ISSN(O): 2320-5407 | ISSN(P): 3107-4928

International Journal of Advanced Research

Publisher's Name: Jana Publication and Research LLP

www.journalijar.com

ISSN NO. 2320-5407

REVIEWER'S REPORT

Manuscript No.: IJAR-55715

Title: EFFECTS OF TWO MODES OF TECHNOLOGICAL TREATMENTS ON THE PROXIMAL COMPOSITION AND SENSORY ACCEPTABILITY OF MILLET(*Pennisetum glaucum* L. R. Br.) AND TIGER NUTS (*Cyperus esculentus* L.), BASED COOKIES- TYPE FOODS ENRICHED WITH PROBIOTICS.

Recommendation:
Accept as it is

Rating	Excel.	Good	Fair	Poor
Originality		√		
Techn. Quality			√	
Clarity		√		
Significance			√	

Reviewer Name: Dr. Manju M

Detailed Reviewer's Report

1. Background and Rationale of the Study

Millet and tiger nuts are nutritionally rich indigenous crops with considerable potential for value addition, yet they remain underutilized in processed food products. Improving their nutritional quality and consumer appeal is essential for promoting dietary diversification and sustainable food systems. Biotechnology, particularly probiotic fermentation, offers a promising approach to enhance nutrient bioavailability, digestibility, and sensory attributes. Transforming these raw materials into cookie-type foods increases their versatility and market relevance. Combining millet and tiger nuts further strengthens nutritional balance and supports local agricultural development. This study is therefore grounded in the need to apply scientific processing strategies to valorize local food resources while aligning with sustainable food development goals.

2. Rationale, Objectives, and Experimental Concept

This study was designed to evaluate the effects of different technological treatments on the nutritional and sensory quality of millet–tiger nut–based foods. Roasting and steaming were selected as thermization methods, followed by probiotic fermentation, to produce innovative cookie-type products without additives. The objectives were to (i) compare the influence of roasting and steaming on flour composition, (ii) assess the impact of fermentation on proximate composition, and (iii) evaluate consumer acceptability of the resulting products. Emphasis was placed on accessible and clean-label biotechnological processing. The study addresses the challenge of producing nutritious, appealing foods using locally available raw materials and simple biotechnology.

ISSN(O): 2320-5407 | ISSN(P): 3107-4928
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

3. Selection and Source of Raw Materials

Millet grains and tiger nut tubers were procured from local markets in Bobo-Dioulasso, Burkina Faso. These materials were selected due to their availability, traditional consumption, and high nutritional potential. Sourcing from local markets ensured representativeness of commonly consumed varieties and supported the valorization of indigenous food resources. Raw materials were transported under hygienic conditions to minimize post-harvest contamination. This selection strategy was consistent with the study's objective of developing competitive local food products.

4. Cleaning, Pretreatment, and Drying of Raw Materials

The raw materials were subjected to systematic pretreatment to ensure safety and quality. Winnowing removed light impurities, while washing and de-stoning eliminated sand and pebbles. Sorting was performed to discard defective grains and tubers. The cleaned materials were dried at 37 °C for 24 h using a RoHS dehydrator. Low-temperature drying reduced moisture content while preserving nutritional integrity and limiting microbial activity. Proper drying facilitated milling and ensured reproducibility in subsequent processing steps.

5. Preparation of Probiotic Sourdough

A probiotic sourdough starter was prepared using lactic acid bacteria and yeast strains. Commercial probiotic capsules containing *Bifidobacterium* and *Lactobacillus* species were combined with *Saccharomyces cerevisiae* boulardii. These microorganisms were inoculated into 100 mL of tiger nut milk and maintained at 37 °C to promote activation. The mixture was incubated at room temperature for 24 h to allow fermentation. The resulting sourdough functioned as both a leavening agent and a probiotic source, enhancing the nutritional and functional quality of the final products.

6. Production of Roasted Composite Flour

Millet grains and tiger nut tubers were roasted at 110 °C for 15 min in a controlled fryer oven. Roasting improved flavor, reduced antinutritional factors, and enhanced nutrient availability. After cooling to ambient temperature, the materials were milled using a high-speed shredder-mixer and sieved through a 0.5 mm mesh to obtain a uniform flour. This roasted composite flour served as one of the main substrates for cookie-type food production.

7. Production of Steamed Composite Lumps

Raw millet and tiger nut flours were prepared separately and mixed in a 50:50 ratio. The composite flour was manually rolled and sieved to obtain uniform granules of approximately 1 mm. The granulated composite was steamed for 45 min using a stainless-steel couscous maker. Steaming promoted starch gelatinization and moisture absorption, resulting in compact composite lumps. This processing method provided a contrasting technological approach for comparative evaluation.

8. Hydration, Dough Formation, and Cooling

Hydration was carried out by gradually adding boiling water (20–35 mL per 100 g of dough) to both roasted flour and steamed lumps. Kneading continued until a homogeneous gel-like consistency was achieved. Proper hydration ensured starch gelatinization, dough cohesion, and optimal fermentation

ISSN(O): 2320-5407 | ISSN(P): 3107-4928
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

conditions. The hydrated doughs were then cooled to 37 °C under refrigerated conditions to prevent thermal damage to probiotic microorganisms prior to inoculation.

9. Inoculation, Molding, Fermentation, and Dehydration

Cooled doughs were inoculated with probiotic sourdough at a rate of 1 mL per 100 g of dough and mixed thoroughly for uniform microbial distribution. The doughs were molded into standardized cookie shapes using a manual piston molder with multi-shaped lids. Fermentation and dehydration were conducted simultaneously at 37 °C for 15 h using a RoHS dehydrator with controlled airflow. This process supported probiotic activity, enhanced flavor development, and gradually reduced moisture, resulting in dried fermented cookie-type foods with improved shelf stability.

10. Proximate Composition and Carbohydrate Analysis

Proximate composition was determined using standardized AOAC methods. Protein content was measured by the Kjeldahl method, lipids by Soxhlet extraction, moisture by oven drying at 105 °C, and ash by incineration at 600 °C. Total carbohydrate content was estimated using the phenol–sulfuric acid method, with absorbance measured at 485 nm. These analyses provided a comprehensive assessment of nutritional quality and allowed comparison between processing treatments.

11. Evaluation of Technological Effects on Nutritional Composition

The effects of roasting, steaming, and fermentation were evaluated through rate-of-change calculations comparing nutrient levels before and after treatments. Roasting increased protein and lipid contents while reducing carbohydrates. Steaming resulted in higher moisture and ash contents but lower protein levels. Fermentation further modified nutrient profiles through microbial metabolism and enzymatic activity. These results demonstrate that both thermization method and fermentation significantly influence nutritional outcomes.

12. Interaction Between Substrate Nature and Processing Method

Nutritional outcomes were strongly governed by the interaction between substrate structure and processing conditions. Roasted flours provided a matrix more favorable for protein and mineral enrichment during fermentation. In contrast, steamed substrates exhibited different nutrient dynamics due to higher moisture content and compact structure. Physicochemical changes affected microbial accessibility and metabolic pathways. This interaction explains the contrasting nutritional profiles of the final products and underscores the importance of integrated process design.

13. Sensory Analysis Design and Consumer Profile

Sensory evaluation was conducted according to ISO 11136 hedonic test guidelines. A total of 380 respondents of diverse age, gender, and professional backgrounds participated. Five attributes—shape, color, odor, taste, and texture—were rated on a 5-point scale, while overall acceptability was assessed on a 10-point scale. Randomized tasting and multiple evaluations ensured reliability. Socio-demographic profiling enhanced interpretation of consumer responses.

ISSN(O): 2320-5407 | ISSN(P): 3107-4928
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

14. Sensory Profile, Acceptability, and Consumer Response

Roasted-fermented cookie-type foods received significantly higher scores for color, taste, aroma, and overall acceptability compared to steamed-fermented products. Roasting enhanced Maillard reactions, while fermentation improved aroma and texture. Most respondents expressed willingness to consume roasted-fermented products regularly, with suggestions mainly related to sweetness adjustment. Acceptability was largely independent of age and gender, indicating broad consumer appeal and strong market potential.

15. Statistical Analysis

All experiments were conducted in triplicate, and results were expressed as mean values. Data analysis was performed using Excel Office 365, R Studio, and Jamovi software. Statistical significance was established at a 5% probability level. Radar histograms were used to compare sensory profiles objectively. These analytical tools ensured scientific rigor, reliability, and reproducibility.

16. Biotechnological Significance and Practical Implications

The study demonstrates that nutritionally enhanced and sensorially acceptable foods can be produced without synthetic additives. The combination of moderate thermization and probiotic fermentation represents a safe, accessible, and clean-label biotechnological strategy. This approach supports local food systems, reduces reliance on imported ingredients, and contributes to nutritional security. The findings highlight the feasibility of developing competitive functional foods from indigenous resources.

17. Limitations and Future Research Perspectives

Further studies are required to confirm the probiotic functionality of the developed products, including microbial survival under gastrointestinal conditions. Long-term storage stability, microbial viability, and health impacts of regular consumption should be evaluated. Molecular and functional characterization of probiotic strains is necessary to support health claims and regulatory approval. Addressing these aspects will facilitate translation from experimental development to validated functional food products.

18. Overall Conclusion

This study provides a comprehensive framework for the valorization of millet and tiger nuts through integrated thermization and probiotic fermentation. Roasting combined with fermentation produced nutritionally superior and highly acceptable cookie-type foods. The work establishes a scientific basis for sustainable, locally driven food innovation and offers a replicable model for future biotechnological food processing research.