MEDIC NUTRICIA
Jurnal Ilmu Kesehatan
ISSN : 3025-8855

Vol. 19 No 3 Tahun 2025
Prefix DOI 10.5455/mnj.v1i2.644

CITIES (Citrus Therapy Diabetes) Cookies: Innovation in Controlling Diabetes Potential for Adolescents with High Economic Value

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ABSTRACT

Diabetes mellitus shows a new phenomenon, namely high prevalence growth. High prevalence is due to the contribution of sufferers from adolescents. The main cause is the habit of consuming high-calorie snacks with excessive sweeteners. This study presents healthy snacks that can help adolescents control their potential for diabetes. The second objective is to design a business strategy for the production and marketing of Cities Cookies snacks. The study succeeded in producing Cities Cookies with the novelty of using naringenin (NAR). The effectiveness of cookies is two to three grains for 24-hour control. Business modeling is based on three aspects, namely product, capacity and operations. The advantages of the product, apart from the name, also include the content of ingredients that are useful as a controller of potential diabetes. Production capacity can be supported by the active involvement of adolescents. Business operations should pay attention to packaging design, cost of goods sold, marketing strategies and exploration of innovation.

Keywords: Cities Cookies, diabetes, business modeling

Article history
Received: Agustus 2025
Reviewed: Agustus 2025
Published: Agustus 2025
Plagirism checker no 234
Doi : prefix doi : 10.8734/Nutricia.v1i2.365
Copyright : Author
Publish by : Nutricia

INTRODUCTION

Diabetes Mellitus (DM) is one of the chronic non-communicable diseases and is still a major problem in the world [1]. Diabetes mellitus (DM) is categorized as a chronic metabolic disease caused by increased blood glucose (hyperglycemia) due to abnormalities in insulin secretion or due to insulin resistance [2]. The International Diabetes Federation (IDF) predicts that the prevalence of diabetes will continue to increase significantly. The main factor increasing this growth is adolescents. Diabetes will not only be suffered by the older generation, but will be suffered more by adolescents now and in the future. An unhealthy lifestyle that includes laziness to exercise, high stress and unhealthy nutritional intake are three main factors causing adolescents to experience diabetes [3].

The unhealthy lifestyle of teenagers has caused vulnerability to diabetes prevalence globally. The main factor causing this vulnerability is in nutritional intake. There are many justifications given about nutritional intake. The justifications given range from busyness to

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Vol. 19 No 3 Tahun 2025
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economic reasons. The phenomenon of adolescent vulnerability to diabetes has become a global discourse [4].

Global discourse on healthy nutrition for adolescents has been responded to with various positive actions. Nepal has implemented a Food Safety policy to protect its citizens from various disease threats. Nepal realizes that creating healthy food within the scope of national development is a consequence [5]. Canada as one of the developed countries has set regulations on healthy food. Healthy food is defined as low- calorie and unsweetened food. This regulation is set as an anticipatory step to protect citizens from the threat of chronic disease [6]. China as a country with the highest prevalence of diabetes in the world [3] has made a very strict policy on snack producers. Every snack that is circulated in the community must not only pass a health feasibility test, but must also include the safe limit for consuming the snack [7].

World Health Organization (WHO) data shows that 14.3% of adolescents aged 13-18 years experience malnutrition in Indonesia. The threats that must be faced are short-term and long-term health problems. Malnutrition in question is the consumption of unhealthy foods that cause obesity and degenerative diseases such as diabetes. Snacks or light foods are the main nutrition for adolescents in Indonesia. Snacks are not only food to delay hunger, but have become a lifestyle in adolescent relationships in Indonesia. There are many healthy snacks thathave been produced, but there are still very few that are specifically for preventing one type of degenerative disease such as diabetes [8].

This study aims to present healthy snacks that can help teenagers in controlling their potential for diabetes. Healthy snack products that specifically aim to prevent one type of disease are still very rare so that a business model is needed. A business model that ensures the sustainability of the healthy snack business.

METHOD AND EXPERIMENTAL DETAILS

The method used in this study is qualitative. The qualitative approach begins with collecting various empirical data. The first empirical data collected were scientific journals to formulate the types of diseases that are a global threat to adolescents in the world, especially in Indonesia. The discovery of the type of disease was followed up by finding the main causative factors of the disease in adolescents. Knowledge of the causative factors of the disease encourages further literature studies in an effort to find solutions. This solution will be continued to find the most appropriate formulation for the research output. The experiment in this study aims to produce snacks that can control the potential for diabetes in adolescents. The type of snack made as an experiment in this study is cookies. The description of this experiment is as follows.

1) The materials used are as follows.
   (1) Rolled Oats: 60g
   (2) Quick Oats: 30g
   (3) Powdered Stevia Sugar: 2.6g (1 pack)
   (4) Ripe Ambon Banana (*Musa acuminata*): 50- 60g
   (5) Grapefruit (*Citrus maxima*) Seed Powder: 600mg (from processed seeds)
   (6) Baking Powder: 1/4 teaspoon
   (7) Kara Coconut Oil (liquid): 1 tablespoon
   (8) Medium-sized chicken egg: 1 egg (beaten)
   (9) Plain UHT milk: 1 tablespoon
   (10) Black Raisins: 12 pieces

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2) The stages of making cookies are as follows.
   (1) Preparation of Grapefruit Seeds: Dry the grapefruit seeds for two days in the sun until dry. Bake in the oven at 1500C for five minutes. Grind the processed grapefruit seeds until 600mg of fine powder is obtained.
   (2) Oat Preparation: Roast the rolled oats on a teflon pan over low heat for five to seven minutes until they give off a fragrant aroma and look drier. Once cool, grind the rolled oats using a grinder until they become finer grains. Also grind the quick oats until they are even finer.
   (3) Oven Preparation: Preheat the oven to 1500C for five minutes before using it to bake cookies.
   (4) Mash the bananas: Mash the ripe bananas in a bowl until smooth.
   (5) Mix Dry Ingredients: In a separate bowl, combine the ground rolled oats, ground quick oats, powdered stevia sugar, and baking powder. Mix until well blended. Add 600mg of grapefruit seed powder, and mix again slowly until combined.
   (6) Mix Wet Ingredients: In a bowl containing mashed bananas, add the beaten eggs and melted coconut oil. Stir until well blended. Add plain UHT milk, stir again until mixed.
   (7) Mix the dough: Pour the wet ingredients mixture into the bowl containing the dry ingredients gradually while stirring using a spoon until all the ingredients are mixed and the dough can be shaped.
   (8) Weigh the Dough: Weigh the entire dough until it weighs about 120g.
   (9) Cookies Shape: Prepare a baking sheet lined with baking paper. Take about 10g of dough, shape into a ball, then flatten on the baking sheet. Leave space between the cookies.
   (10) Decorate with Raisins: Place one black raisin on top of each cookie, press gently.
   (11) Bake: Place the baking sheet in a preheated oven at 1500C. Bake for twenty-five minutes until the edges of the cookies look dry and brown.
   (12) Cool: Remove the pan from the oven and let the cookies cool on the pan for a few minutes until completely cool.

RESULT AND DISCUSSION

The results of the study show that the disease that is a global threat to adolescents in Indonesia is diabetes. This condition is indicated by the prevalence growth of up to 30% each year since 2021. Indonesia is ranked fifth in the world as a country with the highest prevalence of diabetes. Indonesian adolescents are a vulnerable group that needs special attention to avoid the negative impacts of diabetes [1 - 3]. The main factor causing diabetes in adolescents in Indonesia is snacks. Excessive consumption of snacks with high calorie content and containing sweeteners triggers the emergence of type 2 diabetes. Massive promotion of various snacks has caused snacks to become part of the lifestyle of adolescents in Indonesia. This condition is exacerbated by the reluctance of adolescents to exercise regularly. High stress experienced by adolescents in urban areas is also a factor that further strengthens the potential for diabetes [4,7].

The solution obtained from literacy on empirical data is to present healthy snacks. Healthy snacks that can help teenagers control the potential for diabetes due to their lifestyle. Snacks are chosen considering that this type of snack is a food that is widely favored by teenagers in Indonesia. So this healthy snack has a high economic value that can improve the welfare of its producers [8].

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The experiment of making snacks with cookies has been successfully conducted. The novelty of these cookies is the use of grapefruit seeds (Citrus maxima). The results of Scarpa's research show that grapefruit seeds contain flavonoids with a bioactive compound called naringenin (NAR). Tests conducted by Scarpa on the bioactive compounds naringenin, hesperetin, curcumin, polydatin and quercetin show that NAR has the strongest anti-diabetic content. The highest NAR levels were found in grapefruit seeds [9]. The effectiveness of cookies as a controller of diabetes potential is supported by Wang's research results. Wang stated that the most effective NAR dose for diabetes healing therapy is 50mg/DL. So if the glucose content of a diabetic patient reaches 250mg/DL, then 250mg of NAR is needed [10]. The results of the experiment produced 10 cookies so that each cookie has a content of 60mg NAR. So it can be analogized that the 10 cookies can be used to control the potential for adolescent diabetes for 3 days with a consumption proportion of two to 3 cookies per day. This calculation is based on the results of Sumakul's research which states that random blood sugar levels are less than 200mg/DL [11].

The success of this research will certainly be useless if it is not realized in real terms so that it can be enjoyed by teenagers in Indonesia. So a business strategy is needed that focuses on products, capacity and operations. This business strategy was developed from the results of Setyaningsih's research [12].

1) Product
   The products produced in this research have the following advantages.
   (1) The product name is CITIES (Citrus Therapy Diabetes) Cookies.
   The name CITIES was chosen to describe the cookies. The acronym Citrus Therapy Diabetes indicates cookies made from citrus that can be used for diabetes therapy. The name Cities, which literally means city, shows the prevalence of diabetes in adolescents is often found in urban areas. So the name also shows the target market segment.
   (2) Use natural ingredients that are rich in fiber with low glycine content.
   The use of oats as one of the main ingredients rich in fiber can function to help control blood glucose. This is because of the low glycemic content in oats.
   (3) Use of the bioactive flavonoid compound naringenin (NAR) which comes from grapefruit (Citrus maxima). NAR has been scientifically proven as a flavonoid with the strongest anti-diabetic. The use of grapefruit as a local fruit is a special attraction of this product. This orange can be easily cultivated throughout Indonesia so that NAR ingredients will not be difficult to obtain.

2) Capacity
   (1) The production process involves teenagers to create entrepreneurial skills. Making cookies that are relatively easy with materials and tools that can be learned independently will provide business opportunities for teenagers. Teenagers can independently or collectively build businesses with production standardization as done in this study.
   (2) Production capacity is determined based on the number of orders and then there will be a predictive analysis so that the amount of stock in a certain period can be determined. The size of production capacity can be adjusted to the ability of the producer. If teenagers want to be involved as producers, then collective efforts are the right choice to meet market needs in both the short and long term.

3) Operational
   (1) Designing promotional and educational packaging designs. Product packaging

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design should be a promotional and educational medium for the importance of controlling diabetes potential independently. Packaging should display the correct consumption dosage so as not to endanger the health of consumers.

(2) Determining the economic cost of goods sold according to the health benefits of cookies. Cookie products that claim to be able to control the potential for diabetes still do not use NAR. This does not mean that the pricing can be high. Consumers will be very critical of the price so the right price needs to be determined.

(3) Utilization of conventional and digital marketing strategies. Marketing strategies that prioritize the role of teenagers will be effective in marketing products that are useful for their peers. Conventional methods and the use of digital technology can be applied simultaneously.

(4) Exploration to produce CITIES Cookies innovations so that they can meet consumer tastes and needs. Exploration must be carried out continuously periodically so that market tastes do not become saturated.

CONCLUSION

This study successfully introduced Cities Cookies as a healthy snack designed to help control the risk of diabetes among adolescents. These cookies, which can be independently prepared by teenagers, demonstrate effective blood glucose regulation. Consuming two to three pieces is sufficient to maintain optimal blood glucose levels for up to 24 hours.

The right business model for Cities Cookies is to prioritize product excellence, measurable production capacity, and proper operational management. Product excellence, in addition to brand identity, encompasses the use of ingredients with proven benefits for mitigating diabetes risk. Production capacity can be strengthened through the active participation of teenagers. Furthermore, business operations should emphasize packaging design, cost efficiency, targeted marketing strategies, and continuous innovation.

ACKNOWLEDGEMENTS

The research team would like to express their gratitude to our parents who have provided moral and financial support to conduct this research. The highest appreciation to SMA Negeri 1 Tabanan for all the facilities provided so that this research can run smoothly.

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ATTACHEMENT

First attachment

Framework of Thought and Research Results