Journal of Food Technology Research
2025 Vol. 12, No. 4, pp. 278-287
ISSN(e): 2312-3796
ISSN(p): 2312-6426
DOI: 10.18488/jftr.v12i4.4603

Development and quality evaluation of flatbread incorporated with (Colocasia esculenta) taro leaf

Josephine Selvi Balamourougane[1]
Anna Shibu[2+]
Anzil Kareem[3]

[1,2,3]*Department of Food Technology, JCT College of Engineering and Technology, Coimbatore, Tamil Nadu, 641105, India.*
[1]*Email: Drjosephineselvi@gmail.com*
[2]*Email: theresaanna195@gmail.com*
[3]*Email: anzilk5522@gmail.com*

(+ Corresponding author)

Article History
Received: 10 June 2025
Revised: 26 September 2025
Accepted: 4 December 2025
Published: 23 December 2025

Keywords
Dietary fiber
Flatbread
Flavor
Sensory evaluation
Taro leaves.

ABSTRACT

This study investigates the formulation of a nutritional-functional flatbread by adding taro leaf and barley powder to wheat flour. The inclusion of taro leaf and barley powder improved and increased the fiber content (1.2%), protein content (13.11%), and mineral content of dietary flatbreads, while reducing carbohydrates to 3%. For the above reasons, this product is more suitable for health-conscious consumers and plant-based diets. Dough characteristics did change slightly. The high fiber content of the ingredients led to a slight increase in hydration, with a slight reduction in extensibility. However, the dough remained workable for rolling and shaping. The structure of the flatbread held up during cooking, supporting the continued use of this nutritionally functional flatbread in semi-industrial or home preparation. Sensory evaluation indicated positive responses from consumers; in particular, the nutty flavor of barley and the earthy note of taro leaf were appreciated, with a mean score of 4.6 on a 5-point hedonic scale. Lemon juice addition improved the flavor and significantly reduced the oxalate levels in taro leaves. Microbial analysis showed that the final product was safe for consumption, with an acceptable microbial count of 2×10^4 CFU/g, and its shelf life, the duration during which the flatbread remains palatable, was 4 days. This nutritionally functional flatbread provides urban consumers with a nutritious, convenient, and palatable option to enhance the health aspects of their diets. The novelty of this research is based on the addition of the vastly underutilized taro leaves to a widely consumed food item, offering a solution to micronutrient insufficiency.

Contribution/Originality: This study introduces a nutrient-rich taro leaf-incorporated flatbread, utilizing novel analysis methods to assess its sensory, chemical, and microbial properties. It demonstrates the potential of taro leaves, particularly when treated with lemon to reduce oxalates, offering a plant-based solution to micronutrient deficiencies. The study also evaluates the nutritional stability, sensory acceptability, and shelf life of the product.

1. INTRODUCTION

Flatbread is a popular food that is consumed universally across cultures, with its simplicity of preparation and versatility in terms of the types of ingredients and flavor profiles. Although it is popular globally, traditional flatbread, which is commonly made from processed wheat or other cereal flours, is typically lacking in essential micronutrients, particularly iron and calcium, which are critical for general health (Kouame, 2011; Pasqualone et al., 2022). In most developing nations and low-income communities, flatbread is a primary source of energy but makes negligible contributions to the alleviation of prevalent micronutrient deficiencies, often termed "hidden hunger." This condition is responsible for a chain of health complications, including anemia, hindered bone development, weakened immune

systems, and increased susceptibility to infections, particularly in children and women of reproductive age. Food-based approaches to combat micronutrient deficiencies have received considerable attention in recent years. Among such methods, the fortification of staple foods with nutrient-rich ingredients is a viable and cost-effective measure (Bhavya & Prakash, 2021). Leafy greens are highly nutritious, containing a range of essential vitamins and minerals. Their availability in processed and convenient foods is, however, limited. Taro (Colocasia esculenta) leaves are an underutilized commodity (Afifah et al., 2023). Used traditionally in various local food cultures, taro leaves contain high amounts of iron, calcium, vitamin C, and dietary fiber (Brandão, Tagliapietra, & Clerici, 2023).

Their addition to daily diets may impart substantial health benefits, especially when combined with foods already part of regular eating habits. Taro leaves, though rich in nutrients, possess inherent anti-nutrient chemicals such as oxalates that interfere with mineral absorption (Kumbhar, Kunde, & Kushare, 2025). However, the utilization of appropriate processing technologies such as blanching, drying, and powdering reduces these chemicals to tolerable levels without compromising the nutritional value of the leaves (Moy, Wang, & Nakayama, 2019). Such processing makes them suitable to be mixed into flour foods, e.g., flatbread, thus complementing the nutrient content as well as improving product safety and acceptability (Baranwal, Sankhla, Bolia, & Avinash, 2014; Kaushal, Kumar, & Sharma, 2012). Furthermore, drying and powdering technologies of taro leaves also offer a mechanism to improve their shelf life and convenience in bulk application in food fortification programs. The current research seeks to explore the viability of supplementing taro leaves as a fortifier in flatbread preparation. By adding it in different concentrations (0%, 5%, 10%, and 15%) of taro leaf to wheat flour, the research aims to ascertain the effect on the nutritional, physicochemical, and sensory characteristics of the resultant flatbread (Mitharwal, Kumar, Chauhan, & Taneja, 2022; Seyyedlou, Nalbandi, Alizadeh, & Bejaee, 2023; Weerarathna & Wansapala, 2024). Nutritional analysis will seek to determine the major macro- and micronutrients, as well as specific reference to iron and calcium content, while physicochemical analysis will seek to determine alterations in factors such as moisture content and color (Sain et al., 2020).

Sensory analysis conducted by a trained panel will enable the assessment of the acceptability of the fortified flatbreads in terms of taste, texture, visual appearance, and overall acceptability (El-Sohaimy, Shehata, Mehany, & Zeitoun, 2019). The addition of taro leaf to flatbread provides an effective strategy for alleviating micronutrient deficiencies through a culturally acceptable and familiar food product (Kaushal et al., 2012). Compared to supplementation schemes or artificial fortification, which may be expensive or have low levels of acceptability, food-to-food fortification employs locally available materials to achieve nutritional goals (Nip, 2023). This strategy not only enhances the dietary quality of the targeted group but also encourages the utilization of local agricultural produce, thereby promoting sustainability and local empowerment (Waseem et al., 2024). In this regard, this research proposes a novel application of a widely underutilized leafy green in a commonly consumed food product. Through the development of nutritionally enhanced flatbread using taro leaves, this research contributes to the broader goal of promoting public health through dietary improvement (Prasad, Dhital, Williamson, & Barber, 2024). The originality of this research lies in its integration of indigenous knowledge and modern nutritional science towards the development of a functional food with optimized health benefits (Shah et al., 2022). The outcomes of this research are expected to guide future research and food product development efforts toward nutritionally controlling malnutrition through sustainable food-based interventions (Aly, Mohamed, & Abdou, 2017).

2. MATERIALS AND METHODS

This study explores the development of taro leaf-enriched flatbread and evaluates its overall quality. The method followed sequential steps from raw material preparation to the evaluation of sensory properties and microbiological attributes. Each step was planned carefully to ensure uniformity and reproducibility. Wheat flour, barley powder, and fresh taro leaves were selected based on their nutritional content. The study aimed to preserve

the functional and sensory attributes of the flatbread while incorporating taro leaves to enhance its nutritional value. Conventional laboratory procedures and statistical methods were adopted to ensure the validation of the results.

2.1 Collection and preparation of raw materials

The raw materials used in this study were wheat flour, barley powder, and fresh taro (*Colocasia esculenta*) leaves, chosen based on their availability and nutritional composition. Wheat flour was sourced from a reliable local supplier known for its consistent quality. Fresh taro leaves were obtained from local farms in the early morning to ensure maximum freshness and nutrient preservation. The taro leaves underwent a thorough washing process upon collection, using safe drinking water to remove dirt, dust, and potential pesticide residues. Washing was repeated several times until the leaves appeared visibly clean. After washing, the leaves were drained on sanitized trays and dried at room temperature to eliminate excess surface moisture.

Handling of the leaves was carried out using clean hands or gloves to maintain hygiene standards and prevent microbial contamination. Preparation ensured the leaves were free from contaminants and ready for subsequent processing procedures. Wheat flour and barley powder were kept in airtight containers at room temperature to prevent moisture absorption and pest infestation before use.

These processes were important to ensure the integrity of the raw materials, which directly affects the final product quality and safety. Proper raw material preparation was the foundation of the successful fortification of taro leaves in flatbread production.

2.2 Processing of Taro leaves

The washed taro leaves were treated to minimize inherent bitterness and anti-nutritional compounds without losing their nutrient content. The leaves were initially blanched by submerging them in boiling water with a half squeeze of lemon for a standardized period, usually 2 to 3 minutes. Blanching destroys enzymes, causing degradation, lowers bitter compounds, and removes oxalate content, which causes an itching effect, making the leaves more palatable in the final product. The leaves were immediately cooled in an ice water bath to quickly halt the cooking process and maintain color and nutrients. This is an important step to prevent overcooking and nutrient degradation. The blanched leaves were chopped finely and underwent mild roasting for one minute. This allows ease in taro leaves mixing with wheat and barley flour, allowing uniform distribution of the nutrients in the dough and finally in the flatbread upon half cooking. The processing stages were optimized for maximizing nutrient retention and enhancing functional properties for cooking.

2.3 Shaping and Half–cooking

The dough was rested and portioned into equal amounts and rolled into flatbreads. Each was rolled out on a clean, floured surface using a rolling pin to a uniform thickness and diameter, usually 15-20 cm in diameter and 2-3 mm in thickness. Consistent thickness was required to ensure even cooking, where flatbread is pre-cooked on a heated tawa for 15-20 seconds. Flip the flatbread on both sides for uniform cooking. Flatbreads were cooled at room temperature to prevent moisture build-up and sogginess. Cooling also conditions the product for subsequent sensory and physicochemical tests.

2.4 Physicochemical Testing

The half-cooked flatbreads underwent a thorough physicochemical analysis to measure physical and nutritional attributes. Proximate analysis was conducted using standardized procedures to determine moisture, protein, fat, crude fiber, and carbohydrates. Moisture content was measured by oven drying at 105°C to constant weight. Protein content was determined using the Kjeldahl method, and fat content was measured with the Soxhlet extraction

method. Crude fiber was assessed through enzymatic-gravimetric procedures. Carbohydrate content was calculated using the Anthrone method.

2.5 Sensory testing

A trained panel of sensory assessors conducted a sensory test to analyze flatbreads enriched with taro leaf for organoleptic characteristics. Panel members were selected based on prior experience and capacity to objectively identify sensory characteristics. Testing was conducted in a controlled sensory testing facility environment with individual booths to eliminate distractions and bias. Sensory characteristics measured included appearance, color, aroma, flavor, texture, and overall acceptability, rated on a structured 5-point hedonic scale from "dislike very much" to "like very much." Water was provided to facilitate palate cleaning between samples. Panel members were trained to identify characteristic sensory differences related to taro leaf content, such as bitterness or leafy flavor. Data collected were statistically analyzed to determine differences among formulations and the maximum acceptable level of taro leaf that still maintained consumer acceptability. This sensory test was essential to ensure that fortification did not diminish product desirability.

2.6 Microbiological Analysis

Microbiological analysis was conducted to determine the safety and shelf life of the fortified flatbreads. Samples were taken directly after cooking and after storage at ambient temperatures. Standard microbiological techniques were employed to locate total plate counts (TPC). Homogenized samples of flatbreads were given a serial dilution, and suspensions were plated onto nutrient agar to locate TPC and on selective media. Plates were incubated under suitable conditions, and colony counts were conducted to assess microbial load. The purpose of the analysis was to ensure that taro leaf addition and the cooking process effectively prevented spoilage by microbial contamination and did not promote the growth of spoilage organisms. Monitoring microbial growth during storage was part of determining product shelf life and giving storage recommendations. Microbiological quality was crucial to ensure product safety for consumption and compliance with food safety standards.

Figure 1 illustrates the process of preparing taro flatbread.

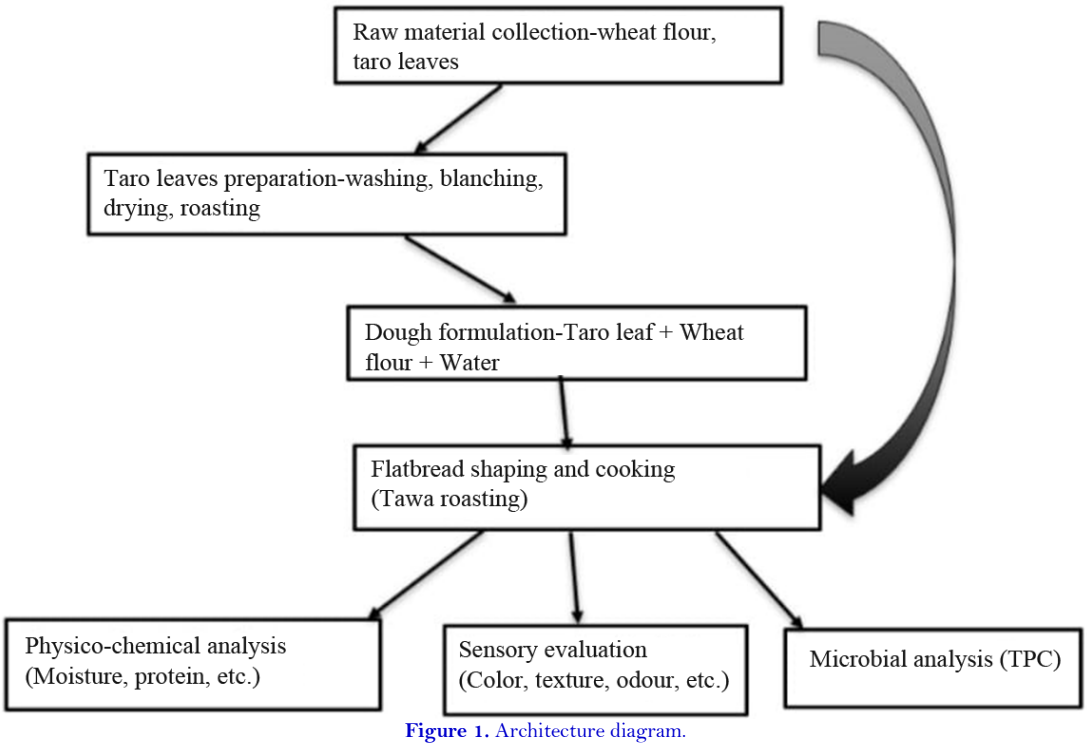

Figure 1. Architecture diagram.

3. RESULTS AND DISCUSSION

The sensory analysis focused on consumer acceptability of taste, texture, aroma, and overall acceptability and reported a positive acceptability. The chemical analysis tested nutrient stability over five days and reported negligible loss in the protein, fiber, and carbohydrate content. The microbial analysis tested the shelf-life and reported a safe consumption period of five days under ambient conditions. Combined, these findings suggest that the formulated flatbread is nutritious, sensorially appealing, and microbiologically safe for short-term storage and potential market introduction.

3.1 Sensory Evaluation

Sensory evaluation of the freshly prepared flatbread was conducted using five trained panelists who scored the product on several sensory characteristics, including appearance, color, texture, flavor, aroma, and overall acceptability. Among the different experimental samples, sample 4 was the most preferred, with consistent positive comments from all the panelists. The mean hedonic scale score of the sample was 4.6 out of 5, indicating that the panelists found it to be moderately to highly acceptable.

It shows positive ratings on different sensory parameters and indicates that the formulation provided an ideal combination of taste and textural attributes. The results establish the successful incorporation of taro leaf and barley powder in the dough, and hence the contribution to a nutritionally improved and sensorially acceptable product. The overall response suggests that this formulation can be capable of meeting consumer demand and can be acceptable for further development or commercialization, as evident from the sensory evaluation figure.

Figure 2 exhibits sensory scores of trials (T1–T4) by five panellists, with T4 rated high.

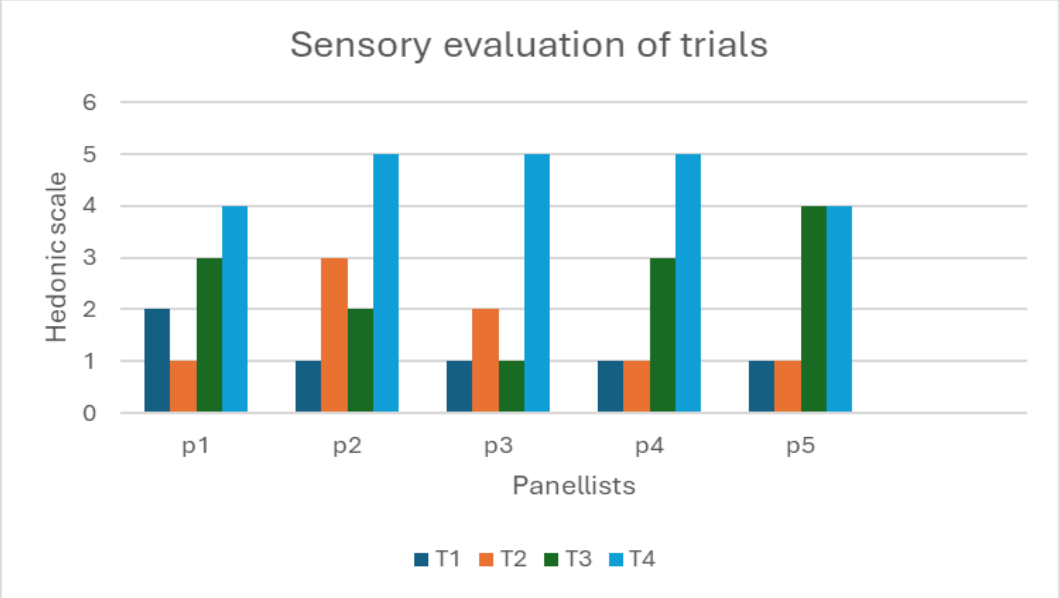

Figure 2. Sensory evaluation of all trials.

3.2 Sensory Analysis of Final Product

The final optimized flatbread sample was subjected to rigorous sensory evaluation, Fig. 3, using a 5-point hedonic rating system to assess consumer response to some of the attributes. Parameters evaluated were appearance, color, texture, odor, taste, and overall acceptability. The findings showed high liking scores for many of the attributes. Appearance, color, texture, and odor all scored a mean of 4.6, which suggests that the attributes were well accepted by the panelists. The acceptable appearance and aroma most likely influenced the first impression of the product, and hence, the overall score was enhanced.

Figure 3 presents sensory scores of the final product for appearance, color, texture, flavor, and odor, all rated high.

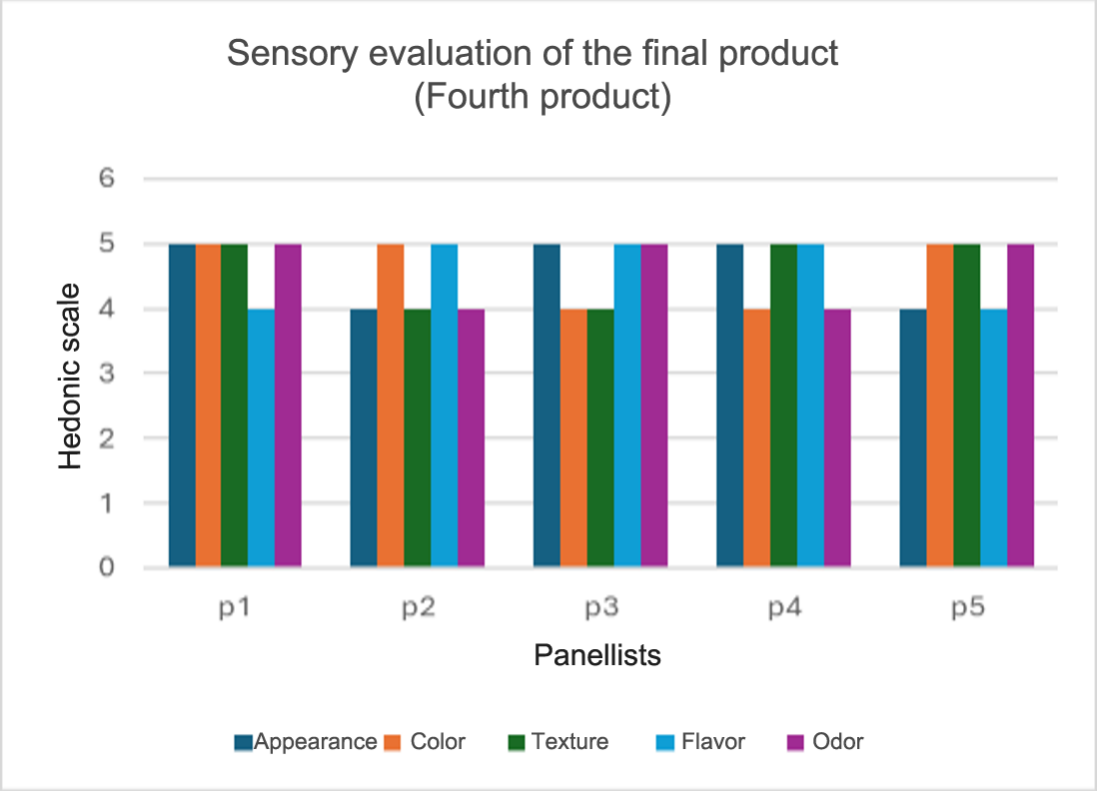

Figure 3. Sensory evaluation of the final product.

From the Table 1, taste was rated a score of 5, indicating full agreement and a high positive response from all panellists. This is particularly useful, since taste is a significant driver of consumer acceptance and repeated consumption. Blending the nutty flavor of barley powder and earthy taste notes of taro leaf created an interesting and rewarding taste experience. The use of lemon juice not only improved taste quality but also contributed to oxalate reduction, a significant nutritional problem with taro-based foods. Total acceptability scores ranged from 4.3 to 5. These represent a high degree of favorability and high satisfaction with the product. What is interesting is the fact that the lowest value still signifies a positive perception, which is an expression of the consistency of the sensory profile of the formulation. The corresponding values, as described in the figure and table of sensory evaluation, reflect the product's potential for high consumer acceptability.

Table 1. Sensory evaluation table of the final product.

Sample	Assessor	Appearance	Color	Texture	Flavor	Odor	Overall Acceptability	Total Score
Taro leaf incorporated with half-cooked chapatti	Panellist 1	5	5	5	4	5	5	4.8
	Panellist 2	4	5	4	5	4	4	4.3
	Panellist 3	5	4	4	5	5	5	4.6
	Panellist 4	5	4	5	5	4	4	4.5
	Panellist 5	4	5	5	4	5	5	4.6

3.3 Chemical Analysis

Chemical characterization of the flatbread was conducted on two occasions to analyze its nutritional content and assess the changes that can occur during a short storage period. The parameters analyzed included moisture

content, lipids, protein content, crude fiber, carbohydrate concentration, and total caloric value. These results contribute to understanding the nutritional stability of the product and its performance over shelf life under natural storage conditions. From Table 2, on Day 1, the new flatbread contained 21.95% moisture, as expected in semi-cooked products. By Day 5, the moisture content had decreased to 18%, primarily due to evaporation. Moisture loss during storage is unavoidable and may influence microbial growth. Moisture loss is typically associated with increased firmness and slight changes in mouthfeel but may also enhance microbial stability.

The lipid content decreased slightly from 1.01 mg KOH/g to 1 mg KOH/g, indicating a minimal degree of lipid oxidation. This slight decrease suggests the product's ability to resist rancidity during the observed period, demonstrating that the addition of barley and taro leaf does not compromise lipid stability.

Similarly, the protein content decreased from 15.09% to 13.11% after five days. Even though the decrease is minimal, it can be linked to preliminary enzymatic degradation or microbial activity. The relatively high protein content retention indicates the food product's quality for the short storage period.

Table 2. Chemical analysis result.

Sl. no.	Parameter	Values (At day 1)	Values (At day 5)
1	Estimation of moisture	21.95%	18%
2	Estimation of lipids	1.01 mg KOH/g	1 mg KOH/g
3	Estimation of protein	15.09%	13.11%
4	Estimation of crude fiber	1.21%	1.2%
5	Estimation of carbohydrate	3.09%	3%
6	Total calorific value	0.5413 kcal/g	0.541 kcal/g

The crude fiber content demonstrated a relatively stable profile with a small shift from 1.21% to 1.2%. This minimal change supports the fact that the fiber content, which is primarily from taro leaves and barley powder, retains its structural form and does not change with short-term storage conditions. The carbohydrate content also demonstrated minimal change, decreasing from 3.09% on Day 1 to 3% on Day 5, thus also demonstrating stability in carbohydrate content. The total calorific content, which is calculated as the sum of all the macronutrients, demonstrated only a small decrease from 0.5413 kcal/g to 0.541 kcal/g. This minimal variation shows that the energy contribution of the product remains constant over time, thus supporting its use as a nutritionally rich alternative even after a couple of days of storage. These findings are presented in the chemical analysis table.

3.4 Microbial Analysis

The microbial quality of food is an essential component of food safety, especially in the context of semi-cooked or partially processed products. A microbial assessment of the flatbread was performed on both Day 1 and Day 5 to evaluate its shelf stability and hygienic standards Table 3. On Day 1, the Total Plate Count (TPC) was observed at 2×10^4 CFU/g, signifying a minimal degree of microbial presence. This finding indicates adherence to good manufacturing practices and a low level of contamination throughout the preparation process.

By Day 5, the TPC has doubled to 1.3×10^6 CFU/g. The microbial growth is extremely impressive and shows that spoilage has begun. Storage temperature, air humidity, and intrinsic water content of the product are some possible reasons behind the growth. Taro leaves with high water activity may also cause microorganism growth if they are not stored properly.

The growth of the microbe over time indicates that the flatbread has a short shelf life under room conditions. From the measured levels of TPC, the window of safe consumption appears to be four days. After this time, the microbial level approaches levels that could raise food safety issues. The findings highlight the need for refrigeration or altered packaging methods to extend shelf life. These results are graphically confirmed in the microbial analysis figure and the data table, which demonstrate time-dependent changes in microbial growth and validate the product's perishable nature.

Table 3. Microbial analysis result.

Sl. No.	Parameter	Value (Day 1) Freshly prepared	Value (on day 5)
1	Total plate count	2×10^4 CFU/g	1.3×10^6 CFU/g

Figure 4 depicts the control plate with no microbial growth.

Figure 4. Control plates.

Figure 5 illustrates the TPC on day 1 with very few colonies.

Figure 5. Total plate count (Day 1).

Figure 6 illustrates TPC at shelf life end with more colonies.

Figure 6. Shelf life.

4. CONCLUSION

The creation of a flatbread fortified with taro leaves and barley flour is a significant advancement in functional food processing. Incorporation of taro leaves introduced essential nutrients, such as dietary fiber, iron, and calcium,

along with enhanced health benefits. Barley flour contributed vital nutrients as well as sensory attributes, creating a subtle nutty and earthy flavor profile that was highly accepted by the sensory panelists. The results of the sensory evaluation supported the product's acceptability, with high ratings in taste, odor, texture, and overall appearance. The mean scores indicated a positive reception, especially during the fourth trial, which achieved an overall sensory score of 4.6. Additionally, the finally optimized product received positive scores, particularly in flavor, where it scored an outstanding 5.

These results validate that the flatbread has been successfully developed to meet consumer expectations in terms of palatability and appearance. Chemical analysis showed that the product retained a significant proportion of its nutritional composition for five days. Though slight decreases in moisture, protein, and lipid content were observed, these were still within acceptable levels. Carbohydrate and fiber levels were highly consistent, thus confirming the product's shelf life for short-term storage.

Microbial testing also guaranteed the safety of the product for consumption for five days, after which microbial growth started to become substantial. The initial microbial activity was still within acceptable limits, which indicates proper hygienic standards while preparing it. Higher counts on day five, however, indicated its loss of recommended shelf life. Nutritionally, the flatbread offers a balanced mix suitable for those in search of health-focused and vegetable-rich food products. The low carbohydrate content and high fiber content improve its functional advantage. Additionally, the addition of lemon juice helped reduce the amounts of oxalates in taro leaves, thus rendering the minerals safer and more bioavailable. The current study well demonstrates the feasibility of incorporating underutilized, highly nutritious ingredients like taro leaf and barley into staple food products without compromising product quality. The semi-cooked form increases the convenience and flexibility of the product to suit today's consumers. Overall, this flatbread shows great potential as a healthy, sensory-acceptable, and commercially viable product for urban and health-conscious markets.

Funding: This study received no specific financial support.
Institutional Review Board Statement: Not applicable.
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

REFERENCES

Afifah, D. N., Madani, P., Mahda, A., Nindita, Y., Syauqy, A., & Pratiwi, S. (2023). Characteristics related to the nutrient composition of white bread with the addition of taro leaves (Colocasia esculenta (L). Schott) as antidiabetic food. *African Journal of Food, Agriculture, Nutrition and Development, 23*(8), 24157-24176.

Aly, S., Mohamed, E. N., & Abdou, E. S. (2017). Research article effect of edible coating on extending the shelf life and quality of fresh cut taro. *American Journal of Food Technology, 12*(2), 24-131. https://doi.org/10.3923/ajft.2017.124.131

Baranwal, D., Sankhla, A., Bolia, S., & Avinash, P. (2014). Effect of malting on the antinutritional factors of composite flour. *Trends in Biosciences, 7*(4), 273–276.

Bhavya, S. N., & Prakash, J. (2021). Nutritional properties of iron fortified flatbreads enriched with greens and legumes. *Journal of Food Processing and Preservation, 45*(5), e15495. https://doi.org/10.1111/jfpp.15495

Brandão, N. A., Tagliapietra, B. L., & Clerici, M. T. P. S. (2023). Taro [Colocasia esculenta (L.) Schott: A critical review of its nutritional value and potential for food application *Food Science and Technology, 43*, 1–11. https://doi.org/10.5327/fst.00118

El-Sohaimy, S. A., Shehata, M. G., Mehany, T., & Zeitoun, M. A. (2019). Nutritional, physicochemical, and sensorial evaluation of flat bread supplemented with quinoa flour. *International Journal of Food Science, 2019*(1), 4686727. https://doi.org/10.1155/2019/4686727

Kaushal, P., Kumar, V., & Sharma, H. K. (2012). Comparative study of physicochemical, functional, antinutritional and pasting properties of taro (Colocasia esculenta), rice (Oryza sativa) flour, pigeonpea (Cajanus cajan) flour and their blends. *LWT – Food Science and Technology*, *48*(1), 59–68. https://doi.org/10.1016/j.lwt.2012.02.028

Kouame, L. P. (2011). Biochemical characteristics of flours from Ivorian taro (Colocasia esculenta, Cv Yatan) corm as affected by boiling time. *Advance Journal of Food Science and Technology*, *3*, 424–435.

Kumbhar, A., Kunde, O., & Kushare, A. (2025). Review on taro (Colocasia esculenta): Its botany, morphology, phytochemistry and medicinal uses *Available at SSRN 5257032*. https://doi.org/10213.9/ssrn.5257032

Mitharwal, S., Kumar, A., Chauhan, K., & Taneja, N. K. (2022). Nutritional, phytochemical composition and potential health benefits of taro (Colocasia esculenta L.) leaves: A review. *Food Chemistry*, *383*, 132406. https://doi.org/10.1016/j.foodchem.2022.132406

Moy, J. H., Wang, N. T. S., & Nakayama, T. O. M. (2019). Processing of taro into dehydrated, stable intermediate products. In Small-scale processing and storage of tropical root crops. In (pp. 223–248). Hawaii, USA: FAO

Nip, W. K. (2023). Taro. In Processing vegetables. In (pp. 355–388). New York: Routledge

Pasqualone, A., Vurro, F., Summo, C., Abd-El-Khalek, M. H., Al-Dmoor, H. H., Grgic, T., . . . Le-Bail, P. (2022). The large and diverse family of Mediterranean flat breads: A database. *Foods*, *11*(15), 2326. https://doi.org/10.3390/foods11152326

Prasad, R. V., Dhital, S., Williamson, G., & Barber, E. (2024). Nutrient composition, physical characteristics and sensory quality of Spinach-enriched wheat bread. *Foods*, *13*(15), 2401. https://doi.org/10.3390/foods13152401

Sain, M. N., Ameer, K., Ahmed, A., Ahmad, A., Nadeem, M., Riaz, A., . . . Kausar, R. (2020). Comprehensive assessment and evaluation of selected wheat varieties for their relationship to chapatti quality attributes. *Food Science and Technology*, *40*, 436–443.

Seyyedlou, S., Nalbandi, H., Alizadeh, S., & Bejaee, F. (2023). Comparison of different flatbread baking beds in terms of their feasibility and qualitative properties of the final product. *Food Research Journal*, *33*(3), 49-66.

Shah, Y. A., Saeed, F., Afzaal, M., Waris, N., Ahmad, S., Shoukat, N., & Ateeq, H. (2022). Industrial applications of taro (Colocasia esculenta) as a novel food ingredient: A review. *Journal of Food Processing and Preservation*, *46*(11), e16951. https://doi.org/10.1111/jfpp.16951

Waseem, M., Akhtar, S., Mehmood, T., Qamar, M., Saeed, W., Younis, M., & Esatbeyoglu, T. (2024). Nutritional, safety, and sensory quality evaluation of unleavened flatbread supplemented with thermal and non-thermal processed spinach powder *Journal of Agriculture and Food Research*, *16*, 101114. https://doi.org/10.1016/j.jafr.2024.101114

Weerarathna, A., & Wansapala, M. A. J. (2024). Compatibility of whole wheat-based composite flour in the development of functional foods. *Food Technology and Biotechnology*, *62*(4), 425–448.