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Developing Healthy Ice Cream Products by Supplementing Vetiver Root and Using Stevia Extract Instead of Sugar

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Abstract:

Objectives: The objectives of this study were: 1. To study ice cream consumption behavior of Thai consumers in Bangkok 2. To develop healthy ice cream products by supplementing vetiver root and using stevia extract instead of sugar and 3. To analyze the chemical, physical and sensory quality of healthy ice cream by supplementing vetiver root and using stevia extract instead of the sugar produced compared to the base formulation.

Methods: From the study of the quantification of the roots of vetiver grass and stevia extract suitable for ice cream production. The experimental planning was carried out using CRD (Completely Randomized Design) method with 4 levels of herbal content, i.e. 10%, 20, 30 and 40, respectively.

Results: The analysis of chemical quality and physical properties revealed that formula D had the highest pH value of 4.30, the highest viscosity was 41.50, and the highest rise was 35.25, and the melting rate was 35.25.

Conclusion: The melting rate was the highest, whereas the ice cream formula D had the lowest melting rate. From the results of color characteristics analysis, it was found that formula A had the highest brightness. Controlled ice cream has the highest protein and fat content and the content of dietary fiber in formula D ice cream was the most. The sensory quality of the 9-Point Hedonic sensory samples showed that the color aspect was the most acceptable to the formula B, the smell aspect, the sweetness aspect, the texture aspect. Melt in the mouth and collective preference Formula D is most accepted.

Keywords: healthy ice cream, vetiver root, stevia, sugar

1. INTRODUCTION

At present, the growth of the snack restaurant business includes coffee shops, beverages, and buns and ice cream desserts. especially the ice cream business is becoming more popular When it comes to desserts, many people will think of ice cream. because of the diversity have a novelty and there are always many flavors to choose from. The change in hot weather has also resulted in consumers increasingly wanting to eat ice cream. because ice cream looks cool When eaten, it will add freshness to the body. In addition, the behavior of Thai people will always have a habit of eating dessert after a meal. As a result, ice cream has become another choice that consumers are interested in choosing to eat [1].

"Ice cream" is a type of food that looks like a sweet food. The composition of ice cream consists of milk products, cream, butter fat, nonfat milk powder or milk mixed with Sugar and flavor enhancers, egg products are added and stabilizers with, when mixed, must be disinfected with microorganisms by heat before being blended for packing and freezing. Currently, ice cream has been made widely up to industrialization. There is competition in terms of quality to improve the different flavors to make it more

modern have a smoother texture. It can be concluded that the physical structure of ice cream is physicochemical System Air cells dispersed in the liquid that surrounds the ice crystals. The liquid contains Solid fat granules, milk proteins, sugar crystals, lactose, sugar and microscopic stabilizers in colloidal state.

For the origin of ice cream in Thailand Beginning in the reign of King Rama 5, His Highness Prince Damrong Rajanupap recorded in a book of memories after his visit to Singapore in 1871 that *"Ice cream was a wonderful thing at that time because I just got a small ice machine that we made in foreign countries to come to Thailand do some days the water is frozen. Some days the water is not frozen. There is ice cream from the machine from some days. Therefore, seen as a wonderful thing*" As this saying goes, it shows that making ice cream must be accompanied by ice. According to Anek Navikmol's research, *"the first ice was brought in from Singapore. and later an ice factory was set up for sale after 1889"* [2].

Most of today's milk ice cream consists of milk fat Non-fat milk content (MSNF), sugar, stabilizers and emulsifier. There will be different amounts of such substances according to suitability and needs. The ingredients that are important in making ice cream are: The fat part and MSNF due to these substances greatly affect the quality of the ice cream. In general, ingredients can be divided into two groups: part 1, which is made from dairy products, and part 2, which will be non-dairy by ingredients made from dairy products very important. Because it can be considered as a basic ingredient for making ice cream [3]. However, ice cream can be considered a sweet food. and high amounts of saturated fat which from the amount of sweetness and high fat Making ice cream is the cause of the increase in sugar levels and cholesterol in the blood as a result, people who eat large quantities of diabetes, Fat in blood, obesity and the risk of heart disease including diabetes. At present, diabetes is regarded as a major public health problem in every country, including Thailand. The prevalence rate of diabetes is increasing. According to the World Health Organization's 2012 Global Health Statistics Report, 1 in 10 people are in their adulthood have had diabetes mellitus, including 1 in 3 had high blood pressure. Later in 2014, the International Diabetes Federation (IDF) estimated the number of people with diabetes in the world. There will be an increase of 372 million people with diabetes worldwide which at present found More than 361 million people are at high risk. In addition, it is estimated that by 2030 there will be 766 million people living with diabetes worldwide. Most of which are in the group of developing countries and Asian countries.

From such a situation as a result, people are now more interested in health care. Products are developed to meet the needs of customers who want to take care of their health. living in today's society Consumers are more interested in health care and love. Health is a picture of happiness. The happiness that comes from eating foods that are beneficial to the body and mind, complete health of the body having good quality. It is what all human beings seek as the foundation of longevity. In addition, nowadays consumers are more concerned about their health. and choosing more foods to eat, for example, wanting to adjust to the consumption of green leafy vegetables by reducing their meat intake, 76% of them opted for plant-based protein instead of meat, such as vegetables, fruit or nuts, and 55% showed that a plant-based protein diet was less which has more nutritional value than animal protein.

The information is consistent with information from UBM Asia (Thailand) Co., Ltd., an operator of business and trade shows which revealed that currently, food trends in 2018 show that Modern consumers have a demand for health products nutritious. Today's consumers are middle-income to high-income earners.

Willing to pay higher prices for quality products anymore especially the middle-income consumer group because due to the analysis of the quality of the product rather than the price and will decide to buy products that have a production process that is more sustainable and environmentally friendly. Of course, this will result in the future of food and beverage products that will come out with a focus on health promotion. For the ice cream market Ice cream has been developed to meet the needs of consumers who are more health-conscious. Therefore, manufacturers have used herbs such as okra, jujube, Chinese, lemongrass and ginger as ingredients in ice cream [4] because the main ingredients of various ice creams contain high amounts of fat and sugar, which when eaten in excess. Necessity will accumulate in the body causing various diseases to follow as well.

Therefore, it is important to avoid foods high in fat and sugar in reducing the risk. Therefore, the researcher is interested in studying ice cream consumption behavior and developing healthy ice cream products by supplementing vetiver root and using stevia extract instead of sugar. Vetiver, commonly known as Vetiver glass, is a biennial plant. Classified in the grass family, like rice, sorghum and lemongrass, there are 2 types in Thailand, namely vetiver grass or vetiver and vetiver grass [5]. The chemical composition of vetiver plants and roots showed that vetiver plants and leaves contained nitrogen, phosphorus, potassium, calcium and magnesium. The percentage of dry weight was 0.811, 0.170, 1.583, 0.142 and 0.123, respectively, while the amount of vetiver root was 0.356, 0.113, 0.459, 0.055 and 0.018 [6]. Vetiver root or vetiver has properties to help cure neurosis, help nourish the blood, help relieve abdominal pain, help relieve abdominal pain. The smell of the roots has properties. Vetiver root contains essential oils, Vetiver oil, helps to sleep and relax [7]. For stevia One of the most popular sources of sweetness today, stevia, also known as "stevia" (Stevia), is certified by the US Food and Drug Administration (USFDA) to be 250- sweeter than sugar. 300 times the sweetness without calories and does not affect the amount of sugar in the body does not accumulate in the body. Therefore, suitable for those who control weight or diabetic patients. Stevia is resistant to acid and heat not decomposed by microorganisms and does not cause a brown reaction when subjected to high heat. It is used in the production of many types of food or beverages.

From the properties of the root of the vetiver group or fragrant vetiver and said sweet grandmother. Therefore, the researcher had an idea to use the root of fragrant vetiver and added stevia in ice cream to make ice cream products have more benefits and there is a novelty with ice cream products which is another option for consumers. It also increases income for farmers who grow a group of vetiver or fragrant vetiver and know how to process vetiver grass or vetiver to create new products. It is considered as one way to change food consumption habits to consume more healthy food, so as to receive proper nutrition which will help prevent and avoid various diseases followed by many and as a supplement to get nutrients in addition to the main dish as well.

MATERIAL AND METHODS

1. Viscosity measurement Measure the viscosity of the ice cream mixture that has been cured at a temperature of 4 - 8 °C with a volume of 600 ml. The viscosity was measured with a Brookfield viscometer using a spindle number 2 with a speed of 100 rpm.

2. Measurement of pH (pH) is taken before the mixture is incubated. Measure the pH with a pH meter.

3. Measure the rise value (overrun) measure the rise value Measured using Arbuckle's (1986) method, the ice cream was weighed in a known weight cup. Liquid ice cream weight record and when

frozen with an ice cream maker until solid Scoop the ice cream in the original plastic cup weigh again. The swell value can be obtained from the following equation.

$$\text{Rising value (percent)} = \frac{(\text{weight of liquid ice cream} - \text{weight of ice cream}) \times 100}{\text{ice cream weight}}$$

4. Texture measurement with Texture Analyzer using cylinder probe diameter 1 cm, height 5.5 cm, using 1kN load cell, speed test 2 mm/s to measure hardness.
5. Color measurement. Color measurement L* a* b* by Spectrophotometer. A Day light 65 display source was used. The measurement angle was 10º. Measurements were taken before and after freezing with an ice cream maker.
6. Melt-down rate Measurement Melt-down rate method of ice cream modified from the method of Rosalina et al. (2004) by first measuring at a controlled temperature (25°C). analysis. The ice cream sample is subjected to a freeze at -20°C for 24 h. A 30 g ice cream is placed on a filter funnel supported by a measuring cylinder. Measure the volume of ice cream dripping into the measuring cylinder every 10 minutes until the ice cream has completely melted.
7. Microbiological Quality Analysis of Herbal Ice Cream Perform microbial quality checks, including checking for total microbial counts in ice cream products.
8. Sensory Quality Analysis of Herbal Ice Cream Sensory quality analysis of ice cream by a 1 to 9 score of liking tests (9-Point Hedonic Scale) on sensory attributes in terms of appearance, color, smell, taste and overall liking. by using a questionnaire with 30 general consumers to find the average liking score from the quality factors determined in the test by the sensory quality assessment form Sensory acceptance was assessed using a 9-Point Hedonic Scale (Randomized Complete Block Design (RCBD) and Duncan's New Multiple Range Test (DMRT) statistical difference at 0.05 confidence level). By using a questionnaire with 30 general consumers to find the average liking score from the quality factors determined in the test by the sensory quality assessment form Sensory acceptance was assessed using a 9-Point Hedonic Scale (Randomized Complete Block Design (RCBD) and Duncan's New Multiple Range Test (DMRT) statistical difference at 0.05 confidence level).

2. RESULTS

Developing healthy ice cream products by supplementing vetiver root and using stevia extract instead of sugar quantification of vetiver grass roots and stevia extract suitable for ice cream production. The experimental planning was carried out using CRD (Completely Randomized Design) method with 4 levels of herbal content, i.e. 10%, 20, 30 and 40, respectively.

Analysis of chemical quality and physical properties of healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar.

Table 1: Physical properties of ice cream, formulas A, B, C and D (mean ± standard deviation).

No.	pH	cp	overrun	Dissolution rate (percent)
A	$4.15^{ab} \pm 0.21$	$17.75^{d} \pm 0.35$	$8.48^{d} \pm 2.07$	$7.88^{cd} \pm 0.77$
B	$3.90^{b} \pm 0.00$	$20.00^{c} \pm 0.00$	$23.22^{c} \pm 2.90$	$6.18^{d} \pm 1.10$

C	$4.05^{ab} \pm 0.07$	$33.00^{b} \pm 0.00$	$27.28^{b} \pm 1.74$	$4.98^{a} \pm 0.32$
D	$4.30^{a} \pm 0.14$	$41.50^{a} \pm 0.70$	$35.25^{a} \pm 2.74$	$4.31^{a} \pm 0.63$

It was found that when considering the pH, formula D ice cream with vetiver root content and 40% stevia extract had the highest pH value, which was 4.30, followed by Formula A, Formula C and Formula B, respectively and 40% of stevia extracts had the highest toughness value, 41.50, followed by formula C, formula B, and formula A, respectively. As for the raising, it was found that Formula D had the highest swell value, 35.25, followed by. These are formula C, formula B, and formula A, respectively. By studying the melt-down rate of healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar, it was found that the formula with the highest melting rate A was followed by BC ice cream. and D, respectively, while formula D had the lowest melting rate. Because the formula D ice cream has the highest viscosity. The high content of vetiver root and stevia extract results in a slower melting rate of ice cream.

Table 2: Color characteristics of ice cream Before and after freezing

Color characteristics	**Color characteristics**			
	A	**B**	**C**	**D**
Before freezing				
L*	12.88^{a}	11.44^{b}	10.50^{c}	9.58^{d}
a*	8.07^{d}	10.33^{c}	11.58^{b}	12.54^{a}
b*	0.05^{a}	1.90^{c}	2.70^{b}	4.48^{a}
After freezing				
L*	42.19^{a}	36.84^{b}	32.31^{c}	28.75^{c}
a*	16.58^{c}	17.86^{c}	19.83^{b}	23.69^{a}
b*	5.96^{d}	7.46^{c}	10.07^{b}	11.83^{a}

Note: a-d means there is a statistically significant difference.

The L* value indicates brightness from 0 to 100.

(+a*) represents the red value (-a*) represents the green value.

(+b*) represents the yellow value (-b*) represents the blue value.

According to the results of color characteristics analysis of healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar, it was found that formula A had the highest brightness of 12.88, followed by formula BC and D. Sequence, formula D ice cream has a red color. and the most yellowness were 12.54 and 4.48, respectively. An ice cream formula with a high content of vetiver root and stevia extract has a high red and yellow hue but has low brightness. Ice cream after blending, every recipe has a brightness value redness and higher yellow because the air entering the ice cream changes the refraction of light.

Chemical Characteristics

Table 3: Show the chemical composition of controlled ice cream and healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar.

Chemical Characteristics	**Controlled ice cream**	**A**	**B**	**C**	**D**

Protein (grams)	2.72	2.16	2.04	2.01	1.96
Fat (grams)	5.33	5.27	5.25	5.17	5.03
Dietary fiber (grams)	0.54	1.23	1.45	1.56	1.74

The analysis for protein, fat and fiber compared with the control formula ice cream found that the protein content of the control formula ice cream was the highest, which was 2.72 g, followed by Healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar, formula A, B, C and D respectively. The fat content of ice cream in the control formula had the highest amount, which was 5.33 grams, followed by Healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar formula A, B, C and D, respectively. Dietary fiber content of formula D ice cream was 1.74 g, followed by formula C, B and A, respectively. When used to calculate nutrients in the amount of one serving or 80 grams according to the criteria in the Notification of the Ministry of Public Health (No. 182) B.E. 2541 Re: Nutrition Labeling. (Ministry of Health, 1998) is found to be low in energy and low in fat. Meet guidelines for nutritional claims on food nutrition labels. (Ministry of Public Health, 1998).

Assess the organoleptic quality of healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar.

Table 4: Sensory tests of ice cream formulas A, B, C and D (mean ± standard deviation).

Sensory tests	A	B	C	D
Color	$7.2^{ab} \pm 0.98$	$7.40^{a} \pm 0.97$	$6.93^{b} \pm 1.02$	$6.91^{b} \pm 1.07$
Smell	$7.06^{b} \pm 1.20$	$7.16^{ab} \pm 1.15$	$7.28^{ab} \pm 1.00$	$7.53^{a} \pm 1.08$
Sweetness	$6.60^{c} \pm 1.02$	$6.78^{c} \pm 1.04$	$7.23^{b} \pm 1.16$	$7.78^{a} \pm 1.12$
Texture	$6.38^{d} \pm 1.19$	$6.83^{c} \pm 1.13$	$7.50^{b} \pm 0.98$	$7.98^{a} \pm 1.01$
Melt in the mouth	$7.63^{a} \pm 7.75$	$6.95^{a} \pm 1.19$	$7.65^{a} \pm 1.00$	$8.00^{a} \pm 0.99$
Collective preference	$6.68^{d} \pm 1.08$	$7.08^{c} \pm 0.99$	$7.58^{b} \pm 0.86$	$8.06^{a} \pm 0.97$

Note: a,b,c,d different characters in the same horizontal line mean that there is a statistically significant difference ($p<0.05$).

Sensory quality of product tasting samples Sensory acceptance was assessed using a 9-Point Hedonic Scale method using a Randomized Complete Block Design (RCBD) trial. By using 30 testers, the data was analyzed for the sensory quality assessment. by using the results of the sensory quality assessment, the statistical difference was analyzed by Duncan's New Multiple Range Test (DMRT) at a confidence level of 0.05. It was found that on the color side, 30 test subjects had the highest acceptance of formula B, which was 7.40, followed by formulas AC and D accordingly number. In terms of odor, 30 test subjects were the most accepted of Formula D, 7.53, followed by C B and A, respectively. On the sweetness side, 30 testers were the most accepted of Formula D, 7.78, followed by CB and Formula A, respectively, on the texture Thirty test subjects had the highest acceptance of Formula D, which was 7.98, followed by Formula C, B and A, respectively. In terms of solubility in the mouth, 30 test subjects

had the highest acceptance of formula D, which was 8.00, followed by formula C, A and B, respectively. Thirty test subjects had the highest acceptance of Formula D, which was 8.06, followed by Formula C, B and A, respectively.

3. DISCUSSION

The researcher developed a healthy ice cream product by supplementing vetiver root and using stevia extract instead of sugar. quantification of vetiver grass roots and stevia extract suitable for ice cream production the experimental planning was carried out using CRD (Completely Randomized Design) method with 4 levels of herbal content, i.e. 10%, 20, 30, and 40%, respectively. and 40% stevia extract had the highest pH value, which was 4.30, followed by Formula A, Formula C and Formula B, respectively. The viscosity (cp) found that formula D ice cream with vetiver root content and 40% of stevia extracts had the highest toughness value, 41.50, followed by formula C, formula B, and formula A, respectively. As for the raising, it was found that Formula D had the highest swell value, 35.25, followed by. They were formula C, formula B and formula A, respectively by studying the melt-down rate of healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar, it was found that ice cream formula with the highest solubility A, followed by ice cream formula BC and D, respectively. The ice cream formula D had the lowest melting rate. Because the formula D ice cream has the highest viscosity. The high content of vetiver root and stevia extract results in a slower melting rate of ice cream. According to the results of color characteristics analysis of healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar, it was found that formula A had the highest brightness of 12.88, followed by formula BC and D. Sequence, formula D ice cream has a red color and the most yellowness were 12.54 and 4.48, respectively. An ice cream formula with a high content of vetiver root and stevia extract has a high red and yellow hue but has low brightness Ice cream after blending, every recipe has a brightness value redness and higher yellow because the air entering the ice cream changes the refraction of light. The analysis of protein, fat and fiber compared with the control formula ice cream showed that the protein content of the control formula ice cream was the highest at 2.72 g, followed by Healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar, formula A, B, C and D, respectively. The highest fat content of ice cream in the control formula was 5.33 g, followed by Healthy ice cream by supplementing vetiver root and using stevia extract instead of sugar, formula A, B, C and D respectively. Dietary fiber content in formula D ice cream was 1.74 g, followed by formula C, B and A, respectively using stevia extract in fresh coconut milk pudding, it was found that the chemical composition of the product, namely moisture, protein, fat ash, coarse fiber and carbohydrate, was 84.04%, 4.04, 2.78, 0.37, 0.40 and 8.43, respectively, with energy of 74.90 kg. Calories per 100g of sample also had a 16.62% reduction in energy from the control formula. Corresponding to the research of Nuntawan Chaweewan conducted a study on Sesbania ice cream product development found that the product development of Sesbania flower ice cream is one way to get new products that have good nutritional value for health especially dietary fiber from the use of Sesbania flowers as well as adding value to local vegetables and being able to increase choices for more health-conscious consumers [3]. In addition, 30 subjects were the most accepting of formula B, 7.40, followed by A C and D, respectively. In terms of odor, 30 testers were the most accepted of Formula D, 7.53, followed by C B and A. In terms of sweetness, 30 subjects had the most acceptance of formula D, 7.78, followed by CB and A,

respectively. Texture Of the 30 test subjects, formula D was the most acceptable, formula D was 7.98, followed by formula CB and A, respectively. In terms of solubility in the mouth, 30 test subjects were the most accepting of Formula D, 8.00, followed by C A and Formula. B respectively in terms of overall preference Thirty test subjects had the highest acceptance of Formula D, which was 8.06, followed by Formula C, B and A, respectively. This study could be used to develop healthy ice cream by supplementing with vetiver root and using stevia extract instead of sugar with appropriate amount of vetiver root and stevia extract. to increase choice for consumers.

4. CONCLUSION

Nowadays, people are increasingly interested in health care. Products are developed to meet the needs of customers who want to take care of their health. by living in today's society Consumers are more interested in health care and love. Health is a picture of happiness. The happiness that comes from eating foods that are beneficial to the body and mind. complete health of the body having good quality It is what all human beings seek as the foundation of longevity. and choose food to eat more, for example, want to adjust the consumption of green leafy vegetables By reducing their meat intake, 76% would choose plant-based protein instead of meat. Such as vegetables, fruit or nuts, and another 55% showed that a diet of plant-based protein which has more nutritional value than animal protein. Food trends in 2018 now show that Modern consumers have a demand for health products. nutritious Today's consumers are middle-income to high-income earners. Willing to pay higher prices for quality products anymore.Especially the middle-income consumer group because due to the analysis of the quality of the product rather than the price and will decide to buy products that have a production process that is more sustainable and environmentally friendly Of course, this will result in the future of food and beverage products that will come out with a focus on health promotion. for the ice cream market Ice cream has been developed to meet the needs of consumers who are more health-conscious. Therefore, manufacturers have used herbs such as okra, jujube, Chinese, lemongrass and ginger as ingredients in ice cream because the main ingredients of various ice creams are high in fat and sugar content, which when eaten more than necessary. will accumulate in the body causing various diseases can follow as well and healthy ice cream development by reducing the amount of fat and sugar and using sweeteners fat substitute and stabilizers in formulation development. It helps to make the product more quality, i.e. the ice cream is more stable and slows down the melting have a good texture. Make consumers more accepting of the product making it possible to further develop products in trade. Other types of Thai fruits with large yields, cheap prices and a unique flavor can be used to make ice cream together with vetiver root and use stevia extract instead of sugar. May be used in juice form or fruit pulp to be beaten in the process of blending ice cream to help solids and give the smell and color of nature and add more appetizing.

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