

A Pilot Study on Advantages of Prebiotic Vegetable Crisp Consumption for Health

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Abstract: Nowadays, many people including children and the public deny eating vegetables for various reasons, leading to consumption of crunchy meals such as junk food that contain high calories. Crispy vegetables (veggie chips), which are produced by a few companies, are limited in a marketplace. Meanwhile, products with prebiotics are of great interest because it helps prevent constipation. This study developed a prebiotic meal that is advantageous for health by using inulin. Inulin is a prebiotic food for probiotics or microorganisms that are beneficial to the digestive organs. Taking inulin might improve the growth of good microorganisms and reduce the number of bad microorganisms to attack the body. Moreover, probiotics can prevent infection and strengthen the immune system. This current pilot study aimed to develop a formulation of prebiotic vegetable crisps and investigate the sensory characteristics produced by the product. The selected volunteers were selected from people who deny eating vegetables with different age groups including children, adults, and the elderly. The sensory perception analysis of prebiotic vegetable crisps in this pilot study was performed with 42 volunteers. The reliability statistics showed that the Cronbach's alpha was 0.72. The results showed that 80.5% of the volunteers were satisfied with the crisp color, and 85.7% were fond of the texture. Similarly, the crisp innovation also contributed to produce less bitterness of vegetables (evaluation score: 81.0), no sweet taste (evaluation score: 76.2), less salty (evaluation score: 83.3), and high overall product acceptance (evaluation score: 90.4). The sensory perceptions from the volunteers are the main initial information in developing a healthy and prebiotic vegetable crisp in the next experiment.


1 INTRODUCTION


Inadequate consumption of vegetables may cause vitamin and mineral deficit. Fruits and vegetables contain the most important nutrients for human body. The USDA says that skipping all three meals of fruit or vegetables gives fewer chances for the body to absorb important nutrients although free radicals will be formed normally. Vitamins and minerals are


required daily by the body to avoid the risk of developing diseases. Green vegetables and fruits contain a lot of fibers that are useful for digestive systems in the body. Dietary fibers can relieve or prevent constipation, stimulating the muscles of the digestive tract and reducing pressure in the lower intestines to prevent hemorrhoids and the risk of cancer.


The American Institute for Cancer Research (AICR) released an idea that no food is one hundred

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percent protective against cancer. However, dietary fibers can reduce the risk of cancer more than any other diet. Vegetables contain antioxidants such as vitamin E, vitamin C, and carotenoids. Without fruits and vegetables, the body will hardly process calories and fat. Meanwhile, higher consumption of fruits and vegetables also decrease calories and fat, except for consuming “starch” derived from potatoes, beans, and corn. One of good dietary fiber is that morning glory is high in nutrients and contains 1.1 grams of fibers along with essential vitamins and minerals to the body, especially vitamin A, which helps nourish the eyes. In addition, spinach is found to contain 1.3 grams of fibers (NRC, 1984), low in calories, and rich in beta-carotene. Vitamin A helps maintain eyesight. It also contains substances such as flavonoids that can fight free radicals. Other than that, Chinese cabbage is high in fibers around 0.5 g that can prevent constipation. A pumpkin consists of important nutrients as many as 2.0 grams of carbohydrates and 2.4 grams of fiber (Glenn R. Gibson et al., 2010). It is also rich in beta-carotene and Vitamin E that acts as antioxidants. Potatoes are nutritious vegetables as well, containing 19.1 grams of carbohydrates and 0.4 grams of fibers per 100 grams. These vegetables contain important minerals such as potassium and magnesium, which help lower blood pressure and prevent constipation (Glenn R. Gibson et al., 2004). Since potatoes are gluten-free, it is suitable for people with intolerance to plant proteins or gluten. All these vegetables can be eaten by children and people alike. In addition, these vegetables are also used for cooking and become a source of nutrients that are beneficial to health.

Prebiotics are a group of nutrients that are non-digestible in the human body but are degraded by gut microbiota. It provides health benefits for the host microbiota. The relationship between prebiotics and human overall health has received an interest in recent years. Prebiotics can be a source of food for the intestinal microbiota, and their degradation products are short-chain fatty acids that are released into blood circulation, consequently, affecting not only the gastrointestinal tracts but also other distant organs (Davani-Davari et al., 2019). Dietary prebiotics are typically non-digestible fiber compounds that are digested through the upper part of the gastrointestinal tract and stimulate the growth or activity of advantageous bacteria in the colon by acting as substrates for them (Glenn R. Gibson et al., 2017). Prebiotics were first identified and named by Marcel Roberfroid in 1995 (Hutkins et al., 2016). Depending on the purposes, they may be categorized as food additives for

marketing purposes. Common prebiotics used in food manufacturing include beta-glucan from oats and inulin from chicory roots (G. R. Gibson & Roberfroid, 1995).

Therefore, this study aimed to develop and analyze the sensory perception of prebiotic vegetable crisps containing high fibers with no trans fats and no sugars for a novel alternative snack for children and those who like to eat crunchy healthy snacks.

Research Questions. What are prebiotic vegetable crisps for health?

Objectives. To collect data on healthy food, this study investigated the advantages of consuming prebiotic vegetable crisps for health.

2 METHOD

This pilot study was one part of the research and becomes an initial way to develop alternatives or new methods of making prebiotic vegetable crisps. It formulates the development of innovative products for healthy food, crispy vegetables, and prebiotic supplements. The populations were children, adults, and the elderly who deny eating vegetables. The samples were randomly selected.

2.1 Method of Data Collection

1. A product prototype of veggie crisps was made by the Faculty of Applied Sciences. Faculty of Nursing put it to the test and find out the causes and needs of vegetable consumption among various age groups.
2. Selection of the binder to form the vegetable crisp package varied based on two groups. 1.) Group 1 instant starch is tapioca starch, rice starch, corn starch, and mixed starch (cassava starch, rice starch, corn starch, and mixed starch with a ratio of 1:1:3), and the amount of starch type was adjusted. 2.) The second group consists of pumpkin, potato, and taro by varying the ratio of tuberous plants to 1:1, 1:2, and 2:1 by weight.
3. Recipe development and cooking prebiotics with vegetables varied based on the changing ratio of the binder as specified in item 1.
4. Properties of vegetable crisps in all conditions (recipe) were analyzed by studying the effect of appearance, color values L, a*, b* by a colorimeter. Crunchiness and texture analyses were performed by a texture analyzer, and a taste

sensibility test was performed by 42 quasi-trained subjects (5-point scoring test).

5. Appropriate formulas were selected to analyze the crunchiness, texture, and acceptance of vegetable crisps statistically using response surface methodology based on color values.
6. Test the sensory acceptance in terms of taste and product characteristics from the sample group of Saint Louis Hospital.

2.2 Data Analyses

Quantitative Data Analysis. Descriptive analysis was used to identify demographic characteristics along with the frequency and the percentage of the frequency.

2.3 Ethics and Consent

Participants were given information about the objective, the method, and the benefits of this study. Written consent forms were obtained before conducting interviews with all participants. The participants actively gave information about health and the healthcare system without posing any harms to them. If participants feel inconvenient with the questions, then they could say “I don’t want to answer this aspect”.

3 RESULTS

3.1 Demographic Characteristics

This section describes the sample characteristics in frequency and percentage. The results showed the volunteers were 7.1% of males and 92.9% of females. Most of the age group in the sample was 21-30 years (31 %), and most of the people held bachelor’s degrees (54.8%). The occupations of the volunteers were mostly private company officers, housewives, and teachers (16.7%). The volunteers obtained under 10,000 baths per month (57.1%). About 57.1% of the volunteers never had vegetable crisps before. A halal of the volunteers intended to buy the product (50%) if the price <50baht; 31% wanted to do the same if the price was between 50-79 baht. Around 14.3% of the volunteers wanted to buy the product if the price was between 80-119 baht; 2.4% of the volunteers wanted to buy the product if the price was between 120-150baht, and 2.4% were also interested to buy the product if the price was <200 baht. Most of the volunteers prefer to buy this product in the future (88.1%).

3.2 The Quality of Product Testing

Table 1.

Items	Level of perception		
	Less	Moderate	High
Color of the product	-	16.7% (7)	83.3% (35)
Color of package	-	19.0% (8)	80.9% (34)
Texture of product	-	14.3% (6)	85.7% (36)
Strong vegetable odor	81.0% (34)	16.7% (7)	2.4% (1)
Bitter taste	81.0% (34)	16.7% (7)	2.4% (1)
Sweet taste	76.2% (32)	19% (8)	4.8% (2)
Salt taste	83.3% (35)	14.3(6)	2.4% (1)
Overview of product	2.4% (1)	7.1% (3)	90.4% (38)
Appreciating the product	-	7.1% (3)	92.8% (39)
Loving vegetables with prebiotics	4.8% (2)	16.7% (7)	78.6% (33)

4 DISCUSSION AND RECOMMENDATION

The results found that the color of the product, the color of the package, and the texture of the product were still highly considered of the product. However, a qualitative report mentions that some of the volunteers said the meals were not crispy. The customers’ feedback indicates a further need for product development focused on the product texture. The absence of vegetable consumption was found in different age groups, and this trend was the highest in the older group. Similarly, Kwon et al. (2020) mentioned that the consumption of unsalted/non-starchy fruits and vegetables is less likely found among people who eat 480.96 g/day of snacks. The World Health Organization recommends plant-based diet sample. The World Cancer Research Fund (WCRF) demands that dietary fiber levels are greater than plant-based dietary standards (greater than 400 g/day of unsalted/no-starch fruit and vegetable intake). Around 47% of the volunteers were elderly population. This suggests that additional basic strategies are necessary to increase the consumption of fruit and vegetable among elderly. In addition, the current results are expected to provide the basis for developing educational programs to improve

elderly's dietary habits. Moreover, probiotics and prebiotics provide various health benefits to the host microbiota and are emerging as promising treatments for many diseases (Wu & Chiou, 2021). Both types of supplements have the potential to reduce the risk of cardiovascular diseases by improving levels of cardiovascular markers such as total low-density lipoprotein (LDL) cholesterol, high-sensitivity C-reactive protein (hs-CRP) and certain cytokines involved in the inflammatory response. The preventive effects of probiotics and prebiotics can be seen from balanced structural and functional changes in the intestinal microflora and maintained immune homeostasis. Future research can choose a variety of alternative food and snacks used by many people who deny eating vegetables. In addition, future research can investigate texture and nutrients of veggie crisps in-depth for health.

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