

STUDY ON THE COMPARISON OF THE RESULTS OF THE DEVELOPER SUBSTANCE IN COOKIES AND THE INTEREST OF STUDENTS AT UBSI KALIABANG

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Abstract

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The selection of the type of developer is a crucial factor in determining the physical and organoleptic characteristics of soft cookies. This study aims to compare the effect of the use of different stimulants, namely baking soda (sodium bicarbonate), baking powder, and a combination of the two (mix), on the quality of soft cookies and to find out students' interest in the results of these products. The research method used a purely experimental approach with a three-treatment Complete Random Design (RAL). The parameters tested included spread diameter, color, aroma, and texture (softness). Furthermore, the acceptance test was carried out through a survey of 100 UBSI Kaliabang student respondents to measure buying interest and taste preferences. The results of the experiment showed that the use of baking soda resulted in cookies that were not too wide and dark in color, baking powder produced a more cakey texture and rose upwards, while the combination of the two (mix) produced the best soft cookie characteristics with a balance between a slightly crispy texture at the edges and soft in the middle.

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INTRODUCTION

Cookies are one of the most popular bakery products consumed worldwide due to their appealing taste, variety of flavors, practical serving size, and long shelf life. Among the many variations available, soft cookies have gained particular popularity, especially among young adults and university students. Soft cookies are characterized by their tender interior, slightly crisp edges, and rich sensory attributes, making them a preferred snack option in both commercial and homemade bakery settings. The increasing demand for



soft cookies has encouraged continuous innovation in formulation techniques, particularly in the selection and optimization of leavening agents that play a crucial role in determining product quality.

In bakery science, the formulation of cookies involves a complex interaction between ingredients such as flour, fat, sugar, eggs, and leavening agents. Each component contributes specific functional properties that influence the final characteristics of the product, including texture, volume, spread, color, aroma, and overall sensory acceptance. Among these components, leavening agents are considered one of the most critical factors affecting the physical and organoleptic qualities of cookies. The proper selection and proportion of leavening agents can significantly determine whether a cookie achieves the desired softness, structural integrity, and visual appeal.

Leavening agents function primarily by producing carbon dioxide (CO₂) gas, which becomes trapped within the dough matrix and causes expansion during mixing and baking. This gas formation influences dough spread, internal crumb structure, and surface appearance. In cookie production, two of the most commonly used chemical leavening agents are baking soda (sodium bicarbonate) and baking powder. Despite their similar function, these two substances differ substantially in chemical composition, reaction mechanisms, and effects on dough behavior and final product quality.

Baking soda is a pure alkaline compound that requires the presence of acidic ingredients to activate its leavening function. When combined with acids and moisture, baking soda produces CO₂ rapidly, often during the early stages of dough mixing. This early gas release can influence dough spread and contribute to a flatter cookie structure. Additionally, baking soda raises the pH level of the dough, which accelerates the Maillard reaction during baking. As a result, cookies made with baking soda tend to exhibit darker surface color and stronger roasted aroma. However, improper use or excessive amounts of baking soda may lead to undesirable bitter aftertastes and overly dense textures.

In contrast, baking powder is a complete leavening system consisting of baking soda, acidic salts, and a drying agent such as starch. Most commercial baking powders are double-acting, meaning they release CO₂ gas in two stages: first when mixed with liquid ingredients and second when exposed to heat during baking. This two-phase gas release allows for more controlled and gradual dough expansion, often resulting in cookies with a thicker structure, finer crumb, and softer texture. Baking powder generally produces lighter-colored cookies compared to baking soda, as it does not significantly increase dough alkalinity.

While both leavening agents are widely used in cookie production, their individual effects on soft cookie characteristics remain a subject of interest in bakery research. Moreover, combining baking soda and baking powder in specific ratios has been proposed as a strategy to balance the advantages of each agent. The combination aims to achieve optimal dough spread, desirable color development, pleasant aroma, and a soft yet stable texture. Despite its common use in practice, empirical studies comparing the effects of baking soda, baking powder, and their combination on soft cookie quality particularly in relation to consumer preference remain limited, especially within the context of student consumer groups.

University students represent a significant consumer segment for bakery products due to their lifestyle, purchasing behavior, and preference for convenient yet satisfying foods. Their acceptance of a product is influenced not only by taste but also by visual appearance, texture, aroma, and overall eating experience. Understanding students'

preferences toward different cookie formulations can provide valuable insights for product development in small-scale food businesses, campus-based culinary enterprises, and hospitality education programs. Therefore, integrating sensory evaluation and consumer interest analysis into experimental food studies is essential for aligning technical formulation outcomes with market expectations.

In hospitality and culinary education, experimental research on food formulation plays a vital role in bridging theoretical knowledge and practical application. By conducting controlled experiments on ingredient variation, students can better understand how chemical and physical processes affect food quality. This approach enhances critical thinking, scientific reasoning, and practical competence in food production. Studies focusing on basic bakery ingredients, such as leavening agents, offer accessible yet meaningful opportunities for applied research that directly relates to real-world culinary practice.

This study was conducted to compare the effects of three different leavening agent treatments baking soda, baking powder, and a combination of baking soda and baking powder in a 1:1 ratio on the physical and sensory characteristics of soft cookies. The physical parameters observed include dough spread, cookie diameter, thickness, color development, and texture. In addition, sensory evaluation was carried out through an organoleptic test involving university students at Universitas Bina Sarana Informatika (UBSI) Kaliabang to assess their level of preference and purchase interest toward the produced cookies.

By employing an experimental research design with a Completely Randomized Design (CRD), this study aims to generate objective data on how different leavening agents influence cookie quality. The inclusion of a consumer preference survey complements the laboratory-based analysis by providing insight into how physical differences translate into perceived quality and acceptance. This dual approach strengthens the relevance of the findings for both academic research and practical application in the bakery and hospitality industry.

Furthermore, this research contributes to the existing literature on bakery product development by providing a comparative analysis of leavening agents in soft cookies within a local Indonesian academic context. The findings are expected to serve as a reference for students, educators, and small-scale food producers in selecting appropriate leavening formulations to achieve desirable cookie characteristics. In addition, the study may encourage further research on related variables, such as baking temperature, fat composition, sugar type, and storage stability, to enhance the quality and consistency of soft cookie products.

In conclusion, the growing popularity of soft cookies, combined with the critical role of leavening agents in determining product quality, underscores the importance of systematic research on ingredient functionality. By examining both physical characteristics and consumer preference, this study seeks to provide a comprehensive understanding of how baking soda, baking powder, and their combination affect soft cookie quality. The results are anticipated to offer practical recommendations for optimal leavening agent use while supporting the development of scientifically informed and consumer-oriented bakery products.

LITERATURE REVIEW

1. Characteristics and Quality Attributes of Soft Cookies

Soft cookies are a category of baked products distinguished by their tender interior, moist crumb, and slightly crisp outer layer. Unlike traditional crisp cookies, soft cookies rely heavily on ingredient formulation and processing conditions to achieve their desired texture. Quality attributes of soft cookies include physical characteristics such as diameter, thickness, spread ratio, and color, as well as sensory attributes including aroma, taste, mouthfeel, and overall acceptability. These attributes are influenced by the interaction of ingredients such as flour, fat, sugar, eggs, and leavening agents.

Texture is one of the most critical quality parameters in soft cookies, as it directly affects consumer satisfaction. A soft cookie is expected to be tender, slightly chewy, and not overly dense or dry. The balance between moisture retention and structural stability determines whether a cookie achieves the desired softness. Fat and sugar play a role in tenderization, while flour proteins contribute to structure formation. Excessive gluten development, however, can lead to harder textures that are undesirable in soft cookies.

Color development is another important quality indicator, as it influences first impressions and perceived doneness. Soft cookies typically exhibit a golden-brown to light-brown surface color, which results from Maillard reactions and caramelization during baking. Variations in pH, sugar type, and baking temperature can significantly alter color intensity. Darker coloration may be associated with richer flavor, but excessive browning can be perceived negatively by consumers.

Overall, the quality of soft cookies is determined by a combination of physical and sensory characteristics. Understanding these attributes provides a foundation for evaluating the effects of ingredient variations, particularly leavening agents, which play a key role in shaping texture, spread, and appearance.

2. Role of Chemical Leavening Agents in Bakery Products

Chemical leavening agents are essential components in bakery formulations, functioning to produce carbon dioxide gas that expands the dough or batter during mixing and baking. This gas formation creates air cells within the dough matrix, contributing to volume, porosity, and texture. In cookie production, chemical leavening agents are preferred over biological leaveners due to their rapid action and predictable performance.

The effectiveness of a leavening agent depends on its chemical composition, reaction conditions, and compatibility with other ingredients. Factors such as moisture content, temperature, pH, and mixing method influence the rate and extent of gas release. In cookies, controlled gas production is crucial, as excessive leavening can cause excessive spread and fragile structure, while insufficient leavening may result in dense and hard products.

Chemical leavening agents also affect dough rheology and baking behavior. As gas is released, the dough expands and weakens structurally, allowing it to spread during baking. This behavior directly influences cookie diameter and thickness. In addition, leavening agents can alter dough pH, which impacts protein interactions, starch gelatinization, and browning reactions.

Beyond physical effects, leavening agents contribute indirectly to sensory attributes. Changes in texture, crumb structure, and color influence consumer perception of freshness and quality. Therefore, selecting the appropriate type and amount of leavening agent is a critical step in bakery product development. Research on leavening agents provides valuable insight into how formulation choices can be optimized to meet specific product goals, such as achieving the soft and balanced texture expected in soft cookies.

3. Chemical and Functional Properties of Baking Soda

Baking soda, or sodium bicarbonate, is a widely used chemical leavening agent in bakery products. It is an alkaline compound that requires an acidic component and moisture to initiate the leavening reaction. When baking soda reacts with an acid, carbon dioxide gas is released, causing the dough to expand. This reaction typically occurs rapidly during the mixing stage, making baking soda particularly influential in early dough development.

One of the distinctive properties of baking soda is its ability to increase the pH of the dough. Elevated pH levels accelerate Maillard reactions during baking, resulting in darker surface color and enhanced roasted flavors. This characteristic is often desirable in cookies that aim for rich flavor and deep coloration. However, excessive alkalinity can lead to overly dark products and undesirable bitter or soapy aftertastes if not properly balanced with acidic ingredients.

In soft cookie production, baking soda tends to promote greater dough spread due to early gas release and weakened dough structure. This can result in flatter cookies with a denser crumb if not carefully controlled. While baking soda contributes to flavor and color development, it may not provide sufficient structural support for achieving a thick and soft cookie profile when used alone.

Therefore, the use of baking soda requires precise formulation and careful consideration of other ingredients. Its functional properties make it effective for specific applications, but limitations in texture control have led researchers and practitioners to explore combinations with other leavening agents to improve overall product quality.

4. Chemical and Functional Properties of Baking Powder

Baking powder is a complete chemical leavening system composed of baking soda, acidic salts, and a starch-based drying agent. Unlike baking soda, baking powder does not rely on external acidic ingredients, making it more versatile and consistent in bakery formulations. Most commercial baking powders are double-acting, releasing carbon dioxide gas in two stages: upon hydration and during heating.

The dual-stage gas release mechanism allows baking powder to provide more controlled and sustained leavening. In cookie production, this characteristic contributes to improved volume retention and more uniform crumb structure. Cookies made with baking powder tend to be thicker, softer, and more evenly textured compared to those made with baking soda alone. Additionally, baking powder generally results in lighter-colored cookies due to its neutral effect on dough pH.

Baking powder plays a significant role in achieving tenderness in soft cookies. The gradual expansion of gas during baking supports the formation of a stable yet soft structure, reducing the risk of excessive spread or collapse. This makes baking powder particularly suitable for products that prioritize softness and uniform appearance.

Despite these advantages, baking powder may produce cookies with milder flavor profiles compared to baking soda. As a result, bakers often seek to combine baking powder with other ingredients or leavening agents to enhance flavor complexity while maintaining desirable texture. Understanding the functional role of baking powder is essential for optimizing soft cookie formulations.

5. Combination of Baking Soda and Baking Powder and Consumer Preference

The combined use of baking soda and baking powder in bakery products has been widely practiced to balance their respective advantages. Baking soda contributes to flavor development and browning, while baking powder provides controlled leavening and structural stability. When used together in appropriate ratios, these leavening agents can

produce soft cookies with optimal texture, color, and sensory appeal.

The interaction between the two leavening agents allows for both early and delayed gas release. Early gas formation from baking soda influences dough spread and surface characteristics, while later gas release from baking powder supports internal structure during baking. This combination often results in cookies that are slightly crisp on the outside but remain soft and tender on the inside an attribute highly valued by consumers.

Consumer preference studies indicate that texture and flavor balance are among the most important factors influencing acceptance of soft cookies. Products that are too flat, too dark, or too hard tend to receive lower acceptance scores. Conversely, cookies with moderate spread, appealing color, and soft mouthfeel are more likely to be favored, particularly among young adult consumers such as university students.

By integrating sensory evaluation with formulation studies, researchers can better understand how ingredient combinations affect consumer perception. The combination of baking soda and baking powder represents an effective strategy for meeting both technical quality standards and consumer expectations. This approach supports the development of bakery products that are not only scientifically optimized but also commercially viable.

RESEARCH METHODOLOGY

This study employed an experimental research design combined with a survey approach to analyze the effects of different chemical leavening agents on the physical characteristics and consumer preference of soft cookies. The experiment was conducted using a Completely Randomized Design (CRD) with three treatments: cookies made using baking soda, baking powder, and a combination of baking soda and baking powder in a 1:1 ratio. Each treatment was prepared using the same base formulation to ensure consistency and to isolate the effect of the leavening agents.

The physical properties evaluated included cookie diameter, spread ratio, color, and texture. Sensory evaluation was conducted through an organoleptic test involving 100 university students from UBSI Kaliabang as panelists. A structured questionnaire was used to assess visual appeal, aroma, taste, texture, and overall preference. The collected data were analyzed descriptively to compare the influence of each leavening agent on cookie quality and student acceptance.

RESULTS AND DISCUSSION

This study compares the influence of three types of stimulants on the physical characteristics and level of preference of UBSI Kaliabang students on soft cookie products. The variations of the developer substances used are baking soda (100%), baking powder (100%), and a mixture of both with a ratio of 1:1

A. *Physical and Visual Characteristics Analysis*

Here is the documentation and analysis of the differences in characteristics of the three samples:

1. **Sampel A (Baking Soda 100%)**



Visual & Spread Analysis: Produces a small diameter of cookies (high spread ratio) with an intense dark brown surface color. Texture Analysis: Textures tend to be denser and harder than other samples. The increase in pH due to baking soda accelerates the Maillard reaction which gives it a strong color and aroma.

2. Sampel B (Baking Powder 100%)



Visual & Spread Analysis: Cookies appear thicker and wider than baking soda. The surface color tends to be lighter than the baking soda sample. Texture Analysis: It has a finer crumb porosity and a softer structure. The use of double-acting baking powder provides a stable release of CO₂ gas during mixing and baking, so that the development volume is better maintained vertically.

3. Sampel C (Mix Baking Soda & Baking Powder 1:1)



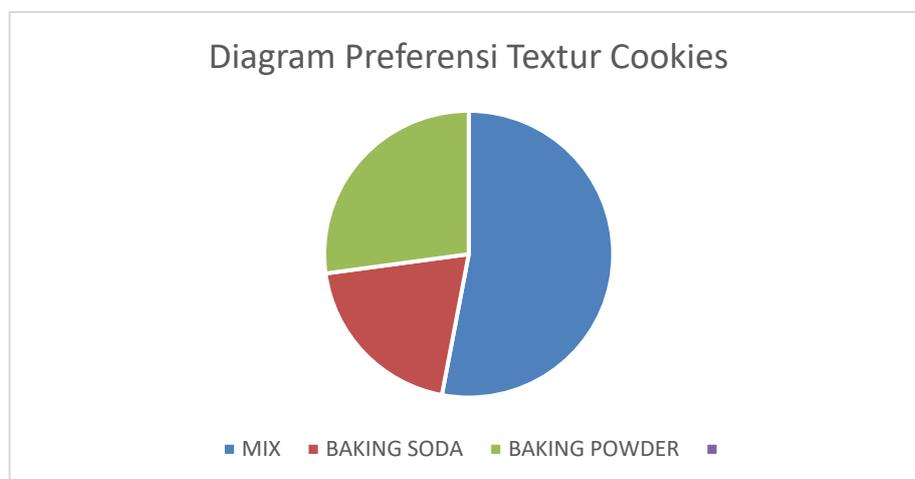
Visual & Spread Analysis: Shows the most proportional results. The spread diameter is quite good with an ideal thickness. Texture Analysis: Produces the most

optimal soft cookie characteristics with crispiness on the outside but still soft on the inside.

B. Organoleptic Test Analysis (Student Interest)

Based on the results of a survey of student panelists at UBSI Kaliabang, there are significant differences in preferences based on visual, taste, and texture aspects. Visual Aspect: Respondents tend to like the color of the baking powder and mix samples because they give the impression of "perfectly cooked" and visually appealing. Flavor & Aroma Aspect: Samples with a mix score are highest because they have a neutral flavor profile without the bitter aftertaste that sometimes appears with the use of pure baking soda.

Overall Choice: The majority of respondents (students) chose Sample C (Mix) as the most popular product. This is because the texture is considered the most ideal for a soft cookie that is, it is soft but still melts in the mouth (sensory optimal)



CONCLUSION

Based on the results of the study on the comparison of developer substances in cookie products, it can be concluded that the choice of the type of developer material has a real effect on the physical, chemical, and student preference characteristics. The use of baking soda independently produces cookies with a diameter that is not too wide and darkest in color due to the intense Maillard reaction, but has a texture that tends to be hard. In contrast, the use of baking powder results in cookies with a thicker structure and finer porosity.

The results of organoleptic tests show that a mix formulation with a ratio of 1:1 is the most optimal choice because it is able to create a balance between softness and volume of development. This characteristic is most in demand by respondents because it provides a slightly crispy but still soft sensation in the mouth with a neutral flavor profile. Thus, the use of mixed developer substances has proven to be the best formula in meeting consumers' sensory expectations.

Based on the findings of this study, it is recommended for culinary business actors or students who want to produce soft cookies to use a combination of baking soda and baking powder to get the most balanced texture and color quality. In addition, for further research, it is necessary to conduct a more in-depth analysis of the effect of baking temperature on the stability of this mixing developer in order to obtain more precise

operational standards for procedures in achieving consistent cookie ripeness.

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