

EXPLORATION OF BUCU CHARCOAL MATERIALITY AND ITS EFFECT ON THE FLAVOR CHARACTERISTICS OF BALI LALKAK

Gede Andika¹, I Komang Mardika², Dendra³, Ni Kadek Rina Juniartini⁴

Institut Teknologi dan Bisnis Muhammadiyah Bali

*Corresponding author: andikagede.lecturer@gmail.com

ABSTRACT

The selection of cooking materials plays a crucial role in shaping the sensory characteristics of traditional foods. One material that has long been used in Balinese culinary practices is *bucu charcoal*, which is believed to influence flavor development during the cooking process. This study aims to explore the materiality of *bucu charcoal* and examine its effect on the flavor characteristics of *Bali Lalkak*, a traditional Balinese food product. The research employs a qualitative–experimental approach, combining material characterization of *bucu charcoal* with sensory evaluation of *Bali Lalkak* prepared using different heat sources. Data were collected through observation, documentation, and organoleptic testing involving aroma, taste, texture, and overall flavor acceptance. The findings indicate that *bucu charcoal* possesses distinct physical and combustion properties that contribute to a more stable heat distribution and impart a characteristic smoky aroma, enhancing the overall flavor profile of *Bali Lalkak*. Compared to alternative cooking fuels, the use of *bucu charcoal* resulted in deeper flavor complexity and higher sensory preference among panelists. This study highlights the importance of traditional cooking materials as cultural assets and supports their potential role in preserving local culinary identity and enhancing product differentiation in traditional food production.

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1. INTRODUCTION

Traditional culinary practices are inseparable from the materials and techniques used in food preparation, particularly the choice of cooking fuel (Djalal et al., 2021). In many food cultures, heat sources are not merely functional tools but integral elements that shape taste, aroma, texture, and overall sensory identity (Sutiarso et al., 2024). In Balinese gastronomy, traditional charcoal known as *bucu charcoal* has historically been used in the preparation of various local foods, including *Bali Lalkak*, a rice-based traditional snack commonly cooked using simple stoves and manual techniques (Setiawan et al., 2022). The continued use of *bucu charcoal* reflects inherited knowledge regarding heat control, flavor formation, and cooking aesthetics passed down through generations (Sukerti et al., 2021).

Beyond its basic function as a heat source, *bucu charcoal* is widely believed by local cooks to contribute to distinctive sensory attributes, particularly a subtle smoky aroma and balanced taste profile that differentiate traditionally prepared foods from those cooked using modern fuels such as gas or electric stoves. Previous studies on traditional food processing suggest that cooking materials and heat sources influence chemical reactions during cooking, including Maillard reactions, caramelization, and moisture retention, all of which affect final flavor characteristics (Cahyono et al., 2019; Rulandari et al., 2020). However, many of these claims remain underexplored in empirical and material-based studies, especially within the context of Balinese traditional cuisine.

In recent decades, the increasing adoption of modern cooking technologies has contributed to a gradual decline in the use of traditional fuels such as *bucu charcoal* (Sari, 2017). While modern stoves offer efficiency and convenience, their widespread use raises concerns regarding the erosion of sensory authenticity and cultural identity embedded in traditional foods (Apriyanto et al., 2024). The loss of traditional cooking materials may also weaken the experiential and symbolic values associated with local

cuisine, which are increasingly recognized as important components of cultural heritage and gastronomic tourism (Iskandar et al., 2023).

The materiality of *bucu* charcoal, encompassing its physical structure, density, combustion behavior, and heat stability, plays a critical role in shaping the cooking environment. These material properties influence heat transfer, cooking duration, surface temperature, and the interaction between heat and food ingredients. From a food science perspective, such factors directly affect flavor development, texture formation, and aroma release. Despite the importance of these aspects, systematic research linking the material characteristics of *bucu* charcoal to the sensory outcomes of Bali Lalkak remains limited.

Therefore, this study aims to (1) explore the material characteristics of *bucu* charcoal used in traditional Balinese cooking and (2) analyze its effect on the flavor characteristics of Bali Lalkak through sensory evaluation. By integrating material exploration with organoleptic analysis, this research seeks to provide empirical evidence on the role of traditional cooking materials in shaping flavor profiles. The findings are expected to contribute to the preservation of Balinese culinary heritage, support the valorization of traditional knowledge, and offer insights for sustainable and culturally grounded food production.

2. METHODS

This study employs a qualitative–experimental research design that integrates material exploration of *bucu* charcoal with sensory analysis of Bali Lalkak, enabling an in-depth understanding of both the physical characteristics of the charcoal and its influence on flavor attributes. The material exploration phase focuses on identifying the physical properties of *bucu* charcoal such as shape, density, and texture along with its combustion behavior, including burning duration and heat stability, and its heat distribution during the cooking process.

Data were collected through direct observation, documentation, and simple comparative testing with commonly used cooking fuels, such as conventional charcoal and gas stoves. Bali Lalkak samples were prepared using standardized ingredients and cooking procedures to ensure consistency, with the type of cooking fuel serving as the only experimental variable; *bucu* charcoal was used as the primary material of analysis, while comparative samples were cooked using alternative heat sources to assess differences in flavor outcomes.

Sensory evaluation was conducted through organoleptic testing involving a panel of participants familiar with traditional Balinese cuisine, assessing attributes such as aroma, taste, texture, smoky nuance, and overall flavor acceptance using a structured Likert-scale evaluation form. Data from the material exploration were analyzed descriptively to highlight the key characteristics of *bucu* charcoal, while sensory evaluation results were examined using descriptive statistical analysis to compare flavor attributes across different cooking materials, complemented by qualitative insights from panelists' feedback. Ethical considerations were addressed by informing all participants about the purpose of the study, ensuring voluntary participation, and adhering to ethical standards related to food testing and participant confidentiality.

3. RESULTS AND DISCUSSION

3.1 Material Characteristics of *Bucu* Charcoal

The exploration of *bucu* charcoal revealed distinctive material properties that differentiate it from other commonly used cooking fuels. *Bucu* charcoal exhibited a relatively dense structure with a stable physical form, allowing it to burn evenly over a longer duration. Observations during the combustion process indicated that *bucu* charcoal produced a consistent and moderate heat output, minimizing sudden temperature fluctuations during cooking. In comparison to conventional charcoal, *bucu* charcoal generated less excessive flame but maintained steady embers, which are essential for controlled heat transfer. This characteristic is particularly important in traditional cooking methods where gradual and uniform heating is required to preserve food texture and prevent surface burning. The stability of heat distribution observed in *bucu* charcoal supports the notion that material composition plays a significant role in influencing cooking performance.

3.2 Heat Stability and Cooking Performance

Results from the cooking trials showed that *bucu* charcoal provided more stable heat throughout the preparation of Bali Lalkak. The cooking process using *bucu* charcoal required a slightly longer time;

however, the heat stability contributed to more even cooking and better moisture retention within the product. This condition reduced the risk of overcooking and resulted in a more balanced texture. The controlled combustion behavior of *bucu* charcoal allowed gradual caramelization and flavor development without producing excessive bitterness. These findings align with traditional culinary knowledge, which emphasizes the importance of slow and stable heat in enhancing flavor depth. The results indicate that heat stability is a key factor linking material properties of *bucu* charcoal to the final sensory quality of Bali Lalkak.

3.3 Sensory Evaluation of Flavor Characteristics

Sensory evaluation results demonstrated notable differences in flavor characteristics between Bali Lalkak cooked using *bucu* charcoal and those prepared with alternative heat sources. Samples cooked with *bucu* charcoal received higher scores in aroma, taste complexity, and overall flavor acceptance. Panelists consistently described a distinctive smoky aroma that was subtle yet persistent, contributing positively to the overall sensory experience. The taste profile of Bali Lalkak cooked with *bucu* charcoal was perceived as richer and more balanced, with enhanced savory notes and reduced harshness compared to samples cooked using conventional charcoal or gas stoves. Texture evaluation also indicated better tenderness and moisture retention, suggesting that the cooking material indirectly influences both flavor and mouthfeel.

3.4 Influence of *Bucu* Charcoal on Flavor Formation

The influence of *bucu* charcoal on flavor characteristics can be attributed to its combustion properties and interaction with the cooking process. The stable embers produced by *bucu* charcoal likely facilitate the gradual formation of flavor compounds through controlled thermal reactions. Additionally, the mild smoky compounds released during combustion may adhere to the food surface, enhancing aroma without overpowering the natural flavors of Bali Lalkak. These findings support the argument that traditional cooking materials contribute not only as heat sources but also as active components in flavor formation. The use of *bucu* charcoal creates a unique sensory signature that is difficult to replicate using modern cooking technologies, highlighting its role in maintaining culinary authenticity.

3.5 Discussion and Implications

The results of this study confirm that the materiality of *bucu* charcoal significantly affects the flavor characteristics of Bali Lalkak. The combination of heat stability, controlled combustion, and subtle smoke production contributes to superior sensory outcomes. This finding reinforces the importance of preserving traditional cooking materials as part of cultural heritage and local food identity. From a broader perspective, the study demonstrates that traditional knowledge embedded in material selection has scientific relevance and practical value. Integrating traditional materials such as *bucu* charcoal into contemporary food production may offer opportunities for product differentiation, gastronomic tourism, and sustainable culinary practices. Furthermore, this research provides a foundation for future studies that may employ quantitative chemical analysis to further explore the relationship between combustion materials and flavor compound formation.

4. CONCLUSIONS

This study concludes that the materiality of *bucu* charcoal plays a significant role in shaping the flavor characteristics of Bali Lalkak. The distinctive physical structure and stable combustion properties of *bucu* charcoal contribute to consistent heat distribution during the cooking process, which supports optimal flavor development and texture formation. Compared to alternative cooking fuels, *bucu* charcoal provides a controlled heating environment that enhances moisture retention and prevents excessive burning.

Sensory evaluation results indicate that Bali Lalkak prepared using *bucu* charcoal exhibits superior aroma, richer taste complexity, and higher overall flavor acceptance. The subtle smoky nuances produced during combustion add depth to the flavor profile without overpowering the natural characteristics of the food. These findings demonstrate that traditional cooking materials function not only as heat sources but also as influential elements in flavor formation. Overall, the exploration highlights the importance of preserving and utilizing traditional materials such as *bucu* charcoal to maintain culinary authenticity and cultural identity. The study also suggests that *bucu* charcoal holds potential value for sustainable traditional food production and product differentiation. Future research is recommended to incorporate quantitative analyses of chemical flavor compounds and broader sensory testing to further validate and expand upon these findings.

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