

## ANALYSIS OF DIFFERENCES IN HOKKAIDO CHEESE TART CRUST CHARACTERISTICS USING LOW-, MEDIUM-, AND HIGH-PROTEIN WHEAT FLOUR BASED ON STUDENT RESPONSES

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### Abstrak

#### Keywords:

Hokkaido Cheese Tart,  
Crust Texture,  
Wheat Flour,  
Protein Content,  
Consumer Preference.

*This study aims to analyze differences in the crust characteristics of Hokkaido cheese tart produced using wheat flour with different protein levels, namely low-protein, medium-protein, and high-protein flour, and to identify student preferences toward the resulting products. The crust is a crucial component of Hokkaido cheese tart because it determines the eating experience through attributes such as crispness, crumbliness, color, and structural durability. This research applied an experimental method using a quantitative descriptive approach. Three crust formulations were prepared using the same ingredient composition and production procedure, with the only difference being the type of flour used. After baking, each crust treatment was evaluated through direct observation and organoleptic testing. Organoleptic data were collected using a questionnaire distributed to student respondents who tasted the three samples. The evaluation focused on sensory attributes of the crust, including texture (crispness and crumbliness), visual appearance (color), and overall preference. The results showed that low-protein flour produced the crispiest and most crumbly crust, which was considered most suitable for tart characteristics. Medium-protein flour produced a moderately crisp crust with better structural stability, while high-protein flour produced the strongest structure but resulted in a harder and denser texture that was less preferred. Consumer preference data revealed that 38.5% of respondents preferred the tart crust made with low-protein flour, indicating that a crisp and crumbly texture is more desirable for Hokkaido cheese tart. In conclusion, wheat flour protein level significantly affects crust quality and student acceptance, and low-protein flour is recommended to produce an optimal crust texture for Hokkaido cheese tart products.*



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## INTRODUCTION

Hokkaido cheese tart is one of the pastry products that is popular and favored by various groups because it features a characteristic combination of a soft cheese filling and a crispy crust. The crust quality is an important factor in determining consumer acceptance of this product, because crust texture directly affects the biting sensation and enjoyment when consumed. Therefore, efforts to produce crust with an optimal texture are an important aspect in the development of Hokkaido cheese tart products.

One of the main factors influencing crust texture in pastry products is the type of wheat flour used. Wheat flour contains different levels of protein, which directly affects gluten formation during dough mixing. Gluten plays a role in determining product structure, crumbliness, and crispness of the final product. Low-protein flour tends to produce products that are more fragile and crispy, whereas high-protein flour produces a structure that is stronger, denser, and harder. These differences make flour selection a crucial aspect in making pastry crust.

In pastry learning practice, low-protein flour is generally recommended for tart products because it is expected to produce a crust texture that is crumbly and crispy. However, in practice, there are still differing opinions regarding the use of other flour types, such as medium- or high-protein flour, which are considered to provide a more stable crust structure. These differing perspectives encourage the need for experimental research to directly prove the influence of wheat flour type on the crust texture of Hokkaido cheese tart.

In addition to technical testing, respondent preference is also an important aspect in assessing pastry product quality. Consumer evaluation through organoleptic testing can provide an overview of which crust texture is most preferred and acceptable to the public. Therefore, this study not only focuses on crust texture observation results, but also involves a consumer survey to determine preferences toward Hokkaido cheese tart crust produced using various types of wheat flour.

Based on this background, the study was conducted to analyze differences in Hokkaido cheese tart crust texture made using low-, medium-, and high-protein flour, and to determine which flour type is most preferred by consumers based on survey results. The findings are expected to serve as a reference in selecting appropriate wheat flour as a raw material for producing Hokkaido cheese tart, particularly in the context of pastry learning and product development.

## LITERATURE REVIEW

### 1. *Wheat Flour*

Wheat flour is the main ingredient in bakery and pastry products derived from the milling of wheat grains (*Triticum aestivum*). According to the Indonesian National Standardization Agency (2020), wheat flour contains starch, protein, water, fat, and



minerals that contribute to the formation of food product characteristics. The protein component of wheat flour plays an important role because it determines dough physical properties and the texture of the final product. Therefore, selecting the appropriate type of wheat flour greatly affects the quality of pastry products.

## **2. Protein Content in Wheat Flour**

Protein content in wheat flour is the main factor distinguishing flour types used in bakery and pastry production. Fauziah and Nugroho (2021) explain that based on protein level, wheat flour is classified into low-protein flour (8–9%), medium-protein flour (10–11%), and high-protein flour (12–13%). These protein differences affect flour's ability to form gluten when mixed with water. The higher the protein content, the stronger the gluten network formed, resulting in a denser and sturdier product structure. Conversely, flour with low protein produces a structure that is more fragile and crisp, and is therefore commonly used in tart and dry pastry products.

## **3. Gluten and Its Effect on Crust Texture**

Gluten is an elastic network formed from the interaction of glutenin and gliadin proteins in wheat flour when mixed with water and kneaded or stirred. According to Aisyah and Rahmawati (2021), gluten formation plays a key role in determining elasticity, crumbliness, and structural strength in bakery products. In pastry products such as tarts, excessive gluten formation can cause the crust to become hard and less crumbly. Therefore, using low- to medium-protein flour is recommended to produce a crust texture that is crispy and easy to bite. In making Hokkaido cheese tart crust, excessive gluten formation can result in a crust that is hard and difficult to bite. Therefore, flour with appropriate protein content is required so that gluten forms in an optimal amount, resulting in a crust that is crispy, crumbly, and still structurally stable.

## **4. Crust Texture in Hokkaido Cheese Tart Products**

Crust texture is one of the main sensory attributes that determines the quality of Hokkaido cheese tart. According to Hapsari and Sari (2024), the desired crust texture in tart products is crispy on the outside but still crumbly when consumed. Crust texture is influenced by the type of flour, protein content, dough mixing process, and baking technique. Differences in protein content lead to different crust characteristics, such as crispness, crumbliness, color, and structural durability. Therefore, flour selection becomes an important factor in producing Hokkaido cheese tart.

## **5. Organoleptic Testing and Consumer Preference**

Organoleptic testing is a method for evaluating food product quality using human senses, such as sight, taste, and touch. According to Astuti and Lestari (2020), organoleptic testing is used to assess sensory characteristics including texture, taste, aroma, and color. In this study, organoleptic testing was conducted to determine consumer preference for Hokkaido cheese tart crust texture. Consumer preference is an important indicator in evaluating product acceptance, because it reflects how well product characteristics match consumer expectations and taste (Nurhayati & Ramadhan, 2023).

## **RESEARCH METHOD**

This study used an experimental method with a quantitative descriptive approach. The experiment was conducted by producing Hokkaido cheese tart using three different wheat flour types based on protein content: low-protein, medium-protein, and high-protein flour. Each treatment was made using the same ingredient composition

and production process, so any differences in results were only influenced by the type of flour used.

Observations were carried out on crust texture, which included crispness level, crumbliness, color, and crust structural durability after baking. In addition, an organoleptic test was conducted by distributing questionnaires to respondents who tasted the products to identify consumer preferences for Hokkaido cheese tart crust texture in each treatment. Data obtained from observation and questionnaires were analyzed descriptively in the form of percentages and presented in tables and narrative explanations to describe differences in crust texture based on flour type.

## RESULT AND DISCUSSION

### *Crust Texture Based on Wheat Flour Type*

Observation results show that different wheat flour protein levels produce different crust texture characteristics in Hokkaido cheese tart.

#### *Low-Protein Wheat Flour (Kunci Biru)*

Hokkaido cheese tart crust made using low-protein wheat flour (Kunci Biru brand) produced the most crumbly and crispy texture compared to other treatments. Visually, the crust surface appeared smoother and easily broke when lightly pressed or bitten. This texture provided a distinct crispy sensation and matched typical tart characteristics.



This result aligns with Fauziah and Nugroho (2021), who stated that low-protein wheat flour forms minimal gluten, resulting in a more fragile dough structure and crispier pastry texture. In addition, Aisyah and Rahmawati (2021) explained that low gluten formation allows higher crumbliness without reducing product doneness.

#### *Medium-Protein Wheat Flour (Segitiga Biru)*

Crust made using medium-protein wheat flour (Segitiga Biru brand) showed a more balanced texture between crumbliness and structural strength. The crust still had a fairly good crispness level, but felt slightly denser than crust made with low-protein flour. The crust structure appeared sturdier and did not crumble easily when cut.



According to Andini and Prasetyo (2022), medium-protein flour forms a moderate amount of gluten, providing a balance between crispness and structural durability. This explains why crust made with medium-protein flour remains acceptable in texture, although its crumbliness is lower than crust made with low-protein flour.

#### ***High-Protein Wheat Flour (Cakra Kembar)***

Hokkaido cheese tart crust made using high-protein wheat flour (Cakra Kembar brand) produced the hardest and densest texture. Physically, the crust had a very strong structure and did not break easily, but required more effort when bitten. This texture was considered less suitable for Hokkaido cheese tart, which is expected to have a crumbly and crispy crust.



Kurniawan and Putri (2022) explained that higher protein content leads to the formation of a stronger and more elastic gluten network. This causes pastry products to become harder and denser, making them less suitable for tart products that prioritize crisp and crumbly textures.

#### ***Crust Color***

Based on visual observations, crust color differences among the three treatments were not very significant. Crust made using low- and medium-protein flour produced a relatively uniform golden color after baking. This color indicated good and even doneness, visually appealing and consistent with tart product characteristics. This uniformity indicates that using low- to medium-protein flour did not greatly affect crust color changes during baking.

Meanwhile, crust made using high-protein flour tended to have a slightly darker

color than the other two treatments. This color difference was assumed to be influenced by higher protein content, which may accelerate browning reactions during baking such as the Maillard reaction. The Maillard reaction occurs due to interaction between proteins and sugars at high temperatures, producing a more intense brown color. However, the color differences remained within reasonable limits and did not indicate burning or underbaking.



Although some color variation existed, observations show that color was not the main aspect in assessing Hokkaido cheese tart product quality. All crusts were still within an acceptable color range visually and did not create a negative impression. Consumers tended to focus more on crust texture during consumption than minor color differences. Thus, crust color was not a dominant variable in determining consumer preference. Color differences only served as supporting characteristics and did not significantly affect liking levels. This strengthens the research focus that crust texture particularly crispness and crumbliness is the main factor influencing consumer acceptance of Hokkaido cheese tart.

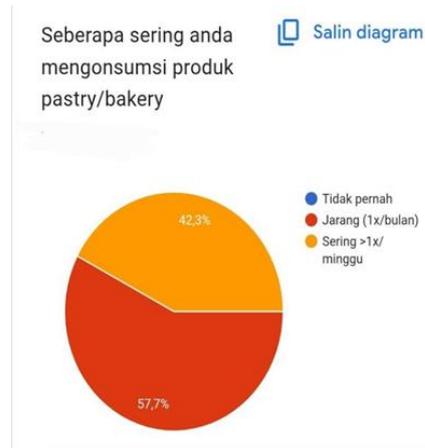
### ***Crust Structural Durability***

Crust structural durability was observed based on the crust's ability to maintain its shape after baking and during serving. Low-protein flour crust showed a more fragile structure and was easily broken under pressure, but still maintained its shape when served with filling. Medium-protein flour crust had better structural durability, making it less likely to crack or crumble.

In contrast, high-protein flour crust had the strongest structural durability. However, this high durability was accompanied by a harder texture, reducing eating comfort. This indicates that overly high structural durability does not always align with the desired texture quality in tart products.

### ***Consumer Responses to Crust Texture***

Organoleptic test results from questionnaires showed that consumers had different preferences for Hokkaido cheese tart crust texture based on flour type. Based on the data, **38.5%** of respondents preferred crust made using low-protein flour. Consumers assessed that this crust had a crispier, more crumbly texture and was easier to bite, providing a more comfortable eating experience.



Crust made with medium-protein flour ranked second. Its balanced texture between crispy and dense was considered fairly good, although some respondents stated it was still slightly harder than crust made from low-protein flour. Meanwhile, crust made from high-protein flour received the lowest preference level because it was considered too hard and not suitable for Hokkaido cheese tart characteristics. Survey results align with crust texture observations, showing that low-protein flour use produces crust texture that best matches consumer preferences.

## CONCLUSION

Based on the research results, it can be concluded that using wheat flour with different protein levels affects the crust texture of Hokkaido cheese tart. Low-protein flour produces the most crumbly and crispy crust, medium-protein flour produces a more balanced texture between fragility and structural strength, while high-protein flour produces a harder and denser crust. Consumer survey results show that crust made using low-protein flour was the most preferred by respondents. A total of 38.5% of consumers expressed preference for low-protein flour crust because it was crispier and easier to bite. This finding aligns with crust texture observations showing that lower protein content results in less gluten formation, producing crust texture suitable for Hokkaido cheese tart characteristics. Thus, low-protein flour is considered the most appropriate choice to produce optimal Hokkaido cheese tart crust texture based on observation and consumer preference results.

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