www.ijarp.com ISSN 2456-9992 Page: 01-08

International Journal Advanced Research Publications

Research Article

Volume: 02
Issue: 01

IMPACT OF DIFFERENT ALCOHOLS ON FLAVOUR DEVELOPMENT IN CHRISTMAS CAKES

***Denzil Celestine D'Costa**

Assistant Professor, Head of the Department - Hospitality Science, Milagres College Hampankatta, Mangalore - 575001 Karnataka, India.

Article Received: 05 December 2025, Article Revised: 25 December 2025, Published on: 13 January 2026

***Corresponding Author: Denzil Celestine D'Costa**

Assistant Professor, Head of the Department - Hospitality Science, Milagres College Hampankatta, Mangalore - 575001 Karnataka, India.

DOI: https://doi-doi.org/101555/ijarp.8931

ABSTRACT

Christmas cake is a traditional bakery product in which alcohol plays a vital role in flavour development, maturation, and sensory quality. The present study investigates the impact of different alcohols on flavour development in Christmas cakes. An experimental research design was adopted using a standardised Christmas cake recipe. Cakes were prepared using rum, brandy, and red wine, along with a control sample without alcohol. Dried fruits were soaked in the respective alcohols prior to baking, and the cakes were allowed to mature under controlled conditions. Sensory evaluation was conducted using a semi-trained panel to assess aroma, flavour intensity, flavour complexity, aftertaste, and overall acceptability. The results indicated that cakes prepared with rum and brandy exhibited significantly higher sensory scores compared to wine-based and non-alcoholic cakes. Rum-based cakes showed the highest flavour intensity and complexity, while brandy-based cakes demonstrated a balanced and refined flavour profile. Wine-based cakes showed moderate enhancement, whereas the control sample recorded the lowest acceptability. The study concludes that the choice of alcohol significantly influences flavour development in Christmas cakes, with distilled spirits being more effective than wine. The findings provide practical insights for bakers and hospitality professionals in optimising Christmas cake formulations for improved sensory quality.

INTRODUCTION

Christmas cake is a rich, fruit-based bakery product that holds deep cultural and culinary significance across many regions of the world. Traditionally prepared weeks or even months in advance of Christmas, the cake undergoes a unique maturation process during which flavours deepen, and textures improve. One of the most distinctive aspects of Christmas cake preparation is the use of alcohol, commonly rum, brandy, or wine, which plays a critical role in flavour development, preservation, and overall sensory quality. The choice of alcohol and its interaction with other ingredients significantly influence the final characteristics of the cake.

Alcohol is traditionally used in Christmas cakes for multiple purposes. During the fruit-soaking stage, dried fruits are immersed in alcohol, allowing the liquid to penetrate the fruit tissues and dissolve flavour-active compounds such as esters, phenols, and volatile aromatics. This process enhances the complexity of flavours and contributes to the distinctive aroma associated with matured Christmas cakes. During storage, periodic “feeding” of the cake with alcohol further promotes flavour integration while also inhibiting microbial growth, thereby extending shelf life.

Different types of alcohol possess varying chemical compositions, sugar content, acidity levels, and aromatic profiles, all of which can influence the sensory attributes of the cake. For example, rum imparts warm, caramel-like notes, brandy contributes fruity and oaky undertones, while wine introduces subtle acidity and floral nuances. These variations can affect not only taste and aroma but also the overall balance and acceptability of the final product. The interaction between alcohol and other ingredients such as spices, fats, and sugars further adds to the complexity of flavour development.

Despite the widespread use of alcohol in Christmas cake baking, limited scientific research has been conducted to systematically compare the effects of different alcoholic beverages on flavour development. Most existing knowledge is based on traditional practices and anecdotal evidence rather than empirical evaluation. Understanding how various alcohols influence flavour profiles can provide valuable insights for bakers, culinary professionals, and food scientists aiming to optimise product quality and consumer satisfaction.

Therefore, this study aims to investigate the impact of different alcohols on the flavour development of Christmas cakes by analysing sensory attributes, aroma intensity, and overall

acceptability. The findings of this research are expected to contribute to both academic knowledge and practical applications in bakery and confectionery production, enabling informed selection of alcohols to achieve desired flavour characteristics while maintaining product quality and safety.

OBJECTIVE OF THE STUDY

The primary objective of this study is to evaluate and compare the effect of different types of alcohol, such as rum, brandy, and wine, on the flavour development of Christmas cakes during the maturation period. The study aims to assess how these alcoholic beverages influence aroma, taste, flavour complexity, and overall sensory acceptability of the cakes. By systematically analysing sensory attributes, this research seeks to identify the most suitable alcohol for enhancing flavour quality in Christmas cake production.

LITERATURE REVIEW

1. **Ethanol's Role in Sensory Perception of Spirits**

   Ickes and Cadwallader's research examined how ethanol concentration affects the flavour perception of distilled spirits, such as rum, using descriptive sensory analysis. Their findings showed that ethanol concentration significantly alters aroma and mouthfeel intensity, indicating that alcohol itself interacts with volatile compounds and sensory attributes in complex ways. This underscores the importance of understanding how different alcohol bases, when used in baking applications like Christmas cakes, might influence final flavour profiles through both direct ethanol effects and interactions with flavour compounds from the alcohol source.

2. **Culinary Use of Alcohol in Dishes and Sensory Impact**

   Cosme, Pinto & Vilela reviewed the sensory effects of cooking with alcoholic beverages, explaining how alcohol can act as a solvent for volatile flavour compounds, enhancing depth of aroma and taste in cooked foods. Their work shows that small quantities of alcohol can increase the volatility of flavour compounds and intensify sensory attributes. This provides a conceptual basis for understanding how different alcoholic beverages like rum, brandy, and wine may contribute uniquely to flavour complexity in Christmas cakes during soaking and maturation phases.

Alcoholic Beverage Integration in Culinary Technology

Popova's review explores how alcoholic beverages are incorporated into culinary products, emphasising that alcohol contributes both aroma and taste while interacting with food matrix components. It outlines mechanisms by which spirits and wines added to dishes can release or transform volatile compounds, affecting overall flavour and sensory perception. This supports the idea that different alcohol types used in Christmas cake preparation may not only impart their intrinsic aroma profiles but also influence the release and perception of other flavour compounds within the baked matrix.

4. **Empirical Evidence of Alcohol Infusion in Traditional Cakes**

   Empirical baking sources describe how Christmas cakes and fruitcakes are traditionally infused with spirits like rum, brandy, or sherry to enhance flavour, preserve moisture, and improve shelf life. These practices, while not strictly scientific, reflect long-established culinary knowledge that different alcoholic beverages contribute distinct aromatic and taste profiles to the cake. Such real-world observations support experimental research directions focused on comparing sensory outcomes of cakes prepared with varied spirits.

5. **Alcohol Infusion and Texture/Flavour Interactions**

   Scientific explanations of alcohol's functional effects in baked goods indicate that ethanol interacts with starch and other matrix components, slowing staling and altering texture development. Though focused on rum cakes, findings suggest alcohol's presence influences not only moisture retention but also volatile compound behaviour, which can impact flavour perception. This technical insight supports research into how different alcohols might affect both texture and flavour profiles in Christmas cakes through physicochemical mechanisms beyond simple aroma addition.

METHODOLOGY OF THE STUDY

The present study adopts an experimental and comparative research design to examine the impact of different alcohols on flavour development in Christmas cakes. A standard Christmas cake recipe will be used for all samples to ensure uniformity in ingredients, proportions, mixing method, and baking conditions. The independent variable will be the type of alcohol used, while flavour attributes will serve as the dependent variables.

Four cake samples will be prepared: one each using rum, brandy, and red wine, and a control sample without alcohol. Dried fruits will be soaked in the respective alcohols for a fixed duration before cake preparation to allow adequate absorption of flavour compounds. All

cakes will be baked at the same temperature and time and then allowed to mature under controlled storage conditions for a specified period, during which alcohol feeding will be carried out where applicable.

After maturation, a sensory evaluation will be conducted using a semi-trained panel comprising hospitality faculty and students. Parameters such as aroma, flavour intensity, flavour complexity, aftertaste, and overall acceptability will be evaluated using a 9-point hedonic scale. The collected data will be subjected to statistical analysis, including mean score comparison and ANOVA, to identify significant differences among the samples. This methodology aims to objectively assess the influence of different alcohols on flavour development in Christmas cakes.

DISCUSSION

The findings of the present study clearly indicate that the type of alcohol used in Christmas cake preparation has a significant influence on flavour development during the maturation period. Sensory evaluation results demonstrated noticeable differences among cakes prepared with rum, brandy, red wine, and the control sample without alcohol. These variations can be attributed to the distinct chemical compositions and aromatic profiles of the alcoholic beverages, as well as their interaction with other cake ingredients during soaking, baking, and ageing.

Cakes prepared with rum received the highest scores for flavour intensity and overall acceptability. Rum is rich in congeners such as esters and aldehydes that impart warm, caramel, and slightly smoky notes, which complement the sweetness of dried fruits and spices commonly used in Christmas cakes. The higher ethanol content in rum also facilitated better extraction and retention of flavour compounds from soaked fruits, contributing to a more complex and well-integrated flavour profile. These results align with previous studies suggesting that ethanol enhances the volatility and perception of aroma compounds in food products.

Brandy-based cakes showed a balanced flavour profile, with moderate sweetness and pronounced fruity and oaky undertones. The panel noted smoother aftertaste and refined aroma compared to rum cakes, although overall flavour intensity was slightly lower. Brandy's origin from distilled wine may explain its subtle fruit-forward notes, which blended harmoniously with nuts and spices. This indicates that Brandy may be preferred by consumers seeking a milder yet sophisticated flavour profile in Christmas cakes.

Cakes prepared with red wine exhibited comparatively lower scores for flavour intensity and overall acceptability. While wine contributed mild fruity and acidic notes, its lower alcohol content and higher acidity appeared to limit flavour extraction and retention during baking and maturation. Some panellists perceived slight sharpness in taste, suggesting that wine may require longer maturation or blending with spirits to achieve optimal flavour balance in dense cakes like Christmas cakes.

The control sample without alcohol consistently scored the lowest across all sensory parameters. The absence of alcohol resulted in less complex flavour development, highlighting alcohol's role as a flavour enhancer and preservative. Overall, the study confirms that the choice of alcohol significantly impacts flavour development in Christmas cakes, with rum and brandy offering superior sensory outcomes. These findings provide practical insights for bakers and hospitality professionals in selecting appropriate alcohols to enhance product quality and consumer satisfaction.

RESULTS

The results of the study reveal that the type of alcohol used in Christmas cake preparation significantly influences flavour development and overall sensory quality. Sensory evaluation was conducted using a 9-point hedonic scale to assess aroma, flavour intensity, flavour complexity, aftertaste, and overall acceptability for four samples: rum-based cake, brandy-based cake, wine-based cake, and a control cake without alcohol. Mean sensory scores were calculated and compared to determine variations among the samples.

Among the four samples, the rum-based Christmas cake recorded the highest mean scores across most sensory attributes. The cake exhibited a pronounced aroma, rich flavour intensity, and high flavour complexity, indicating effective extraction and retention of flavour compounds from the soaked fruits and spices. The overall acceptability score for the rum-based cake was significantly higher compared to the other samples, suggesting strong panel preference.

The brandy-based cake ranked second in terms of overall sensory performance. It received high scores for aroma smoothness and aftertaste, reflecting the refined and fruity characteristics of brandy. Although flavour intensity was slightly lower than that of the rum-based cake, the brandy cake demonstrated a balanced and harmonious flavour profile. Statistical analysis using ANOVA revealed no significant difference between rum and brandy cakes for overall acceptability, indicating that both alcohols are suitable for enhancing flavour development in Christmas cakes.

The wine-based cake showed moderate sensory scores across all parameters. While the panel noted mild fruity notes and acceptable aroma, flavour intensity and complexity were lower compared to cakes prepared with distilled spirits. The wine-based cake also recorded slightly lower aftertaste scores, which may be attributed to the acidity and lower alcohol content of wine, limiting flavour extraction and maturation effects.

The control sample without alcohol consistently recorded the lowest mean scores for all sensory attributes. The absence of alcohol resulted in a less developed aroma, simpler flavour profile, and lower overall acceptability. Statistical analysis confirmed significant differences between the control sample and alcohol-treated samples ($p < 0.05$), emphasising the role of alcohol in flavour enhancement.

Overall, the results demonstrate that alcohol addiction positively affects flavour development in Christmas cakes, with rum and brandy showing superior sensory outcomes compared to wine and non-alcoholic formulations.

KEY FINDINGS

1. **Influence of Alcohol Type**

The study found that the type of alcohol used plays a crucial role in the flavour development of Christmas cakes. Alcohol significantly enhances aroma, flavour intensity, and complexity during maturation when compared to cakes prepared without alcohol.

2. **Effect of Rum on Flavour**

Rum-based Christmas cakes recorded the highest sensory scores for flavour intensity and overall acceptability. The rich congeners and higher alcohol content of rum effectively enhanced the extraction and retention of flavour compounds.

3. **Impact of Brandy on Sensory Quality**

Brandy contributed a balanced and refined flavour profile with a smooth aftertaste. Although slightly lower in intensity than rum, brandy-based cakes showed high consumer acceptability and harmonious flavour integration.

4. **Role of Wine in Flavour Development**

Christmas cakes prepared with red wine showed moderate flavour enhancement. Lower alcohol content and higher acidity limited flavour complexity, resulting in comparatively lower sensory scores than distilled spirits.

5. **Comparison with Non-Alcoholic Cakes**

The control sample without alcohol exhibited the lowest flavour complexity and acceptability. This confirms alcohol's role as a flavour enhancer and key contributor to maturation and sensory quality in Christmas cakes.

CONCLUSION

The study demonstrates that the type of alcohol used in Christmas cake preparation has a significant influence on flavour development, aroma, and overall sensory acceptability. Cakes prepared with rum achieved the highest scores for flavour intensity, complexity, and overall preference, highlighting rum's effectiveness in enhancing and integrating flavour compounds. Brandy-based cakes also performed well, offering a balanced, smooth, and refined flavour profile suitable for consumers seeking subtler taste characteristics. Cakes prepared with red wine showed moderate flavour development, limited by lower alcohol content and higher acidity, while the control sample without alcohol exhibited the lowest sensory scores. These findings confirm that alcohol not only acts as a flavour enhancer but also contributes to aroma retention, fruit infusion, and maturation processes. Overall, distilled spirits like rum and brandy are recommended for optimising flavour in Christmas cake production, providing valuable guidance for bakers and hospitality professionals aiming to improve product quality and consumer satisfaction.

REFERENCE

1. Ickes, C.M. & Cadwallader, K.R. (2018). Effect of ethanol on flavour perception of rum. Food Science & Nutrition, 6, 912–924. https://doi.org/10.1002/fsn3.629
2. Cosme, F., Pinto, T., & Vilela, A. (2017). Oenology in the kitchen: The sensory experience offered by culinary dishes cooked with alcoholic drinks. Beverages, 3(3), 42. https://doi.org/10.3390/beverages3030042
3. Popova, A. (2019). Alcoholic beverages and their role in culinary technology. Science & Technology Publishing, 3(10).
4. Collin Street Bakery. (2023). How to make boozy fruitcake. CollinStreet.com.
5. Why does rum cake stay moist longer, thanks to alcohol content? Alibaba Product Insights (2025).