# Innovative Low-Calorie Apple Pie Product With Natural Sweeteners as An Alternative Snack For Low-Calorie Diets

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Keywords: *Honey, Apple, Pie, Low Calorie, Food Innovation, Healthy Snacks*

Abstract: Healthy food innovations are urgently needed to address the rising prevalence of obesity and diabetes caused by excessive sugar consumption. Therefore, choosing healthy snacks or foods is crucial in today's era to avoid unwanted diseases. This study aims to develop a low-calorie apple pie product with natural honey sweetener as a healthy snack alternative. The method used is a research and development model (R7D) 4D (Define, Design, Develop, Deploy). The apple pie product is formulated using apples as a source of fiber and antioxidants, and honey as a natural sweetener to replace sugar. Nutritional content calculations show that one serving of apple pie contains 84 kcal, categorizing it as a low-calorie snack. Organoleptic tests on 30 respondents indicated good acceptance, particularly in terms of taste (57% strongly liked, 33% liked), and appearance (37% strongly liked, 43% liked). Thus, this low-calorie apple pie innovation has the potential to become a diet-friendly dessert alternative that can be consumed by various groups, including diabetics, obese individuals, and those on a low-calorie diet.

## 1 INTRODUCTION

Currently, public health is not only related to infectious diseases but also to non- communicable diseases that threaten the quality of human life. Non-communicable diseases consist of several types, such as diabetes mellitus and hypertension. These diseases are caused by various factors, such as smoking, obesity, diet, and excessive sugar consumption. Obesity is a complex disease that has been on the rise over the past 40 years regardless of gender, age, or economic status. Currently, more than one-third of the population can be classified as obese (Mehrzad, 2020).

According to the 2018 Riskesdas, the prevalence of obesity among adults aged 18 years and older was 35.4% of the population, an increase of 1.9% from 2016. Obesity occurs because high carbohydrate intake produces excess glucose, which is then converted into glycerol and stored as triglycerides in adipocytes. Obesity is a complex disease that has been on the rise over the past 40 years regardless of gender, age, or economic status. Additionally, obesity is caused by an excess of energy intake compared to the energy required by the body. Excessive sugar consumption is one of the main factors contributing to the onset of diabetes. Excessive sugar consumption, particularly from sweet foods and beverages, is one of the main

factors contributing to an increased risk of both diseases.

As a result of modern developments, there have been changes in people's consumption patterns. There is a tendency to consume sweet foods frequently because many people are not yet fully aware of the need to reduce their consumption of sweet foods, even though the prevalence of metabolic diseases such as obesity and diabetes mellitus continues to increase significantly. The types of food are very diverse, and the variety of food available in society has increased with the advent of cookies, along with the increasing number of cookie products, public interest in them has also increased, including cookies, bread, and desserts. Variations of desserts include cookies, biscuits, and pies (Putri et al., 2022). Desserts are foods that are generally high in sugar, which is a major source of calories. Therefore, excessive sugar consumption can worsen health conditions. Managing calorie and sugar intake is an important step in preventing obesity and diabetes. Therefore, changes in consumption patterns are necessary in cases of obesity and diabetes, moving towards healthier consumption patterns by choosing desserts that are low in sugar and calories (Faruque et al., 2019). The consumers are mostly teenagers and children because desserts are quite sweet or high in glucose, so dessert consumption is limited, especially among the elderly, as this group has limited sugar intake. Therefore, the author created an innovative product from pastry crust using apples and natural sweeteners, so that the consumer reach of this innovative product is wide enough to be consumed by all groups.

## 2 METHOD

This research is a research and development (R&D) study that aims to develop new products by innovating Apple Pie products. This research model uses 4D (Define, Design, Develop, and Deploy). The four steps of the 4D method are:

1. Define, identify, and find basic recipes from various sources. Then, experiment until you find the best basic recipe for Apple Pie.
2. Design, create recipes for product development by adding apples and natural honey to the dough.
3. Develop: At this stage, product feasibility is assessed. The results of these tests will be used to improve the product in further research.
4. Distribution, the stage where the product development results are tested by a panel of experts through sensory testing.

additional ingredients. The ingredients for apple pie are:

Tabel 1. Standard Pie Recipe

| Bahan | Jumlah |
|---|---|
| Flour | 200 grams |
| Butter | 75 grams |
| Chicken Egg | 1 egg |
| Salt | ¼ teaspoon |
| Condensed Milk | 1 can |
| Vanila powder | ¼ sdt |
| Cornstarch | 2 Spoon |

Method:

1. First, make the pie crust.
2. Mix 200 grams of flour with 75 grams of margarine.
3. Stir gently until all ingredients are mixed.

4. Once mixed, crack one egg, add it to the mixture, and stir until smooth and well blended.
5. Prepare a container for the pie filling. Take 5 eggs and mix with 1 can of sweetened condensed milk and water.Stir the three ingredients until well combined.
6. Prepare the pie mold.
7. Take the pie crust dough and flatten it with your hands.
8. Place the filling into the pie crust base.
9. Bake for no more than 45 minutes.
10. The pie is ready to serve

Table 2. Modified Apple Pie Recipe

| Material | Sum | Function |
|---|---|---|
| Red apples | 1 piece | The main ingredient of the filling and the source of fiber |
| Honey | 1 tbsp | Natural Sweeteners |
| Wood powder sweet | 1/2 tsp | Aroma enhancer |
| Lemon Water | ½ piece | Flavor enchancer sour |
| Water | 60-100 ml | For stir-frying apple |
| Pastry Crust | 6 Sheets | Low pie crust calorie |
| Beaten eggs | 1 grain | To add colour to keemasan |

Method:

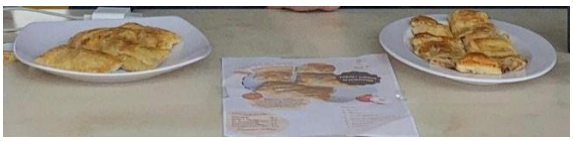
1. Peel and dice the apples into small cubes.
2. Heat a Teflon pan on the stove, then add the diced apples and enough water to the pan.
3. Add 1 tablespoon of honey, ½ teaspoon of cinnamon powder, and 1 tablespoon of lemon juice, then stir until well mixed.
4. Remove the pie filling and place it in a bowl.
5. Prepare the pastry crust, then place the pie filling into the pastry crust.
6. Brush the pastry crust with egg white.
7. Preheat the oven.
8. Set the temperature to 100-120ºC with top and bottom heat.
9. Place the apple pie dough in the preheated oven and set the temperature to 180-190 ºC for 25-30 minutes.
10. Once cooked, remove the Apple Pie from the oven.
11. Place the Apple Pie on a flat plate and it is ready to serve

# 3 RESULT

## Pie Recipes Using Sugar and Pie Recipes Using Natural Sweeteners

The standard recipe for milk pie generally uses granulated sugar as the main sweetener, resulting in a relatively high energy (calorie) content, a soft, sweet taste, and a texture that melts in the mouth. One serving of milk pie contains about 105 kcal (Siswara et al., 2023). Research conducted by (Angkih et al., 2019) shows a pie recipe with a substitution of 60% gayam flour and 40% wheat flour. The standard recipe research conducted by (Angkih et al., 2019) uses sugar as the sweetener in the pie base. The author

developed a new recipe for a healthy, low- calorie snack. This was done by replacing sugar with natural honey and adding apple juice. Honey was chosen because it has a lower glycemic index than sugar,



making it safe for consumption by diabetics. This allows everyone to enjoy apple pie as a snack.

Figure 1. Modified Apple Pie Recipe

## Energy intake of apple pie

Based on the nutritional content calculations for each apple pie ingredient, the following energy values were obtained :

Table 3. Calorie Energy Intake

| Bahan | Berat (G) | Energi (kkal) |
|---|---|---|
| Red Appel | 49 | 26 |
| Honey | 1 sdt | 14.7 |
| Lime Juice | 1 sdt | 1.7 |
| Egg | 5 | 8.6 |
| Pastry Crust | 10 | 9.3 |
| Cinnamon | 5 | 12.3 |
| Cornstarch | 3 | 11.4 |

Based on Table 3, one serving of low- calorie Apple Pie produces a total of 84 kcal of energy. The innovative Apple Pie dessert uses

49 grams of apples as the main ingredient, which produces 26 kcal of energy. The author uses apples as the main ingredient because they contain antioxidants called flavonoids, which are good for health and help you feel full longer. The sweetener used is 1 teaspoon of honey with 14.7 kcal of energy, a substitute for sugar to produce a more natural taste. Honey not only provides natural sweetness but also contains bioactive compounds that are beneficial for adding freshness and helping to balance the sweetness, with 1 teaspoon of lemon juice with 1.7 kcal of energy added. Egg wash with 8.6 kcal and puff pastry with 9.3 kcal are used to give a crispy texture. The addition of 5 grams of cinnamon with 12.3 kcal provides a distinctive aroma and the antioxidant benefits of cinnamon. Meanwhile, 3 grams of cornstarch with 11.4 kcal is used as a thickener for the apple filling to improve its consistency. The total energy content of the ingredients used is relatively low, so this product can be categorized as a diet-friendly dessert innovation. Thus, this dish can be a low-calorie dessert alternative suitable for everyone, especially those with limitations in consuming foods high in sugar and calories.

In the process of making Apple Pie, there are two cooking techniques. The first is sautéing, where apples are first cut and then sautéed with water, lemon juice, honey, cinnamon, and cornstarch solution. This process is done so that the nutritional content of the apples is not reduced during processing. Sautéing can reduce the fat content in food ingredients, making this technique suitable for the author's research on “low-calorie diet snacks” (Nguju et al., 2019).

## Hedonic Test

A subjective observation test method to assess and evaluate products that have been made to measure consumer acceptance of the product. Product assessment uses 5 parameters,

namelycolor, taste, aroma, texture, and appearance with a value scale of 1-5 as follows:

Table 4. Hedonic Apple Pie Scale Test

| Skor | Parameter | | | | |
|---|---|---|---|---|---|
| | Color | Taste | Aroma | Texture | appearance |
| 1 | No Like | No Like | No Like | No Like | No Like |
| 2 | Rather No Like | Rather No Like | Rather No Like | Rather No Like | Rather No Like |
| 3 | Rather Like | Rather Like | Rather Like | Rather Like | Rather Like |
| 4 | Like | Like | Like | Like | Like |
| 5 | Very Like | Very Like | Very Like | Very Like | Very Like |

The observation was conducted by seeking 30 respondents to evaluate the products based on the parameters of color, taste, aroma, texture, and appearance provided.

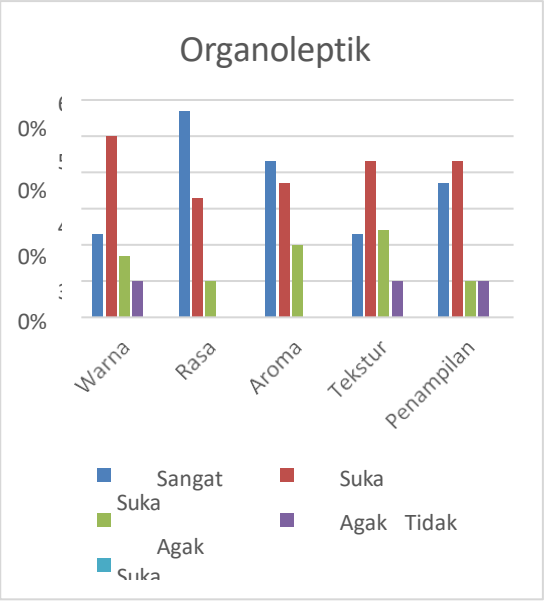



Figure 2. Organoleptic test percentage of pie

Source: Questionnaire data processed based on organoleptic test results

## Color Preference Test

Overall, 50% of respondents liked it and 23% really liked it, indicating that apple pie has a slightly golden brown color due to the Maillard reaction and caramelization that occur during baking. Egg wash contains protein, which aids the baking process. The chemical reaction produces an attractive golden brown color that appeals to respondents. Egg wash is applied before baking to enhance the color. This is in line with Hidayah & Putri (2021), who found that pies with 5% flour substitution and egg wash produced a light golden brown color that was not too dark.

## Taste Test

Taste is an important factor for consumers in determining whether a product is acceptable or unacceptable. When a product has good color, aroma, and texture but does not taste as good, consumers can easily reject the product because it is considered unfit for consumption. The taste parameter received a very high rating, with 57% of respondents liking it very much and 33% liking it. This is in line with the statement by Nguyen et al. (2020) that taste is a crucial aspect in determining the success of food products with natural sweeteners, especially as healthy snacks.

## Texture Preference Test

Texture is the sensation felt in the mouth when pressure is applied to a product (when bitten, chewed, or swallowed). The texture of apple pie also received a positive response, with 43% liking it and 23% liking it very much. The right texture, between

the crispness of the pie crust and the softness of the filling, will increase consumption satisfaction.

### Aroma Preference Test

Aroma is one of the indicators in food product evaluation. The aroma of apple pie with natural honey sweetener was also well received, with 80% of respondents rating the aroma as like or very like. According to research (Wadhani etal., 2021), aroma evaluation is a highly subjective process and is highly dependent on individual sensitivity.

### Appearance Preference Test

The appearance of apple pie gives consumers a first impression. For this product, 43% of respondents rated it as liking and 37% as very liking. This shows that appearance affects the perception of quality. Food products with natural colors and a consistently attractive appearance can significantly increase interest, especially products that are good for health and the body.

## 4 CONCLUSIONS

Research has successfully developed a low-calorie apple pie recipe with natural honey sweetener as a healthy food innovation. Replacing sugar with honey and using apples as the main ingredient results in a product with lower energy content, namely 84 kcal per serving. Organoleptic test results show high consumer acceptance in terms of color, taste, aroma, texture, and appearance. This product not only offers a delicious taste and attractive appearance but also provides health benefits. Better than regular pie Therefore, this apple pie can serve as a healthy snack alternative suitable for everyone, especially those following a low-calorie diet or individuals with diabetes.

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