the results are presented in the table 4.74. A gradual decline in overall acceptability scores was observed across all treatments with the advancement of storage duration.

At first day after preparation, overall acceptability scores ranged from 7.47 to 8.87. The highest score of 8.87 was recorded in T₅, indicating the greatest consumer preference. This was followed by T₆ with score of 8.73. The lowest overall acceptability score 7.47 was observed in T₁ (100% refined wheat flour). After 30 days of storage, all treatments exhibited a reduction in acceptability scores, with values ranging from 7.08 to 8.77. Cookies prepared with T₅ continued to retain the highest overall acceptability score of 8.77, followed by treatment T₆ was recorded 8.62 score. The minimum score of 7.08 was noted in T₁ (100% refined wheat flour), indicating greater deterioration in sensory quality during storage. Overall, cookies formulated with moderate proportions of banana flour T₅ exhibited lowest decrease overall acceptability score uptake 8.87 and 8.77 during storage at 0 and 30 DAPS respectively. whereas the highest decrease score was observed in the cookies prepared with 100% refined wheat flour at 0 and 30 DAP respectively with 4.6 and 4.86.

Discussion

In general, cookie formulations containing moderate levels of banana flour (40–60%) maintained higher overall acceptability throughout the storage period when compared to formulations with either very high or very low banana flour inclusion. The reduction in acceptability during storage may be attributed to combined effects of flavour loss and colour changes, which collectively influence consumer perception.

Throughout the 30day storage period, there was gradual decline in the sensory attributes of appearance, color, taste, flavour and overall acceptability of blended wheat and banana flour cookies. The decrease in appearance during storage may be attributed to moisture absorption and gradual formation of acidic compounds, resulting from biochemical and oxidative changes during storage (Jood and Dayanand, 2001).

Manley, (2011) reported that the reduction in color quality could be attributed to storage induced changes such as oxidative reactions, moisture uptake and progression of non-enzymatic browning, which influence surface appearance. The decrease in taste scores over time may be attributed to oxidative changes, moisture uptake, and gradual loss of desirable flavour compounds during storage (Gupta *et al.*, 2011). The decline in flavour during storage may be attributed to oxidative changes in fats, moisture absorption, and loss of volatile flavour compounds, which are common during prolonged storage of bakery products (Adebiyi *et al.*, 2018). The reduction in acceptability during storage may be attributed to combined effects of flavour loss, taste and colour changes, which collectively influence consumer perception by Alam *et al.* (2021) in banana and banana peel flour cookies. Hedonic scale showed highest overall acceptability scored in these cookies by substitution of banana and banana peel flour .

Similar findings have been reported by Akubor *et al.* (2003) in cookies prepared from cowpea and plantain flour blends. Likewise, Aslam *et al.* (2014) reported that the cookies incorporation of mango kernel and peel powder and Ajila *et al.* (2008) in biscuits, prepare with mango peel powder supplementation. Further, Asif-Ul-Alam *et al.* (2014) reported that biscuits prepared using freeze-dried banana flour, Wani *et al.* (2014) reported that the biscuits prepared from malted wheat flour and cauliflower leaf powder, Khapre *et al.* (2015) in fig enriched cookies.

Conclusion

For the investigations conducted on “effect of banana flour and refined wheat flour blends on sensory and storage quality of cookies” following conclusion could be drawn. The decrease in, appearance, colour, flavour, taste and overall acceptability of blended banana and refine wheat flour cookies were observed during storage. cookies with 60:40 (Banana flour :Wheat flour) were opted best treatment during storage of 30 days, secured the highest score in sensory evaluation as compared to other combination of blended flour at 30th days of storage. The above conclusion is however based on the laboratory study and hence suggestive.

Table 1 : Effect of banana flour and refined wheat flour blends on Appearance, Colour, Taste, Flavour, Overall acceptability of cookies during 30 days of storage.

Treatments	Days after storage									
	Appearances		Colour		Taste		Flavour		Overall acceptability	
	0	30	0	30	0	30	0	30	0	30
T ₁	7.53	6.82	7.48	7.17	7.58	7.01	7.57	6.87	7.47	7.08
T ₂	8.38	8.06	8.67	8.49	8.58	8.35	8.57	8.13	8.45	8.22
T ₃	8.41	8.13	8.68	8.44	8.51	8.45	8.37	8.03	8.38	8.10
T ₄	8.68	8.39	8.48	8.23	8.77	8.57	8.64	8.46	8.64	8.47
T ₅	8.84	8.67	8.96	8.82	9.11	8.96	8.79	8.60	8.87	8.77
T ₆	8.70	8.52	8.77	8.60	8.87	8.71	8.57	8.27	8.73	8.62
T ₇	8.52	8.23	8.37	8.01	8.48	8.07	8.27	7.90	8.31	8.02
T ₈	8.59	8.40	8.16	7.90	8.35	7.90	8.11	7.55	8.23	7.92
T ₉	7.85	7.51	7.96	7.65	8.02	7.52	8.07	7.45	8.02	7.63
S.Em ±	0.04	0.05	0.04	0.04	0.08	0.10	0.05	0.04	0.04	0.05
CD at 5%	0.12	0.14	0.12	0.11	0.23	0.31	0.14	0.11	0.13	0.14

**Plate 1 :** Cookies prepared from nine different blends of banana flour and Refined wheat flour.

References

- Adebisi, J. A., Obadina, A. O., Adebo, O. A., and Kayitesi, E. (2018). Fermented and malted millet products in Africa, Expedition from traditional/ethnic foods to industrial value-added products. *Critical reviews in food science and nutrition*. **58**(3), 463-474.
- Ajila, C.M., Leelavathi, K. and Rao, U.J.S.P. (2008). Improvement of dietary fibre content and antioxidant properties in soft dough biscuits with mango peel powder. *Journal of Cereal Science*, **48**(2), 319-326.
- Akubor, P.I., Obio, S.O., Nwodomere, K.A. and Obiomah, E. 2003. Quality evaluation of cookies produced from composite flours of wheat and plantain. *Plant Foods for Human Nutrition*. **58**(3), 1-9.
- Alam, M. J., Akter, S., Afroze, S., Islam, M. T., and Sayeem, E. H. (2021). Development of fiber and mineral enriched cookies by utilization of banana

- and banana peel flour. *Journal of microbiology, Biotechnology and Food Sciences*, **10**(3), 329-334.
- Asif-Ul-Alam, S. M., Islam, M. Z., Hoque, M. M., and Monalisa, K. (2014). Effects of drying on the physicochemical and functional properties of green banana (*Musa sapientum*) flour and development of baked product. *American Journal of Food Sciences*.**2**(4), 128-133.
- Aslam, H. K. W., Raheem, M. I. U., Ramzan, R., Shakeel, A., Shoaib, M., and Sakandar, H. A. (2014). Utilization of mango waste material (peel, kernel) to enhance dietary fiber content and antioxidant properties of biscuit. *Journal of Global Innovations in Agricultural and Social Sciences*. **2**(2), 76-81.
- Chhuria, S., Maji, A., Dash, D. K., Biswal, M., and Patnaik, K. (2016). Effect of biofertilizer on growth and yield of banana cv. Grand Naine (ratoon crop) in west central zone of Odisha. 75-77.
- Gupta, M., Bawa, A. S., and Abu-Ghannam, N. (2011). Effect of barley flour and freeze-thaw cycles on textural nutritional and functional properties of cookies. *Food and Bioproducts processing*, **89**(4), 520-527.
- Jood, S. and Dayanand, M. (2001). Effect of storage on nutritional and sensory quality of bakery products. *Food Chemistry*. **73**(4), 441-444.
- Khapre, A. P., Satwadhar, P. N., and Syed, H. M. (2015). Studies on processing technology and cost estimation of fig (*Ficus carica* L.) fruit powder enriched Burfi (Indian cookie). *Journal of Applied and Natural Science*, **7**(2), 621-624.
- Manley, D. (2011). Manley's technology of biscuits, crackers and cookies. *4th edn. Woodhead Publishing, Cambridge*.
- Nakasone, H. Y., and Paull, R. E. (1999). Tropical fruits. Banana. *Wallingford, UK, New York, USACABI Publishing*. 103-131.
- Silva, E.O. and Conti-Silva, A.C. (2018). Evaluation of physical and sensory properties of cookies enriched with fruit by-products. *Journal of Food Science and Technology*, **55**(6), 2194-2203.
- Wani, S.A., Gull, A. and Allaie, F. (2014). Development and quality evaluation of biscuits supplemented with cauliflower leaf powder. *Journal of Food Science and Technology*. **51**(3), 561-567.
- Wasala, W. M. C. B., Benaragama, C. K., Kumara, G., Sarananda, K. H., and Dissanayake, C. (2021). Application of 1-methylcyclopropene (1-MCP) for delaying the ripening of banana, a review. *Asian Research Journal of Agriculture*. **14**(1), 44-56.