Development Of Flower Tea Ice Cream

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(Mrs. Roungdao Klinjapo)

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Finally, my sincere and deepest gratitude in extended to my parents for their infinite love, support and inspiration.

Abstract

Flower tea ice cream was developed and formulated. Flower tea ice cream formula composted of fresh milk 500 ml, cream 250 ml, sugar 120 g, 2 egg yolks, and flower tea. Three types of flower tea were rose tea, lavender tea and Chrysanthemum tea. Rose tea and Chrysanthemum tea were varied at 2, 3, 4, and 5 g, while lavender tea was varied at 0.5, 1.0, 1.5, and 2.0 g. As the results, rose tea at 5 g, chrysanthemum tea at 3 g, and lavender tea at 0.5 g were the suitable amount for the ice cream production. Then, the consumer preference test showed the best formula was Chrysanthemum tea at 5 g because of the highest score of preference (60 %). Flavor profile of Chrysanthemum tea ice cream were conducted as tea flavor, sweet flavor, Chrysanthemum flavor, milky, creamy, and bitter aftertaste. Average sensory intensity of tea flavor, sweet flavor, Chrysanthemum flavor, milky, creamy, and bitter aftertaste were 10, 9, 14, 9, 12, and 4, respectively. Chrysanthemum tea ice cream had 22.8 % overrun and 74 % consumer acceptance. There was also a potential market because 92 % consumers will/might buy the product 15 baht/ 55 g packing size while the production cost was approximately 8 baht per 55 g of ice cream.

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INTRODUCTION

The creation of iced desserts, by mixing snow with fruit and fruit juices, is an ancient culinary practice. This product probably originated in China. Iced desserts appear to have been introduced to Europe in the late 13th century. But over 500 years were made only as novelties. Larger-scale manufacture and sale in restaurants began in the 19th century with the invention of a hand-operated ice cream maker. Wholesale manufacture began in 1851 after which the industrial expanded rapidly.

Ice cream comprises a number of related products, which primarily differ in the relative quantities of ingredients rather than in manufacturing technology. Ice cream is a commercial dairy food made by freezing while stirring a pasteurized mix of suitable ingredients. It is the most popular sweet frozen dessert in many countries. The product may include milk fat, nonfat milk solids, or milk-derived ingredients. Other ingredients may include corn syrup, water, flavoring, egg products, stabilizers, emulsifiers, and other non-milk-derived ingredients. Air incorporated during the freezing process is also an important step to increase the volume and provide the characteristic of the product.

The composition of ice cream may vary depending on whether it is an economy brand satisfying minimal requirements, a trade brand of average composition, or a premium brand of superior composition. Traditionally, a commercial regular ice cream should contain minimum 10 – 16% of fat and 18 – 27% of sugar. The caloric value of ice cream is about 9.61 to 11 kJ/g. This made the ice cream as a high calorie product. Recently, the components by weight of an average-composition ice cream are 12 % fat, 11 % nonfat milk solids, 15 % sugar, and 0.3 % vegetable gum stabilizer. According to UK regulations, ice cream should be contained not less than 5 % fat and 7 % other milk solids; according to US regulations, 10 % milk fat and 20 % other milk solids.

The 1970s saw the development of gourmet ice cream manufacturers with an emphasis on natural ingredients. Ice cream flavors have come a long way from the standard vanilla, strawberry, and chocolate. By the 1970s, the International Association of Ice Cream Manufacturers had recorded over 400 different flavors of ice cream. In an ever-expanding array of combinations, fruit purees and extracts, cocoa powder, nuts, cookie pieces, and cookie dough are blended into the ice cream mixture.

Tea is very popular drink in many countries; there are the interests to develop tea ice cream to provide the new choices for the ice cream market. Not only provide the new choice of health concerning but tea also is recognized as the exotic flavor of Asia because tea drinking has evolved into a very delicate art in some Asian countries, especially China, Japan, and India. Proposed health uses for tea include protective effects against cancer and heart disease. Some promote green tea for weight loss.

Flower Tea is a simple concept where dried flowers are used, without much processing, to make tea. It is one of the herbal tea varieties. Flower Tea has light to medium flavor and medium to strong aroma. The rich aroma of the flower and the brisk taste of the tea make the beverage a work of art. They are claimed for their health benefits depending on the species of flower. The examples of popular flower tea in the market are rose tea, chamomile tea, lavender tea, chrysanthemum tea, jasmine tea, etc. Therefore, the aims of this study are to choose the proper flower tea to make ice cream and to formulate the new flavor for milk-based ice cream.

OBJECTIVES

1. To formulate flower tea ice cream
2. To study the effect of flower tea variation on ice cream production
3. To study the consumer acceptance of flower tea ice cream

LITERATURE REVIEW

I. ICE CREAM

Ice cream or ice-cream is a sweet frozen dessert usually made from dairy products, such as milk and cream, combined with sugar, flavoring, stabilizer, and sometimes eggs, fruits, or nuts. The broad guidelines allow producers to use ingredients ranging from sweet cream to nonfat dry milk, cane sugar to corn-syrup solids, fresh eggs to powdered eggs. However, the federal regulations do stipulate that each package of ice cream must contain at least 10% butterfat. This mixture is stirred slowly while cooling to prevent large ice crystals forming; the result is a smoothly textured ice cream.

The meaning of the term ice cream varies from one country to another. Terms like frozen custard, frozen yogurt, sorbet, gelato and others are used to distinguish different varieties and styles. In some countries, like the USA, the term ice cream applies only to a specific variety, and their governments regulate the commercial use of all these terms based on quantities of ingredients. In others, like Italy and Argentina, one word is used for all the variants. Alternatives made from soy milk, rice milk, and goat milk is available to those who are unable to tolerate traditional ice cream due to lactose intolerance or allergy to dairy protein.

1. History of ice cream (cream)

The origins of ice cream can be traced back to at least the 4th century B.C. Early references include the Roman emperor Nero (A.D. 37-68) who ordered ice to be brought from the mountains and combined with fruit toppings, and King Tang (A.D. 618-97) of Shang, China who had a method of creating ice and milk concoctions. Ice cream was likely brought from China back to Europe. Over time, recipes for ices, sherbets, and milk ices evolved and served in the fashionable Italian and French royal courts. (3)

Ice cream is often called "The Great American Dessert". Although the product is typically American, the U.S. cannot claim its origin. Very little is known of the early history of ice cream; however, the product is definitely known to have been introduced from Europe. The ice cream industry as we know it today however was wholly developed in the United States.

Ice cream undoubtedly evolved from iced beverages and fruit ices that were popular in early medieval periods, some of which probably contained milk or cream. The practice, in early times, of cooling drinks in ice and snow containing salt is a matter of record. It seems possible that in overcooling some of these punches, the "ice" was discovered. At any rate, various records of frozen fruit flavored ices have been found in European history and frozen ices are still more popular in continental Europe than in the United States and Canada.

The United States has gained undisputed leadership among all other countries in the production of ice cream. The industry grew slowly until about 1900, when the output of ice cream did not exceed 25 to 30 million gallons per year. The annual production has been on a continuously increasing rate, with production of both soft and hard ice cream now at more than one billion gallons. This represents a per capita consumption of more than 19 pounds. Approximately 9% of the total US milk production is utilized by the ice cream industry.

2. Raw materials

Ice cream is commercially the most important and contains fat and milk solids-non-fat in accordance with legislation. Legislation varies considerably, but minimum requirements in the UK are listed in table 1. Minimum quantities are commonly considerably lower than those used in commercial practice. Basically raw materials for ice cream are fresh milk, cream, sugar, flavoring, coloring, emulsifiers, stabilizers, and/or other ingredients such as nuts or dried fruit.

Table 1: Typical composition of ice cream and related products

	Fat (%)	Milk solid-non-fat (%)	Sugar (%)	Stabilizer (%)
Ice cream				
Standard	10	11	14	0.5
Premium	15	10	17	0.3
Super premium	17	9.25	18.5	–
Milk ice	4	12	13	0.7
Sherbet	2	4	25	0.6
Water ice	–	–	30	0.5

As shown in table 1, ice cream has the following composition:

(i) Milk fat is greater than 10% by legal definition, and usually between 10% and as high as 16% fat in some premium ice creams

(ii) Milk solids-not-fat (MSNF) 9 to 12% also known as the serum solids, contains the proteins (caseins and whey proteins) and carbohydrates (lactose) found in milk

(iii) Sweeteners (12 to 16%) is usually a combination of sucrose and glucose-based corn syrup sweeteners

(iv) Stabilizers and emulsifiers are 0.2 to 0.5%

(v) Water 55 to 64% comes from the milk or other ingredients

These percentages are by weight, either in the mix or in the frozen ice cream.

2.1 Fresh milk

It is the most suitable source of both fat and solid-non-fat (SNF). It also gives a better flavor than more highly processed sources. The fat and SNF content, although adequate for milk ice, requires supplementation for ice cream. Concentrated whole milk is increasingly used but results in a slight cooked flavor.

2.2 Fresh cream

It is the most suitable of concentrated fat sources and imparts a rich character to the end product. However, is highly perishable and expensive. Frozen cream may also be used, but the finish product is low quality. A good quality ice-cream may be use butter, sweet cream which has advantage of being associated with phospholipids. Milk fat fractions can be tailored to suit specific applications and winder use may be anticipated especially for specialty ice-cream. The use of low-cholesterol milk fractions in dietary ice-cream has also been proposed.

2.3 Milk fat

It promotes desirable textural properties, contributes a subtle flavor and its good synergist for added flavors, although there is some lowering of the whipping rate. As such milk fat is used for higher quality ice cream, but acceptable quality ice cream may be made from vegetable fats. Coconut, palm, palm kernel, and other are used either singly or as a blend. The oil is partly hydrogenated to produce a fairly sharp major melting peak at 28-30°C. It is also necessary to ensure that all of the fat is melted below 37°C to avoid a persistent fatty mouth-feel.

2.4 Solid non fat (SNF)

It may be also obtained from a number of sources in addition to milk and that contributed by cream or other fat source. In all cases protein is key component, functional activities being water binding and emulsification. Concentrated milk is very widely use is being made of concentrated whole milk. Sweetened condensed milk has been popular in past, but is difficult to handle and give ice cream of a rough texture due to lactose crystallization.

2.5 Stabilizers

The stabilizers are used in virtually all ice cream except super-premium ice cream. The purposes to add stabilizers are to improve the mix viscosity, the air incorporation, body, texture and melting properties of the finished ice-cream. Stabilizer also increase perceived creaminess and minimize the effect of temperature variations during storage. The amount and type of stabilizer are varied according to composition of the mix, nature of other ingredients, process parameters, and projected storage life. In general terms, mixes of high solid content processed by Ultra-High Temperature require (UHT) shows fewer stabilizers than mixes of low solids content processed by High Temperature – Short Time (HTST) pasteurization. There are many types of stabilizers such as carrageenan, alginate, gum type and etc.

2.6 Emulsifiers

They are used to improve the whipping quality of the mix and to produce the ice cream s texture. Emulsifier also facilitates the manufacturing process. Egg yolk, of which the ingredient is lecithin, was original emulsifier. Egg yolk, either frozen or dried, remains in use in custards and in high-quality natural ice cream, where it contributes other desirable qualities. Egg yolk is only moderately effective emulsifier, best performance obtained when butter is used as the fat source.

2.7 Sugar

It plays an important role in producing body and texture of ice cream. Sucrose is still the most widely used as sweetener and may be used alone, or in combination with other sweeteners. Sugar is relatively cheap and available either in granulated or crystalline from, or as a syrup.

2.8 Coloring and flavoring

Both of them are added to almost all ice cream. Even though, artificial colors and flavors have been important ingredient to keep the quality of ice cream each batch, the trend to natural has been raising according to the health concerning.

Table 2: Ingredients of ice cream and their principle functions

Ingredients	Principal functions
Fat	Provides flavor, body, texture and mouth-feel
Milk solid-non-fat	Provides body, texture and contributes to sweetness and air incorporation
Sugar	Provides sweetness and improve texture
Flavoring	Provides non-dairy flavors
Coloring	Improve appearance and reinforces flavors
Emulsifiers	Improve whipping quality and texture
Stabilizers	Improve mix viscosity, air incorporation, texture and melting qualities
Value-added ingredients	Provide additional flavor and enhance appearance

3. Manufacturing process

The manufacturing process of the ice cream facility is broken down into 7 steps:
(i) raw material reception and storage
(ii) base mixing and standardization
(iii) homogenization and pasteurization
(iv) aging
(v) flavor addition and continuous freezing
(vi) packaging
(vii) hardening.

In addition to main production line equipment, refrigeration is an optimized ammonia refrigeration unit has to be designed to utilize three temperatures -45.6 °C for the hardener system, -40.0 °C for the continuous freezer system, and -34.7 °C for and the cold storage room. Cold Storage is another important unit. Warehouse should be able to hold 2 – 3 months of production. Its capacity should be optimized according to market demand and inventory needs.

3.1 Blending the mixture

The milk fat source, nonfat solids, stabilizers and emulsifiers are blended to ensure complete mixing of liquid and dry ingredients. Firstly, the ingredients are selected based on the desired formulation and the calculation of the recipe from the formulation and the ingredients chosen, then the ingredients are weighed and blended together to produce what is known as the "ice cream mix". Blending requires rapid agitation to incorporate powders, and often high speed blenders are used.

3.2 Pasteurization of the Mixture

Pasteurization is the biological control point in the system, designed for the destruction of pathogenic bacteria. In addition to this very important function, pasteurization also reduces the number of spoilage organisms and helps to hydrate some of the components (proteins or stabilizers). Therefore, ice cream mix is pasteurized at 68.3°C for 30 minutes or 79.4°C for 25 sec. The conditions used to pasteurize are greater than those used for fluid milk because of increased viscosity from the higher fat, solids, and sweetener content, and the addition of egg yolks in custard products.

3.3 Homogenization

Homogenization also ensures that the emulsifiers and stabilizers are well blended and evenly distributed in the ice cream mix before it is frozen. Homogenization provides the size reduction of fat globules, the increasing of surface area, and the formation of membrane that make possible the use of butter, frozen cream, etc. By helping to form the fat structure, ice cream mix is homogenized (2500 to 3000 psi) to decrease the milk fat globule size to form a better emulsion and contribute to a smoother, creamier ice cream. The following indirect effects are making a smoother ice cream, giving a greater apparent richness and palatability, better air stability, and increasing resistance to melting.

Homogenization of the mix should take place at the pasteurizing temperature. The high temperature produces more efficient breaking up of the fat globules at any given pressure and also reduces fat clumping and the tendency to thick, heavy bodied mixes. The higher the fat and total solids in the mix, the lower the pressure should be. In the homogenizer, which is essentially a high-pressure piston pump, the mixture is further blended as it is drawn into the pump cylinder on the down stroke and then forced back out on the upstroke.

3.4 Aging

Ice cream mix is aged at 5°C for at least 4 hours and usually overnight. Aging the mix cools it down before freezing, allows the milk fat to partially crystallize and the gives the proteins and carbohydrates to fully hydrate. This improves the whipping properties of the mix and body and texture of ice cream. Aging is performed in insulated or refrigerated storage tanks, silos, etc. Mix temperature should be maintained as low as possible without freezing, at or below 5°C. An aging time of overnight is likely to give best results under average plant conditions. Non-aged mix exhibits a loose standup, is very wet at extrusion, and exhibits variable whipping abilities. The whipping qualities of the mix are usually improved with aging.

3.5 Addition of flavors and colors

Liquid flavors and colors may be added to the mix before freezing. Only ingredients that are liquid can be added before the freezing, to make sure the mix flows properly through the freezing equipment.

3.6 Freezing or whipping of ice cream

The process involves freezing the mix and incorporating air. Ice cream mix can be frozen in batch or continuous freezers and the conditions used will depend on the type of freezer. Batch freezers consist of a rotating barrel that is usually filled one-third to one-half full with ice cream mix. As the barrel turns, the air in the barrel is incorporated into the ice cream mix. Ice cream freezers designed for home use are batch freezers. Continuous freezers consist of a fixed barrel that has a blade inside that constantly scrapes the surface of freezing barrel. The ice cream mix is pumped from a bulk tank to the freezing barrel and the air is incorporated with another pump just before it enters the freezing barrel. The continuous freezing process is much faster than the batch freezing process.

The addition of air is called overrun and contributes to the lightness or denseness of ice cream. Up to 50% of the volume of the finished ice cream (100% overrun) can be air that is incorporated during freezing. The overrun level can be set as desired to adjust the denseness of the finished product. Premium ice creams have less overrun (approximately 80%) and are denser than regular ice cream.

3.7 Hardening

After the ice cream is packaged, it is still relatively soft. Therefore, ice cream is cooled as quickly as possible down to a holding temperature of less than -25°C (-13°F). Below about -25° C, ice cream is stable for indefinite periods without danger of ice crystal growth; however, above this temperature, ice crystal growth is possible and the rate of crystal growth is dependent upon the temperature of storage. This limits the shelf life of ice cream. The temperatures and times of cooling will depend on the type of storage freezer. Rapid cooling will promote quick freezing of water and create small ice crystals. Storage at -25°C (-13°F) will help to stabilize the ice crystals and maintain product quality. At this temperature there is still a small portion of liquid water. If all the water present in the ice cream were frozen, the ice cream would be as hard as an ice cube.

Hardening involves static freezing of the packaged products in the freezers. Freezing rate must still be rapid, so freezing techniques involve low temperature (-40°C) with either enhanced convection (freezing tunnels with forced air fans) or enhanced conduction (plate freezers). The rate of heat transfer in a freezing process is affected by the temperature difference, the surface area exposed, and the heat transfer coefficient. Thus, the factors affecting hardening are those affecting this rate of heat transfer:

(1) Temperature of blast freezer – the colder the temperature, the faster the hardening, the smoother the product.

(2) Rapid circulation of air – increases convective heat transfer.

(3) Temperature of ice cream when placed in the hardening freezer – the colder the ice cream at draw, the faster the hardening. This must get through packaging operations fast.

(4) Size of container – exposure of maximum surface area to cold air, especially important to consider shrink wrapped bundles – they become a much larger mass to freeze. Bundling should be done after hardening.

(5) Composition of ice cream – related to freezing point depression and the temperature required ensuring a significantly high ice phase volume.

(6) Method of stacking containers or bundles to allow air circulation. Circulation should not be impeded – there should be no 'dead air' spaces (e.g., round vs. square packages).

(7) Care of evaporator – freedom from frost - acts as insulator.

(8) Package type, should not impede heat transfer – e.g., foam liner or corrugated cardboard may protect against heat shock after hardening, but reduces heat transfer during freezing so not feasible.

4. General structure of ice cream

Ice cream structure is both fascinating and confusing. It is a complex food colloid that consists of air bubbles, fat globules, ice crystals, and unfrozen serum phase. The air bubbles are usually partially coated with fat globules and the fat globules are coated with a protein/emulsifier layer. The serum phase consists of the sugars and high molecular weight polysaccharides in a freeze-concentrated solution. Various steps in manufacturing process, include pasteurization, homogenization, aging, freezing, and hardening contribute to the development of this structure. Proteins and emulsifiers compete for interfacial space during the homogenization of the fat and the creation of the mix emulsion.

Following homogenization, the emulsion is further affected by changes occurring during the aging step, crystallization of the fat and rearrangement of the fat globule membrane to the lowest free energy state. This emulsion then undergoes both whipping and ice crystal formation during the dynamic freezing process, which contributes to the development of the four main structural components of the frozen product.

4.1 Emulsion formation

Ice cream is both an emulsion and foam. The milk fat exists in tiny globules that have been formed by the homogenizer. Homogenization begins the process of fat structure formation. After preheating and pasteurization, the mix is at a temperature sufficient to have melted all the fat present, and the fat passes through one or two homogenizing valves, creating globules of 0.5 to 2.0 μm.

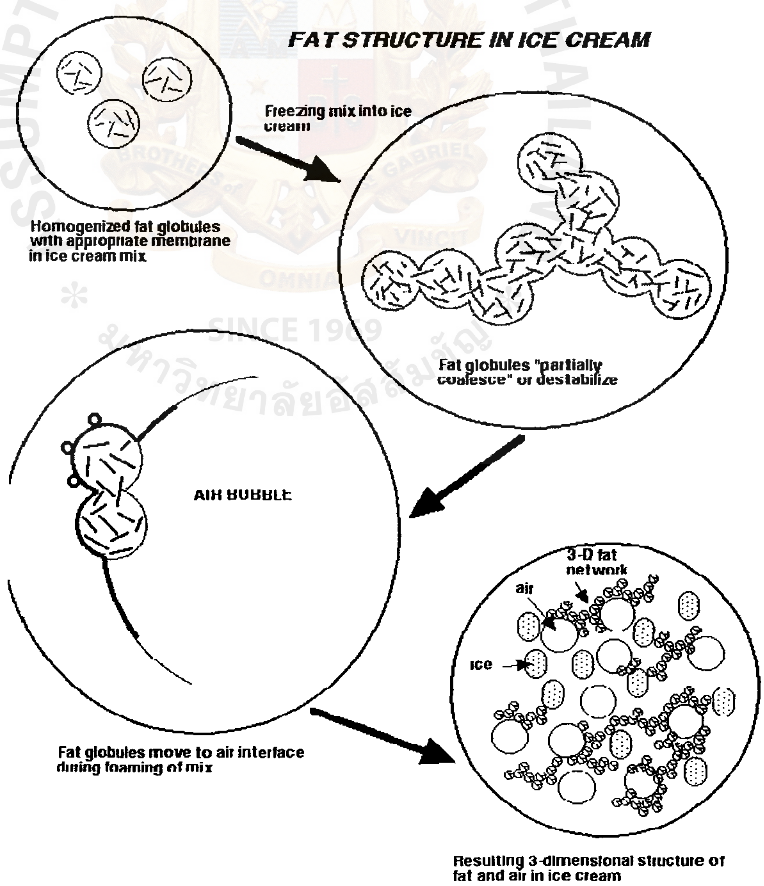


Figure 1: Fat structure in ice cream

Source: *http://www.uoguelph.ca/foodscience/sites/uoguelph.ca.foodscience/files/images/icstruc.gif*

As shown in figure 1, when the mix is subjected to the whipping action of the barrel freezer, the fat emulsion begins to partially break down and the fat globules begin to flocculate or destabilize. The air bubbles which are being beaten into the mix are stabilized. The emulsifiers are added to ice cream to actually reduce the stability of this fat emulsion by replacing proteins on the fat surface, leading to a thinner membrane more prone to coalescence during whipping. If emulsifiers were not added, the fat globules would have so much ability to resist this coalescing, due to the proteins being adsorbed to the fat globule, that the air bubbles would not be properly stabilized and the ice cream would not have the same smooth texture (due to this fat structure) that it has.

4.2 Ice crystals formation

The formation of the ice crystals is also adding structure to the ice cream. Water freezes out of a solution in its pure form as ice. In a sugar solution such as ice cream, the initial freezing point of the solution is lower than 0°C due to these dissolved sugars (freezing point depression), which is mostly a function of the sugar content of the mix. As ice crystallization begins and water freezes out in its pure form, the concentration of the remaining solution of sugar is increased due to water removal and hence the freezing point is further lowered. This process is shown in figure 2, schematically.

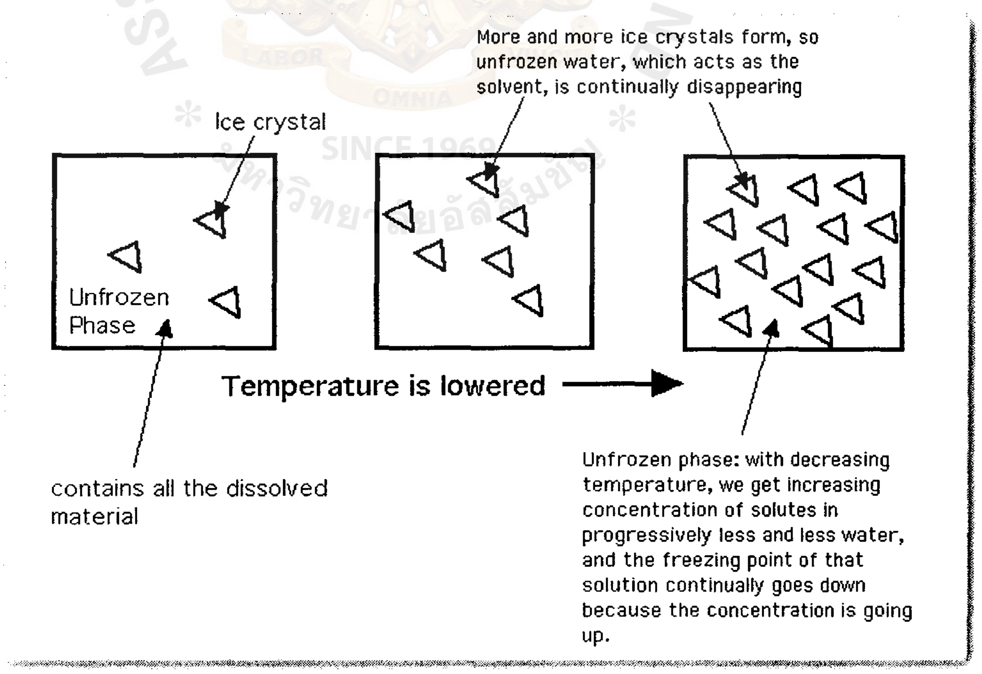


Figure 2: Formation of ice crystals

Source: *http://www.uoguelph.ca/foodscience/sites/uoguelph.ca.foodscience/files/images/frzconc.gif*

This process of freeze concentration continues to very low temperatures. Even at the typical ice cream serving temperature of -16° C, only about 72% of the water is frozen. The rest remains as a very concentrated sugar solution. The air content also contributes to this ability, as mentioned in discussing overrun.

Thus the structure of ice cream can be described as partly frozen foam with ice crystals and air bubbles occupying a majority of the space. The tiny fat globules, some of them flocculated and surrounding the air bubbles also form a dispersed phase. Proteins and emulsifiers are in turn surrounding the fat globules. The continuous phase consists of a very concentrated, unfrozen solution of sugars.

In 2003, Caillet, A. *et.al.* revealed the characterization of ice cream structure by three types of microscopic techniques; indirect method, direct method and destructive method.

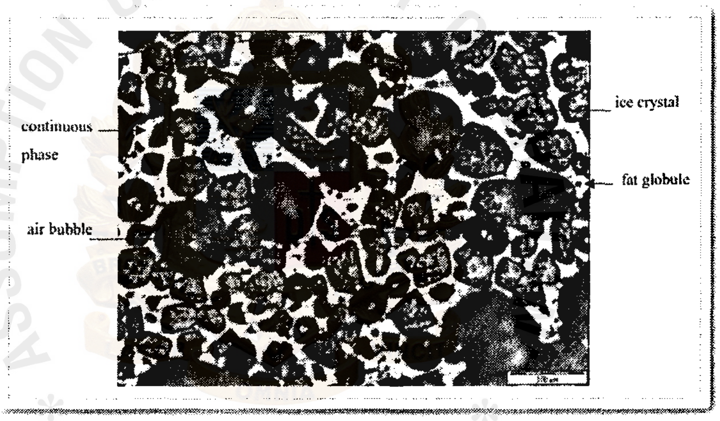


Figure 3: Structure of ice cream observed by direct microscopy method

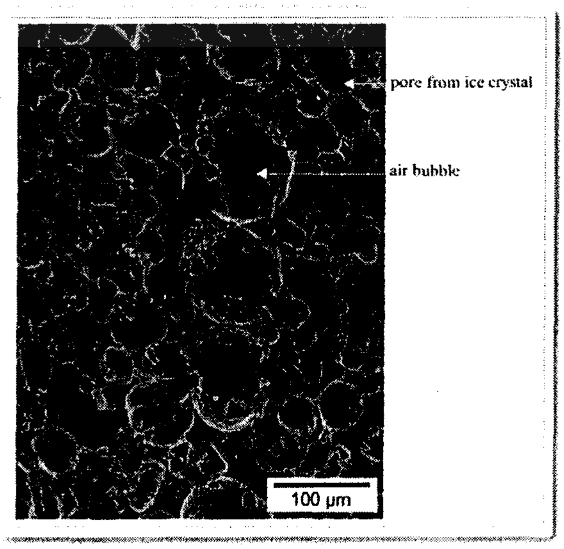


Figure 4: Ice cream structure image by scanning electron microscopy

As the results, ice crystals appeared in grey color and the cryoconcentrated continuous phase (containing the dry matter and the unfrozen water), in white levels. Fat globules—with mean diameter values according to literature around 1 mm—could be the dark points round about the air bubbles surface (figure 3). They also could differentiate clearly the air bubbles by their spherical shape, and the pores generated after the ice sublimation as shown in figure 4. They concluded that the direct method of optical microscopy with episcopic coaxial lighting has the advantage to characterize, in situ, the ice cream structure by preserving at best the original properties of the frozen overrun ice cream sample.

II. TEA

1. Origin and History of Tea

Tea plants are native to East and South Asia. The point where the lands of Northeast India, north Burma, southwest China, and Tibet meet was probably the place of origin of the plant. The earliest evidence that was ever recorded for tea consumption was in China, around the 10^{th} century BC and during the Qin Dynasty, it was used as a common drink and later became popular in the Tang Dynasty where its use as drink was extended to Korea and Japan. The Japanese had taken tea into their special occasions and holiday meals. In 1662, tea drink reached England and was fully introduced to the world. England then later announced tea as their national beverage, which lasted for hundreds of years. Despite the fact that the place of origin of tea is in China, India and Sri Lanka also have their own tea trees that are commercially cultivated to be sold throughout the world.

2. Tea species

The tea leaf that had been made into tea drinks, populously consumed by the population all over the world, has its scientific name of *Camellia sinensis,* which is about one from 80 species of East Asian evergreen shrubs and trees that belong to the tea family, Theaceae. The name '*sinensis*' means Chinese in latin root, which indicates its place of origin. *Camellia sinensis* has a strong taproot and is usually trimmed to below 2 meters when cultivated for the leaves. They bare yellow/white flowers that are 2.5 to 4 cm in diameter, with 7 – 8 petals. Their seeds can also be pressed to yield tea oil. Apart from *Camellia sinensis,* the Chinese type, there are also two other varieties of tea plant commercially used, the Indian type or the Assam variety, and the hybrid type. The

Chinese type has softer and smaller leaves, and grows well in high altitudes whereas the Indian or Assam type has larger leaves and grows well in lower altitudes.

3. Types of Tea

Tea is defined as a beverage obtained from the treatment of several steps of the plant material derived from *Camellia sinensis* which was originated and traditionally developed by the Chinese in the ancient times. The preparation of tea requires the steeping (soaking in water or other liquid, as to soften, cleanse, or extract some constituent) of the dried leaves, buds, and twigs of the tea plant, *Camellia sinensis,* in water of warm to hot. The definition of tea is restricted by its use of *Camellia sinensis* due to its specific compositions but the treatment used in making tea could also be applied to other types of plant. Different types of teas that are made from *Camellia sinensis* have distinguished flavor and aroma because of the way they are treated during the procedures. Several types of plant that provide flavor and aroma besides the tea plant *Camellia sinensis* such as Korean ginseng tea and other herbal teas were cured with similar methods.

Tea making is known to be a delicate process involving the steeping of the tea plant parts followed by a variety of treatments which are responsible for the distinguishing characteristics of flavor and aroma. The degree of tea flavor in the final product depends on the relative compounds being released during the treatments, usually involves heat due to the simple extraction method of applying hot water. The table below shows the different types of tea drink which obtained their unique characteristics according to the way they are processed.

There are four major types of tea where processing methods define each type: White, Green, Oolong and Black tea. All four types of tea come from the same raw material of *Camellia sinensis* but what grouped them into different types is the processing methods where the leaves are processed-steamed, fermented (oxidized), dried, or bruised in order to provide the tea with their distinctive characteristics.

3.1 *White Tea*

It has a silver-like appearance due to the presence of the new growth of tiny white hairs on the unopened buds of the tea plant. The finished product is sweet and delicate with a clean, airy fragrance. The tea has delicate, pure natural taste, and slightly sweet. It also has less caffeine than green or black tea.

3.2 *Green tea*

Green tea is greenish-yellow due to absence of oxidation. It tastes like fresh leaves or grass due to the leafy parts being used. It also is lower in caffeine and has higher antioxidant properties with no fermentation involved in the process, other characteristics, such as the grassy taste and slightly bitter, of green tea are very close to that of white tea.

3.3 *Oolong Tea*

The characteristic of oolong tea is in between green and black tea due to the partial oxidation in the process. The color varies in relation to the degree of oxidation. Fermentation of oolong tea can determine whether it could be like green tea or black tea, according to the extent of fermentation.

3.4 *Black Tea*

Despite the fact that black tea does not have as many antioxidants as the other types of teas, it is the most popular tea throughout the world. It also has the most caffeine content. The process of black tea allows full oxidation to occur. One type of black tea known as Keemun black tea is said to have a chocolate-like flavor. Darjeeling and Ceylon are also types of black tea.

Figure 5: The various types of loose tea leaf; white tea (a), green tea (b), oolong tea (c), black tea (d), and scented tea (e).

3.5 Other kinds of tea

Apart from the four main types of tea (White, Green, Oolong, and Black tea), there are various types of tea derived from different parts of the world.

(1) ***Irish Breakfast*** – a tea with rich taste, made from a blend of Assam and Ceylon black tea varieties. Brewing results in a dark-reddish tea with a medium aroma and a brisk malty taste together with undertones that are slightly bitter.

(2) ***English Breakfast*** – a strong smoky beverage made from Keenum Chinese black tea and also is one of the common tea drinks.

(3) ***Earl Grey Tea*** – the tea, common to the English and Americans, was named after the early 19th century Prime Minister, Charles Grey. It is a drink infused with the bergamot orange oil. It brews a bitter-citrus but sweet.

(4) ***Sencha Green Tea*** – one of the Japanese varieties of green tea made from tea leaves that are small.

(5) ***Dragon Well Green Tea*** – one of the famous green tea that is grown in China. It could be viewed as the Chinese version of Sencha. The leaves are broad flat and make tea that is less grassy than Sencha, resulting in a medium-bodied taste.

(6) ***Silver Needle White Tea*** – The most powerful tea from all types of tea. The tea is made from leaves aged at a certain time where they appear as fuzzy silver-like hairs thus, brewing a drink with whitish-silvery appearance.

(7) ***Wu-yi Oolong Tea*** – Named after its place of cultivation, Wuyi mountains of China, the leaves are large, producing a fruity, nutty, and rich taste.

(8) ***Pu-erh Tea*** – pu-erh tea is a unique type of tea because of its distinctive growing conditions and the strain of tea plant used. Named after the region where it was first harvested, Pu-erh teas are harvested from a broad-leaved variety of tea, a very ancient strain of tea plant. Thing makes Pu-erh tea so unique is that it helps reduce cholesterol and also help with digestion, as well as weight lost. The leaves give dark red color of the liquor and the processed is done through secondary oxidation and fermentation that is caused by organisms in the tea. Pu-erh tea is classified as dark tea but is technically a type of green tea that is ripened or aged raw.

(9) ***Scented Tea*** – scented teas are made by applying flower petals or blossoms, herbs, or sliced fruits to base tea (green, black, oolong tea, and etc). This will give essence and undertones of new flavors and smells of the tea. Jasmine tea and Earl Grey tea are basic examples of scented teas.

(10) ***Herbal Tea*** – herbal tea is a combination of boiling water and dried fruits, flowers or herbs, that does not usually made from the leaves of the tea plant. Herbal teas can be made with fresh or dried flowers, leaves, seeds or roots and they are simply prepared by pouring boiling water over these ingredients.

3.5.1 Rose Tea

Rose tea or rose hip tea is known for its many medicinal properties. It is derived from the db of the wild rose hip plant. It is a popular herbal health tea, which has a slight tart flavor but is refreshing and delicious to drink. The fruit confers many of the health benefits because it contains many essential vitamins like C, D, K and E, as well as organic acids, like citric and malic acids and pectin. HolisticOnline.com and RoseMagazine.com cite the many health benefits of rose tea, which include building a strong immune system, strengthening the digestive system and the detoxification of the urinary tracts and kidneys.

For women, the menstrual period each month, are often depressed, plagued by pain in lower abdomen. Chinese medicine practitioners believe the roses mild in nature but have calm, appease the effectiveness of antidepressants. The tea and rose tea should not be together. Because the tea contains much tannic acid, tannic acid will affect the effectiveness of roses. In addition, while it rose tea to alleviate the pain of menstrual period, but not too much to drink.

Figure 6: Rose tea

3.5.2 Lavender Tea

The lavender plant is known to be a genus (defined as taxonomic group containing one or more species) that belongs to the mint family. There are about 39 species of flowering plants that are classified in this genus, which is thought to be originally endemic to the Asian region. The plant is usually 6 – 24 inches in length. It is known for its leaves that wear a silvery-green shade, and more for its pretty flowers; tubular shaped and lavender, violet or purple in color. Apart from its wide use as an ornamental plant, the lavender plant is popular for its health benefits in its tea form, which help in dealing with many kinds of ailments.

Figure 7: Lavender tea

Lavender Tea Benefits

– People who have trouble falling or staying asleep must have lavender tea on a daily basis. The tea helps in the treatment of insomnia or sleeplessness.

– One of the most important benefits of drinking lavender tea is stress reduction, and improvement of mood disorders to some extent

– Lavender tea helps in reducing fever. This it does by increasing the body's temperature and helping it to perspire

– Lavender tea has been a boon for treating digestive disorders like constipation, diarrhea, etc.

– Ailments such as bowel infections, headaches, and flatulence, can also be improved with the help of this herbal tea

– The tea acts a 'detoxifier', getting rid of toxins from the blood, digestive and urinary tract. And one of the benefits of this process is a healthy, clear and glowing skin

3.5.2 Chrysanthemum Tea

Chrysanthemum tea is one of China's most popular Herbal teas. This Chrysanthemum tea is picked in the mountains of Taiping in Anhui. These wild chrysanthemums grow in the mountains and are harvested once a year by the local villagers. After the harvest, the Chrysanthemum are dried and processed as tea. Others name are yellow Chrysanthemum tea or Ju Hua tea.

This tea is well-known for its cooling properties that help to decrease body heat and is recommended for those with fever, sore throat, and other heat-related illnesses. Chrysanthemum tea acts as a natural coolant and has been talked about in the ancient Chinese medicinal science. The Chinese medicinal practice included the use of herbs as

6. Chrysanthemum tea has stimulating property and helps in alerting the senses and rejuvenating the brain. It stimulates all your senses very quickly and also calms down the nerves.

7. Drinking Chrysanthemum tea helps in providing relief in sore throat, redness in the eyes, itchiness in the eyes, dryness in the eyes and dark sport in the eye area.

8. It makes the lungs strong and helps in providing relief in respiratory problems such as shortness of breath.

9. Chrysanthemum tea when taken with lunch or dinner especially with oily foods helps ease digestion.

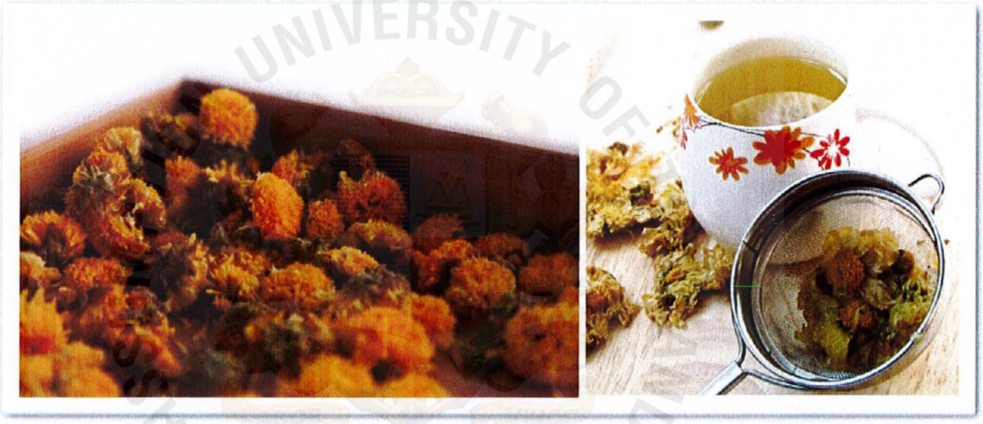


Figure 8: Chrysanthemum tea

MATERILAS AND METHODS

1. Materials

Heavy cream, milk, egg, salt, sugar, and rock salt bought from local market and supermarket. Rose tea, Lavender tea, and Chrysanthemum tea ordered from tea shop. All chemical reagents were food grade and available in laboratory.

2. Develop basic formula of flower tea ice cream

The ingredients of ice cream were ground sugar, fresh milk, cream, egg yolk, and flower tea (rose tea, lavender tea, and Chrysanthemum tea). The basic formula was shown in Table 1.

Table 1: Basic formula of flower tea ice cream

Ingredients	Rose tea	Lavender tea	Chrysanthemum tea
Ground sugar (g)	120	120	120
Fresh milk (mL)	500	500	500
Cream (mL)	250	250	250
Egg yolk	2	2	2
Flower tea (g)	2	0.5	2

To make flower tea ice cream, firstly, fresh milk, cream, and flower tea (rose tea, lavender tea and Chrysanthemum tea) were mixed and pasteurized at 72°C for 15 sec. After finished the pasteurization, flower tea was filtered. Then, the second part, egg yolk and ground sugar, was beat and then added into the pasteurized mixture. The mixture was cooled down to 50 °C, and then remained part of ground sugar was added and blended with hand mixer to ensure the completely mixing of the butter. The ice cream mix was then added into ice cream maker and operated the machine until gained ice cream. Then ice cream was packed in the plastic box and kept in the freezer overnight.

3. Study the effect of flower tea concentration on the flower tea ice cream

Flower tea ice cream was produced by varying the concentration of flower tea. Rose tea and Chrysanthemum tea were varied at 2, 3, 4, and 5g, while lavender tea was varied at 0.5, 1, 1.5, and 2 g. All flower tea ice cream samples were evaluated by 15 panelists using Liking preference test with 9-point hedonic scale.

4. Investigate the preference of flower tea ice cream

From the previous study, the suitable concentrations of each flower tea (rose tea, lavender tea and Chrysanthemum tea) were selected to produce and to evaluate by 45 panelists using Liking preference test with 9-point hedonic scale. The best formula of whey ice cream was selected to analyze % overrun.

To measure % overrun, ice cream was cut into cubic size 4 cm and put into cylinder. After ice cream was melt, the final volume of melted ice cream was read as % overrun.

5. Determine the flavor profile of flower tea ice cream by using descriptive analysis

The most preferred flower tea ice cream was produced and determines the descriptive terms by 5 trained panelists. Then, the sensory intensities were done by 50 panelists using 15-point scale.

6. Investigate the consumer acceptance and behavior of flower tea ice cream

The most preferred flower tea ice cream was produced and evaluated by 100 panelists.

RESULTS & DISCUSSION

1. Develop basic formula of flower tea ice cream

The method of making the ice cream is mentioned in the methodology part above briefly. To make flower tea ice cream, firstly, fresh milk, cream, and flower tea (rose tea, lavender tea and Chrysanthemum tea) were mixed and pasteurized at 72°C for 15 sec. The tea flowers were added and boiled together with milk and cream during the pasteurization process. Therefore, flower tea fragrance and flavor was passed on to the ice cream mix.

After finished the pasteurization, flower tea was filtered and cooled down. Then, the second part, egg yolk and ground sugar, was beat and then added into the pasteurized mixture. The mixture was cooled down to 50 °C, and then remained part of ground sugar was added and blended with hand mixer to ensure the completely mixing of the butter. The ice cream mix was then added into ice cream maker and operated the machine until gained ice cream. Then ice cream was packed in the plastic box and kept in the freezer overnight.

From the preliminary sensory evaluation of flower tea ice cream, the basic formulas of all types of flower tea ice creams are shown in table 1. The amount of rose tea and Chrysanthemum tea were 2 grams, while the amount of lavender tea for basic formula was 0.5 grams according to the strong smell of lavender tea.

2. Study the effect of flower tea concentration on the flower tea ice cream

As the basic formula shown in table 1, flower tea ice creams were produced by varying the concentration of flower tea. Rose tea and Chrysanthemum tea were varied at 2, 3, 4, and 5g, while lavender tea was varied at 0.5, 1, 1.5, and 2 g. All flower tea ice cream samples were evaluated by 15 panelists using liking preference test with 9-point hedonic scale.

As shown in table 2, the highest score for the color of rose tea ice cream was found in the third formula containing 4 g of rose tea) at score 6.3. Other attributes showed the highest score for the forth formula (contained 5 g of rose tea). The score for appearance, flavor, taste, texture, aftertaste, and overall liking of rose tea ice cream containing 5 g of rose tea were 6.5, 6.3, 6.7, 6.2, 6.1, and 6.3, respectively. Therefore, the rose ice cream formula 4 which containing Rose tea 5 g was selected for further steps.

Table 2: Sensory evaluation of rose tea ice cream at various concentrations

Attributes	Rose tea			
	2 g	**3 g**	**4 g**	**5 g**
Color	6.0^{a}	6.0^{a}	**6.3^{a}**	6.2^{a}
Appearance	5.4^{b}	5.5^{b}	5.9^{ab}	**6.5^{a}**
Flavor	5.5^{b}	5.8^{ab}	5.7^{ab}	**6.3^{a}**
Taste	5.5^{b}	6.0^{ab}	6.2^{ab}	**6.7^{a}**
Texture	5.5^{ab}	5.8^{ab}	5.5^{ab}	**6.2^{a}**
Aftertaste	5.5^{a}	5.6^{a}	6.1^{a}	**6.1^{a}**
Overall liking	5.9^{ab}	5.9^{ab}	5.6^{b}	**6.3^{a}**

Table 3: Sensory evaluation of lavender tea ice cream at various concentrations

Attributes	Lavender tea			
	0.5 g	**1.0 g**	**1.5 g**	**2.0 g**
Color	5.5^{a}	4.9^{b}	5.5^{a}	**5.7^{a}**
Appearance	5.8^{ab}	5.4^{b}	5.7^{ab}	**6.1^{a}**
Flavor	**5.9^{a}**	5.1^{b}	5.3^{ab}	4.7^{b}
Taste	**5.9^{a}**	5.0^{b}	5.1^{b}	4.5^{b}
Texture	6.0^{a}	5.6^{a}	5.8^{a}	**6.1^{a}**
Aftertaste	**5.9^{a}**	5.3^{b}	5.2^{b}	4.1^{c}
Overall liking	**6.2^{a}**	5.2^{bc}	5.7^{ab}	5.1^{c}

As the results shown in table 3, the highest score of color, appearance, and texture were found in lavender tea ice cream at 5.7, 6.1, and 6.1, respectively, while the flavor, taste, aftertaste, and overall liking showed the highest score as 5.9, 5.9, 5.9, and 6.2, respectively, in the 2 g of lavender tea adding. Thus, the 0.5 g lavender tea was selected from the highest score of flavor, taste, and overall liking for further study.

Table 4: Sensory evaluation of Chrysanthemum tea ice cream at various concentrations

Attributes	Chrysanthemum tea			
	2 g	**3 g**	**4 g**	**5 g**
Color	4.6^{b}	4.9^{ab}	**5.2^{a}**	**5.2^{a}**
Appearance	5.3^{a}	5.5^{a}	**5.7^{a}**	**5.7^{a}**
Flavor	5.3^{ab}	**5.9^{a}**	5.8^{a}	5.0^{b}
Taste	4.9^{ab}	**5.3^{a}**	**5.3^{a}**	4.5^{b}
Texture	5.1^{a}	5.1^{a}	**5.6^{a}**	5.3^{a}
Aftertaste	5.1^{a}	**5.8^{a}**	5.6^{a}	4.3^{b}
Overall liking	5.0^{bc}	**6.0^{a}**	5.5^{b}	4.8^{a}

From the results shown in table 4, there are many attributes showed the equal score from two concentrations. Color and appearance of Chrysanthemum tea ice cream containing 4 and 5 g of Chrysanthemum tea showed the equal score at 5.2, while the taste of ice cream containing 3 and 4 g of Chrysanthemum tea showed the same score at 5.3 ($p<0.05$). Chrysanthemum tea ice cream containing 4 g of Chrysanthemum tea showed the highest score at 5.6 for the texture. Chrysanthemum tea ice cream with 3 g of Chrysanthemum tea showed the highest score for the flavor, aftertaste, and overall liking as 5.9, 5.8, and 6.0, respectively. Therefore, the Chrysanthemum tea ice cream adding Chrysanthemum tea 3 g was selected from the highest score of flavor, taste, and overall liking for further study.

4. Investigate the preference of flower tea cream

As the previous studied, the suitable concentrations of rose tea, lavender tea, and Chrysanthemum tea were 5, 0.5, and 3 g, respectively (table 5). The selected formulas were produced and evaluated the consumer acceptance by 45 panelists using preference test. The results showed in table 6.

Table 5: Selected formula for rose tea, lavender, and Chrysanthemum tea ice cream

Ingredients	Rose tea	Lavender tea	Chrysanthemum tea
Ground sugar (g)	120	120	120
Fresh milk (mL)	500	500	500
Cream (mL)	250	250	250
Egg yolk	2	2	2
Flower tea (g)	**5**	**0.5**	**3**

Table 6: Percentage of preference in each flower tea ice cream

Flower tea ice cream	Preference (%)
Rose tea	28.8
lavender tea	11.2
Chrysanthemum tea	60.0

As the results shown in table 6, the most prefreable flower tea ice cream was Chrysanthemum tea ice cream due to highest percentage of preference as 60 %. Thus, the Chrysanthemum tea ice cream was selected to investigate the consumer acceptance, descriptive analysis, and analysis % overrun.

5. Study the consumer acceptance and descriptive analysis of flower tea ice cream

The most preferred flower tea ice cream was produced and studied the consumer acceptance, consumer behavior, and descriptive analysis. Moreover, the flower tea ice cream was measured %overrun. It is the term for the percent of expansion of ice cream achieved from the amount of air incorporated into the product during the freezing process and the result showed in table 7 below.

Table 7: % Overrun of Chrysanthemum tea ice cream

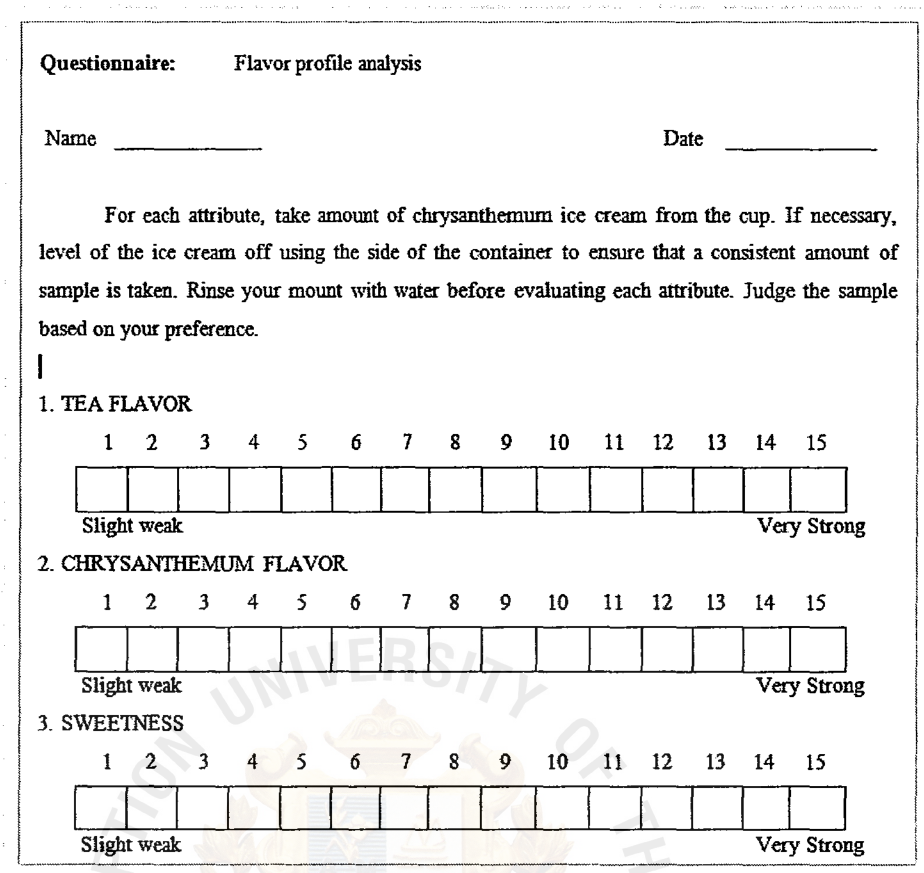
	Overrun (%)
Chrysanthemum tea ice cream	22.8

The amount of overrun affects the texture and mouthfeel. Without an overrun, the ice cream would become a frozen mass that is not consumer friendly or easy to consume. Overrun does not have to be declared on the label. Quality ice creams have lower overruns than those of reduced quality. Generally the more overrun, the lower the cost of the ice cream. In home freezing the overrun obtained is seldom as great as with commercial ice creams, for the freezing conditions in the home are not controlled so carefully as in the factory. That might be the reason why Chrysanthemum tea ice cream had low % overrun. Too great an overrun produces an ice cream of poor body and quality, for it becomes very frothy and foamy. An overrun of 50 % is considered to give a desirable texture.

5.1 Determine the flavor profile of Chrysanthemum tea ice cream using Descriptive Analysis

Five trained panelists were served with Chrysanthemum tea ice cream as advisory stimuli for the consensus language development, or generation of descriptive terms. Sufficient time was given to the panelists to discuss and come up with terms that best described tea and bamboo leaf's tea quality. Once the terms were generated, a consensus among panelists will finalize to the most appropriate and important terms.

Sensory attributes were decided among a consensus in order to create a profile of the tea. The Chrysanthemum tea ice cream attributes consist of tea flavor, sweet flavor, Chrysanthemum flavor, milky, creamy, and bitter aftertaste. As shown in figure 9, the score sheet with a 15-point scale was then used by the panelists to rate sensory intensities.



Questionnaire: Flavor profile analysis

Name ____________ Date ____________

For each attribute, take amount of chrysanthemum ice cream from the cup. If necessary, level of the ice cream off using the side of the container to ensure that a consistent amount of sample is taken. Rinse your mount with water before evaluating each attribute. Judge the sample based on your preference.

1. TEA FLAVOR

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Slight weak Very Strong

2. CHRYSANTHEMUM FLAVOR

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Slight weak Very Strong

3. SWEETNESS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Slight weak Very Strong

Figure 9: Example of score sheet used to rate each attributes of Chrysanthemum flavor

Average sensory intensity of tea flavor, sweet flavor, Chrysanthemum flavor, milky, creamy, and bitter aftertaste were 10, 9, 14, 9, 12, and 4, respectively (Table 8). The averages of the scores for each attribute by each panelist shown as the radar chart in figure 10.

Table 8: Average of sensory intensities scored for the profile development by 50 panelists of Chrysanthemum tea ice cream

Attributes	Sensory Intensity
Tea	10
Sweet	9
Chrysanthemum	14
Milky	9
Creamy	12
Bitter aftertaste	4

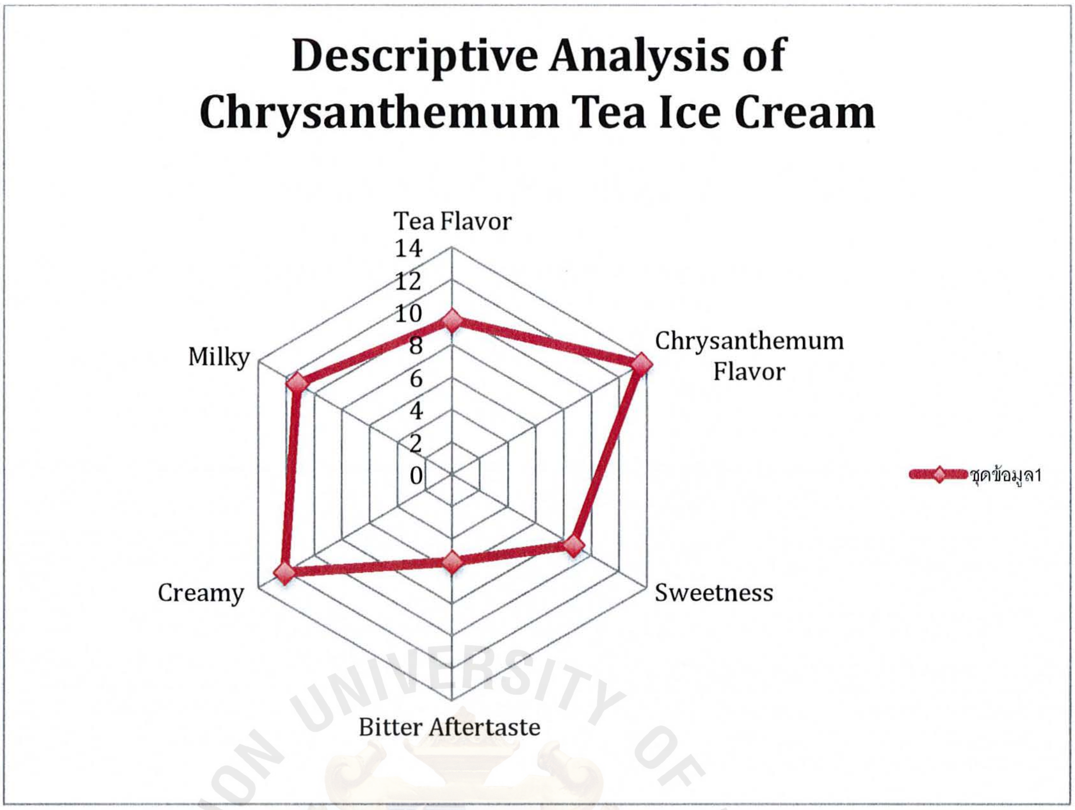


Figure 10: The spider web of Chrysanthemum tea ice cream by 50 panelists

The figure above demonstrated the descriptive analysis profile of the ice cream indicating that the ice cream has a pretty strong creamy, milky and Chrysanthemum flavor. The Tea Flavor and Sweetness was just about right and the bitter aftertaste which was not strong bitter.

5.2 Study the consumer acceptance of Chrysanthemum tea ice cream

The study of consumer acceptance was divided into 2 parts that are consumer behavior and consumer acceptance. The Chrysanthemum tea ice cream was evaluated by 100 consumers. The first part, consumer behavior, asked general questions like how often to buy ice cream, what the favorite brand is, or the place to buy. The second part, consumer acceptance, asked about the product acceptance and the opportunity in the market launch.

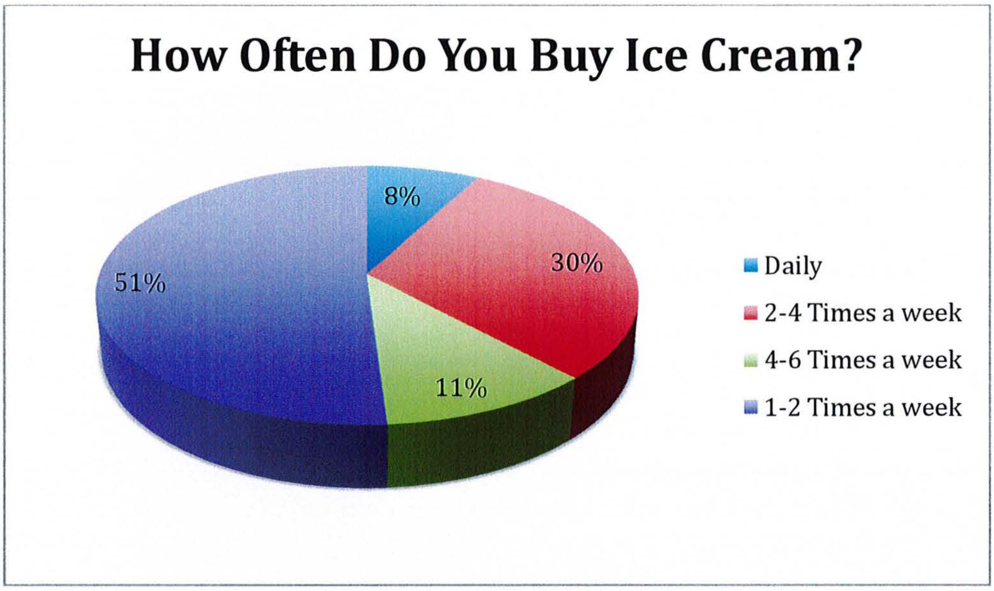


Figure 11: The frequency to buy ice cream

According to the figure 11, the pie chart showed that 3% of the consumers buy ice cream daily, 6% of the consumer buy ice cream 4-6 times a week, 26% of the consumers buy ice cream 2-4 times a week and 41% of the consumers buy ice cream 1-2 times a week.

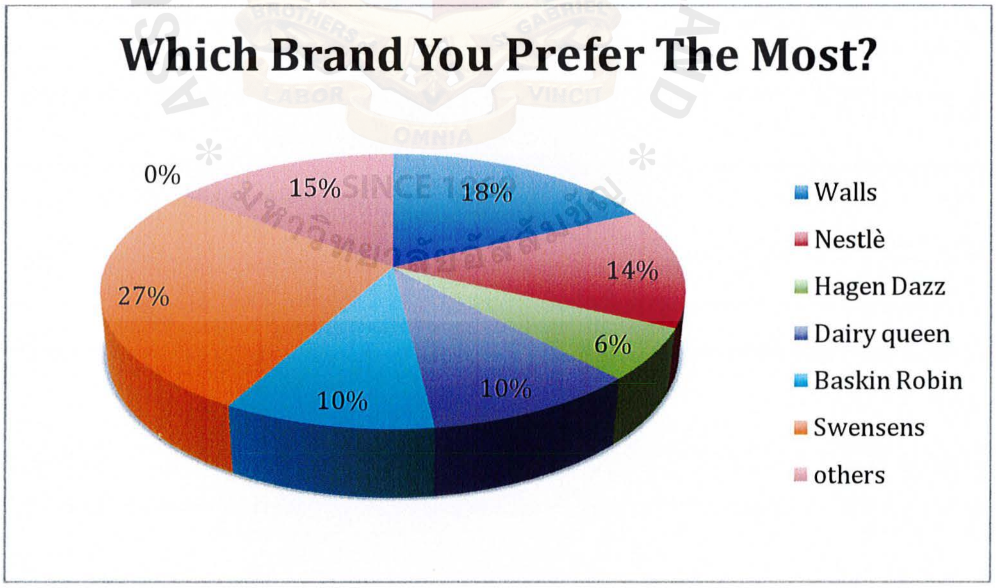


Figure 12: The favorite brand of ice cream

From the chart above the most preferred brand is likely to be Swensens, which is 27%, followed by walls, which is 18% and the next brand which is likely to be nestle. The least preferable brand is likely to be Haagen-Dazs, which is about 6% of the consumers.

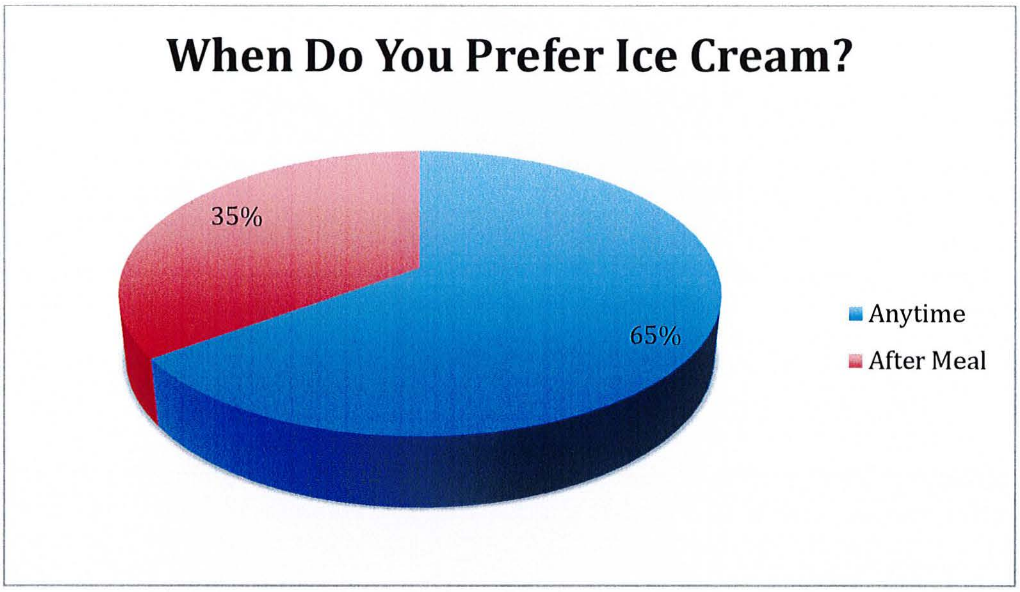


Figure 13: Time for ice cream eating

From the figure 13, 65% of the consumers prefer to eat ice cream at any time while the rest 35% of the consumer they prefer to eat their ice cream after a meal as their desert.

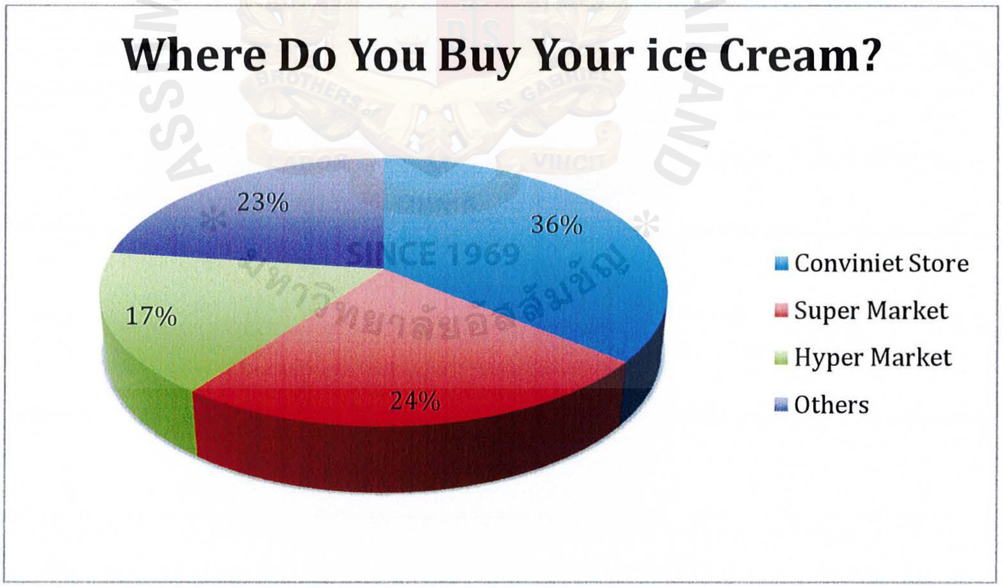


Figure 14: Place for buying ice cream

From figure 14, most of consumers which is 36% the buy their ice cream at the convenient store like 7-11, family mart and etc., and 23% of the con summers they buy their ice cream at a supermarket while the least number of consumers which is 17% they buy their ice cream at a hyper market.

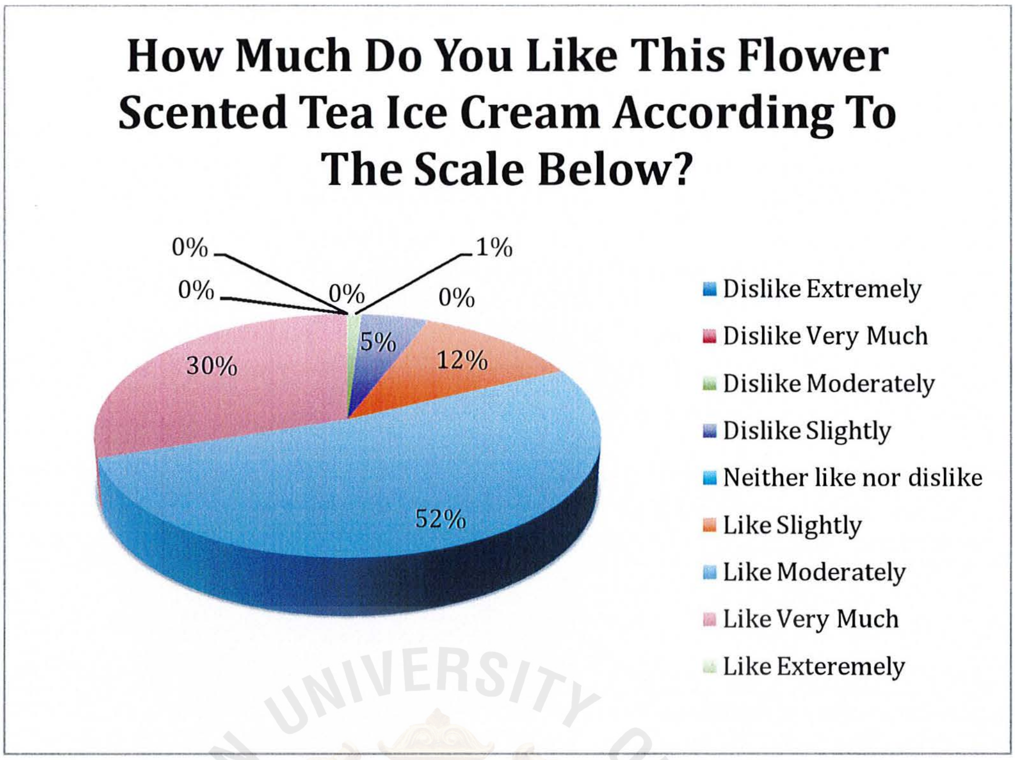


Figure 15: Rate the preference of flower tea ice cream

Figure 15 showed the average preference score of Chrysanthemum tea ice cream. The result showed that 52% of consumers like Chrysanthemum tea ice cream moderately and gave the preference score as 7 whereas 30% of consumer's rated Chrysanthemum tea ice cream with preference scores of 8. This could be interpreted that they like this Chrysanthemum tea ice cream very much. However, this Chrysanthemum tea ice cream was rated as 6 by 12% of consumers and 4 by 5% of consumers indicating that they slightly like and slightly dislike this Chrysanthemum tea ice cream respectively. There was only 1% of consumers dislike this Chrysanthemum tea ice cream.

The second part of the questionnaire, consumers were asked would they acceptance of the Chrysanthemum tea ice cream. As the results shown in figure 16, 74% of the consumers accept the product while the rest 26% of them don't accept the product.

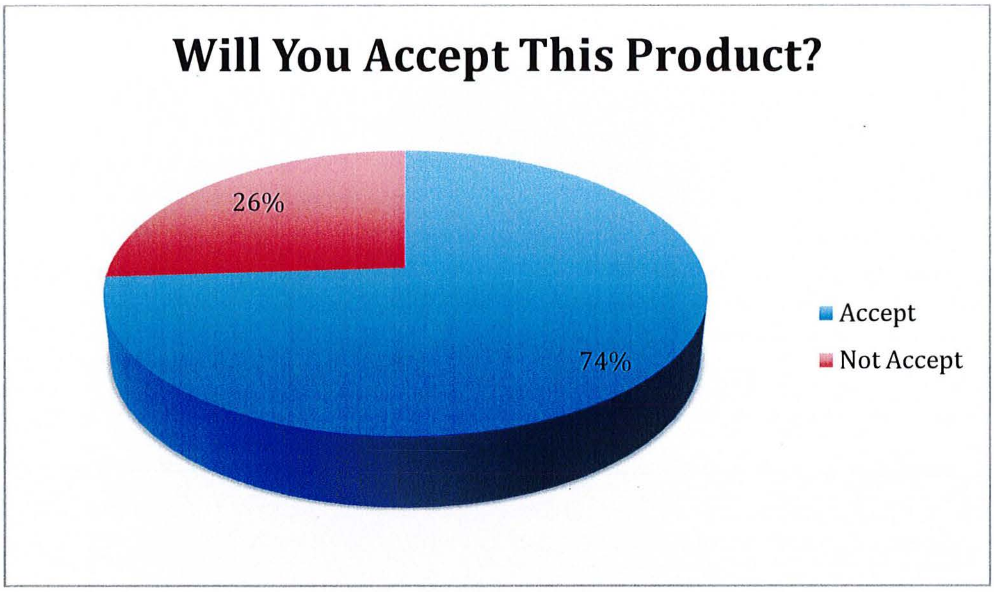


Figure 16: Product acceptance

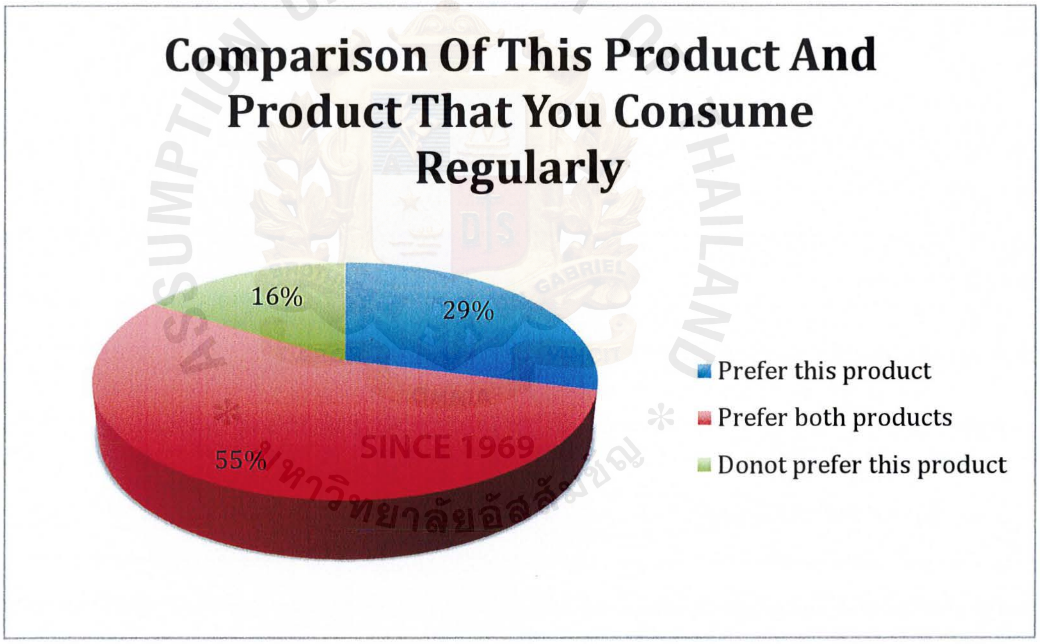


Figure 17: Product comparison

Consumers were asked about their preference of the Chrysanthemum tea ice cream over the other commercial ice cream. From the results in figure 16, it proved that 55% of the consumers they prefer both the ice cream. Moreover, 29% of the consumer they prefer the Chrysanthemum tea ice cream because of its unique taste and fragrance. However there is also a consumer who doesn't prefer this product which accounts to 16% of the consumers who don't prefer the newly developed Chrysanthemum tea ice cream.

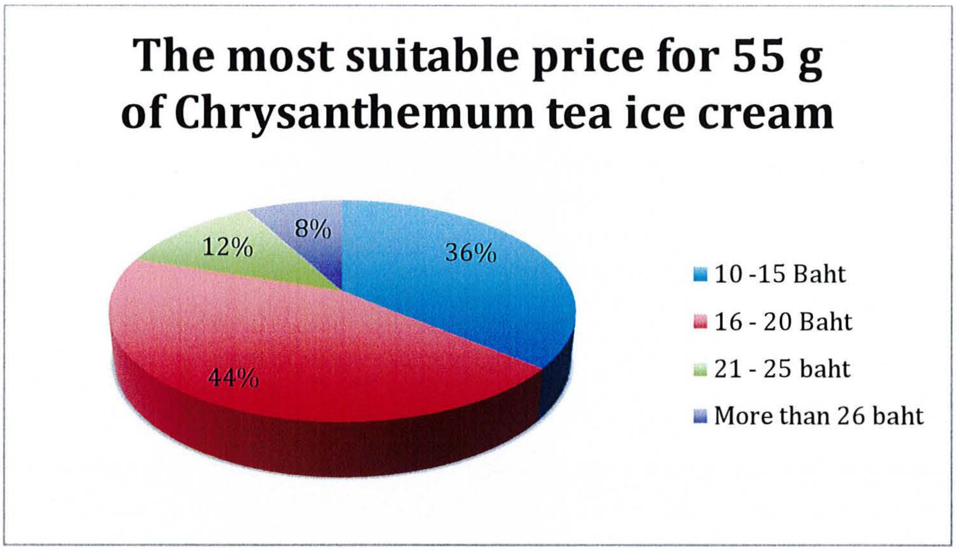


Figure 17: Suitable price of Chrysanthemum tea ice cream

In this part, consumers were asked to set up the most appropriate price for 55g of Chrysanthemum tea ice cream. From the figure above, the study found that 36% of the consumers are willing to pay 10 – 15 baht, 44% of the consumers are willing to pay 16 – 20 baht, 12% of the consumers are willing to pay 21 – 25 baht, and moreover, there are also 8% of the consumers who are willing to pay more than 26 baht.

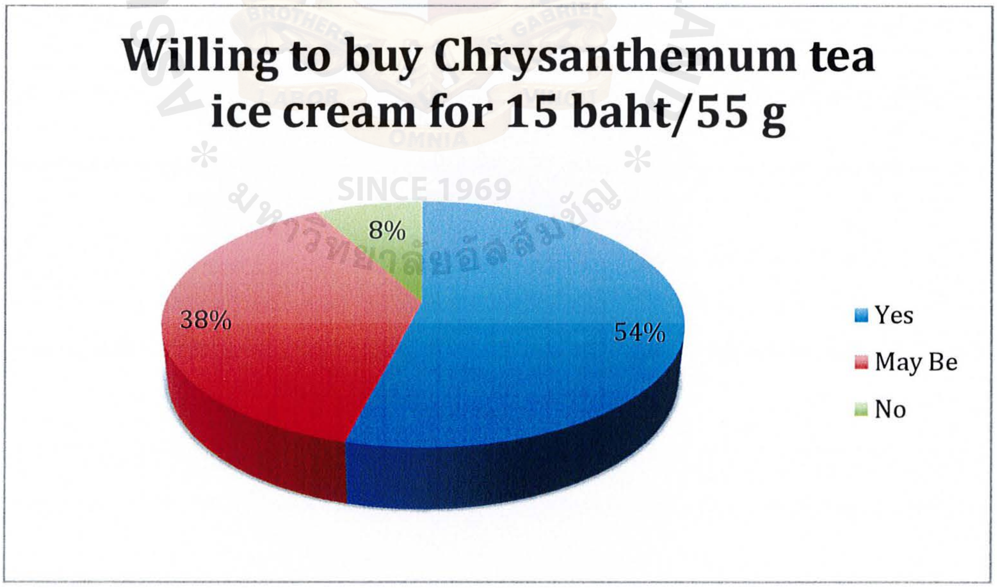


Figure 18: The willing to buy Chrysanthemum tea ice cream

As the results, 54% of the consumers they will buy, 38% of the consumers they may or may not buy but there's 8% of the consumers who is not willing to buy the Chrysanthemum tea ice cream for 15 baht.

Table 9: General information of consumer

Information		Percentage
1. Gender	Male	70
	Female	30
2. Age	Below 20	23
	20 – 24	56
	25 – 29	11
	30 – 34	6
	35 above	4
3. Education	Below high school	6
	High school	27
	Bachelor degree	48
	Master degree	13
	Above Master degree	6
4. Occupation	Student	76
	Self employed	6
	Employee	6
	Unemployed	6
	Retired	6
5. Monthly income	Below 5,000	32
	5,001 – 10,000	33
	10,001 – 15,000	12
	15,001 – 20,000	8
	20,001 – 25,000	5
	25,001 and above	10

From table 9, 70% of the consumers were male and 30% of the consumers were female. The most common age group is from 20 – 24(56 %), while other range that are below the age of 20, 25 – 29, 30 – 34, and above 35 showed 23, 11, 6, and 4 %, respectively. Education of consumers showed that 48 of them have bachelor, 13 of the consumers doing their high school, 13 of them doing their Master, while 6 of them have higher than Master degree and the other 6 below high school. For the consumer's occupation, the results showed that 76 % were students, while self-employed, employee, unemployed, and retired officers were 6 % of each group. Consumer income showed that 32 % consumers have monthly income less than 5000, 33 % consumers have income between 5000 – 10000, 12 % consumers have income between 10001 – 15000, 8 % consumers have income between 150001 – 20000, 5 % consumers have monthly income between 20001 – 25000, and 10% consumers have 25000 and above as their monthly income.

CONCLUSION

1. The final composition of the Chrysanthemum tea ice cream was milk 55%, cream 27%, sugar 13%, egg yolk 4%, and Chrysanthemum tea 1%.
2. Flavor profile of Chrysanthemum tea ice cream consists of tea flavor, sweet flavor, Chrysanthemum flavor, milky, creamy, and bitter aftertaste. Average sensory intensity of tea flavor, sweet flavor, Chrysanthemum flavor, milky, creamy, and bitter aftertaste were 10, 9, 14, 9, 12, and 4, respectively.
3. Overrun (%) of Chrysanthemum tea ice cream was 22.8 %.
4. For the consumer acceptance, 74 % of consumer accepted the Chrysanthemum tea ice cream with the price at 15 baht per 55 g – packing size.

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APPENDIX

PART A: LAVENDER ICECREAM

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Block	15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Trt	4	242 352 739 813

Number of Observations Read 60
Number of Observations Used 60

A1: Color

The ANOVA Procedure

Dependent Variable: Color

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	177.7666667	10.4568627	26.40	<.0001
Error	42	16.6333333	0.3960317		
Corrected Total	59	194.4000000			

R-Square	Coeff Var	Root MSE	Color Mean
0.914438	11.65390	0.629311	5.400000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	171.9000000	12.2785714	31.00	<.0001
Trt	3	5.8666667	1.9555556	4.94	0.0050

A2: Appearance

The ANOVA Procedure

Dependent Variable: App

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	103.3833333	6.0813725	16.10	<.0001
Error	42	15.8666667	0.3777778		
Corrected Total	59	119.2500000			

R-Square	Coeff Var	Root MSE	App Mean
0.866946	10.68933	0.614636	5.750000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	100.0000000	7.1428571	18.91	<.0001
Trt	3	3.3833333	1.1277778	2.99	0.0418

A3: Flavor

The ANOVA Procedure

Dependent Variable: Flavor

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	92.6833333	5.4519608	7.76	<.0001
Error	42	29.5000000	0.7023810		
Corrected Total	59	122.1833333			

R-Square	Coeff Var	Root MSE	Flavor Mean
0.758560	15.86275	0.838082	5.283333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	81.43333333	5.81666667	8.28	<.0001
Trt	3	11.25000000	3.75000000	5.34	0.0033

A4: Taste

The ANOVA Procedure

Dependent Variable: Taste

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	117.1666667	6.8921569	9.11	<.0001
Error	42	31.7666667	0.7563492		
Corrected Total	59	148.9333333			

R-Square	Coeff Var	Root MSE	Taste Mean
0.786705	16.94188	0.869683	5.133333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	103.4333333	7.3880952	9.77	<.0001
Trt	3	13.7333333	4.5777778	6.05	0.0016

A5: Texture

The ANOVA Procedure

Dependent Variable: Texture

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	67.93333333	3.99607843	8.83	<.0001
Error	42	19.00000000	0.45238095		
Corrected Total	59	86.93333333			

R-Square	Coeff Var	Root MSE	Texture Mean
0.781442	11.46465	0.672593	5.866667

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	65.93333333	4.70952381	10.41	<.0001
Trt	3	2.00000000	0.66666667	1.47	0.2354

A6: Aftertaste

The ANOVA Procedure

Dependent Variable: Aftertaste

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	90.1500000	5.3029412	8.10	<.0001
Error	42	27.5000000	0.6547619		
Corrected Total	59	117.6500000			

R-Square	Coeff Var	Root MSE	Aftertaste Mean
0.766256	15.71211	0.809174	5.150000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	64.90000000	4.63571429	7.08	<.0001
Trt	3	25.25000000	8.41666667	12.85	<.0001

A7: Overall Liking

The ANOVA Procedure

Dependent Variable: OL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	72.28333333	4.25196078	7.91	<.0001
Error	42	22.56666667	0.53730159		
Corrected Total	59	94.85000000			

R-Square	Coeff Var	Root MSE	OL Mean
0.762080	13.20736	0.733009	5.550000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	60.10000000	4.29285714	7.99	<.0001
Trt	3	12.18333333	4.06111111	7.56	0.0004

A8: t Tests (LSD) for Color

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.396032
Critical Value of t	2.01808
Least Significant Difference	0.4637

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	5.6667	15	242
A			
A	5.5333	15	352
A			
A	5.5333	15	739
B	4.8667	15	813

A9: t Tests (LSD) for Appearance

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.377778
Critical Value of t	2.01808
Least Significant Difference	0.4529

Means with the same letter are not significantly different.

t Grouping		Mean	N	Trt
	A	6.0667	15	242
	A			
B	A	5.8000	15	352
B	A			
B	A	5.7333	15	739
B				
B		5.4000	15	813

A10: t Tests (LSD) for Flavor

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.702381
Critical Value of t	2.01808
Least Significant Difference	0.6176

Means with the same letter are not significantly different.

t Grouping		Mean	N	Trt
	A	5.9333	15	352
	A			
B	A	5.3333	15	739
B				
B		5.1333	15	813
B				
B		4.7333	15	242

A11: t Tests (LSD) for Taste

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.756349
Critical Value of t	2.01808

Least Significant Difference 0.6409

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	5.8667	15	352
B	5.1333	15	739
B			
B	5.0000	15	813
B			
B	4.5333	15	242

A12: t Tests (LSD) for Texture

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.452381
Critical Value of t	2.01808
Least Significant Difference	0.4956

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	6.0667	15	242
A			
A	6.0000	15	352
A			
A	5.8000	15	739
A			
A	5.6000	15	813

A13: t Tests (LSD) for Aftertaste

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha 0.05
Error Degrees of Freedom 42
Error Mean Square 0.654762
Critical Value of t 2.01808
Least Significant Difference 0.5963

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	5.9333	15	352
B	5.3333	15	813
B			
B	5.2000	15	739
C	4.1333	15	242

A14: t Tests (LSD) for overall liking

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha 0.05
Error Degrees of Freedom 42
Error Mean Square 0.537302
Critical Value of t 2.01808
Least Significant Difference 0.5402

Means with the same letter are not significantly different.

t Grouping		Mean	N	Trt
	A	6.2000	15	352
	A			
B	A	5.7333	15	739
B				
B	C	5.2000	15	813
	C			
	C	5.0667	15	242

PART B: ROSE ICECREAM

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Block	15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Trt	4	164 420 786 832

Number of Observations Read 60
Number of Observations Used 60

B1: Color

The ANOVA Procedure

Dependent Variable: Color

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	124.6333333	7.3313725	7.20	<.0001
Error	42	42.7666667	1.0182540		
Corrected Total	59	167.4000000			

R-Square	Coeff Var	Root MSE	Color Mean
0.744524	16.54239	1.009086	6.100000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	123.9000000	8.8500000	8.69	<.0001
Trt	3	0.7333333	0.2444444	0.24	0.8679

B2: Appearance

The ANOVA Procedure

Dependent Variable: App

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	154.4166667	9.0833333	8.56	<.0001
Error	42	44.5666667	1.0611111		
Corrected Total	59	198.9833333			

R-Square	Coeff Var	Root MSE	App Mean
0.776028	17.70950	1.030102	5.816667

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	144.2333333	10.3023810	9.71	<.0001
Trt	3	10.1833333	3.3944444	3.20	0.0329

B3: Flavor

The ANOVA Procedure

Dependent Variable: Flavor

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	175.0500000	10.2970588	7.00	<.0001
Error	42	61.8000000	1.4714286		
Corrected Total	59	236.8500000			

R-Square	Coeff Var	Root MSE	Flavor Mean
0.739075	21.85630	1.213025	5.550000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	172.6000000	12.3285714	8.38	<.0001
Trt	3	2.4500000	0.8166667	0.56	0.6476

B4: Taste

The ANOVA Procedure

Dependent Variable: Taste

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	158.5333333	9.3254902	4.95	<.0001
Error	42	79.0666667	1.8825397		
Corrected Total	59	237.6000000			

R-Square	Coeff Var	Root MSE	Taste Mean
0.667228	22.12995	1.372057	6.200000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	145.6000000	10.4000000	5.52	<.0001
Trt	3	12.9333333	4.3111111	2.29	0.0922

B5: Texture

The ANOVA Procedure

Dependent Variable: Texture

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	193.4500000	11.3794118	6.50	<.0001
Error	42	73.5333333	1.7507937		
Corrected Total	59	266.9833333			

R-Square	Coeff Var	Root MSE	Texture Mean
0.724577	24.13086	1.323176	5.483333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	178.7333333	12.7666667	7.29	<.0001
Trt	3	14.7166667	4.9055556	2.80	0.0514

B6: Aftertaste

The ANOVA Procedure

Dependent Variable: Aftertaste

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	390.1666667	22.9509804	31.95	<.0001
Error	42	30.1666667	0.7182540		
Corrected Total	59	420.3333333			

R-Square	Coeff Var	Root MSE	Aftertaste Mean
0.928232	14.52855	0.847499	5.833333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	385.8333333	27.5595238	38.37	<.0001
Trt	3	4.3333333	1.4444444	2.01	0.1270

B7: Overall Liking

The ANOVA Procedure

Dependent Variable: OL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	136.9333333	8.0549020	5.46	<.0001
Error	42	62.0000000	1.4761905		
Corrected Total	59	198.9333333			

R-Square	Coeff Var	Root MSE	OL Mean
0.688338	19.80955	1.214986	6.133333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	130.9333333	9.3523810	6.34	<.0001
Trt	3	6.0000000	2.0000000	1.35	0.2697

B8: t Tests (LSD) for Color

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	1.018254
Critical Value of t	2.01808
Least Significant Difference	0.7436

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	6.2667	15	164
A			
A	6.1333	15	786
A			
A	6.0000	15	420
A			
A	6.0000	15	832

B9: t Tests (LSD) for Appearance

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	1.061111
Critical Value of t	2.01808
Least Significant Difference	0.7591

Means with the same letter are not significantly different.

t Grouping Mean N Trt

A	6.4667	15	786
A			
B A	5.8667	15	164
B			
B	5.5333	15	832
B			
B	5.4000	15	420

B10: t Tests (LSD) for Flavor

The ANOVA Procedure

t Tests (LSD) for Flavor

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	1.471429
Critical Value of t	2.01808
Least Significant Difference	0.8939

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	6.3667	15	786
A			
B A	5.6667	15	832
B A			
B A	5.4667	15	164
B			
B	5.2667	15	420

B11: t Tests (LSD) for Taste

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	1.88254
Critical Value of t	2.01808
Least Significant Difference	1.0111

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	6.6667	15	786
A			
B A	6.2000	15	164
B A			
B A	6.0000	15	832
B			
B	5.5333	15	420

B12: t Tests (LSD) for Texture

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	1.750794
Critical Value of t	2.01808
Least Significant Difference	0.975

Means with the same letter are not significantly different.

Grouping	Mean	N	Trt
A	6.2000	15	786
A			
B A	5.8000	15	832
B A			
B A	5.4667	15	164
B A			
B A	5.4667	15	420

B13: t Tests (LSD) for Aftertaste

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.718254
Critical Value of t	2.01808
Least Significant Difference	0.6245

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	6.1333	15	786
A			
A	6.0667	15	164
A			
A	5.6000	15	832
A			
A	5.5333	15	420

B14: t Tests (LSD) for Overall Liking

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	1.47619
Critical Value of t	2.01808
Least Significant Difference	0.8953

Means with the same letter are not significantly different.

t Grouping		Mean	N	Trt
	A	6.2667	15	786
	A			
B	A	5.9333	15	832
B	A			
B	A	5.9333	15	420
B				
B		5.5667	15	164

PART C: CHRYSANTHEMUM ICECREAM

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Block	15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Trt	4	357 489 569 572

Number of Observations Read	60
Number of Observations Used	60

C1: Color

The ANOVA Procedure

Dependent Variable: Color

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	153.1500000	9.0088235	19.21	<.0001
Error	42	19.7000000	0.4690476		
Corrected Total	59	172.8500000			

R-Square	Coeff Var	Root MSE	Color Mean
0.886028	13.83577	0.684871	4.950000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	149.1000000	10.6500000	22.71	<.0001
Trt	3	4.0500000	1.3500000	2.88	0.0472

C2: Appearance

The ANOVA Procedure

Dependent Variable: App

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	119.6166667	7.0362745	11.71	<.0001
Error	42	25.2333333	0.6007937		
Corrected Total	59	144.8500000			

R-Square	Coeff Var	Root MSE	App Mean
0.825797	13.96592	0.775109	5.550000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	118.1000000	8.4357143	14.04	<.0001
Trt	3	1.5166667	0.5055556	0.84	0.4789

C3: Flavor

The ANOVA Procedure

Dependent Variable: Flavor

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	97.0833333	5.7107843	6.01	<.0001
Error	42	39.9000000	0.9500000		
Corrected Total	59	136.9833333			

R-Square	Coeff Var	Root MSE	Flavor Mean

0.708724	17.77531	0.974679	5.483333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	90.23333333	6.44523810	6.78	<.0001
Trt	3	6.85000000	2.28333333	2.40	0.0810

C4: Taste

The ANOVA Procedure

Dependent Variable: Taste

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	112.6833333	6.6284314	8.21	<.0001
Error	42	33.9000000	0.8071429		
Corrected Total	59	146.5833333			

R-Square	Coeff Var	Root MSE	Taste Mean
0.768732	17.67366	0.898411	5.083333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	103.8333333	7.4166667	9.19	<.0001
Trt	3	8.8500000	2.9500000	3.65	0.0198

C5: Texture

The ANOVA Procedure

Dependent Variable: Texture

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	115.7666667	6.8098039	10.15	<.0001
Error	42	28.1666667	0.6706349		
Corrected Total	59	143.9333333			

R-Square	Coeff Var	Root MSE	Texture Mean
0.804308	15.25944	0.818923	5.366667

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	113.4333333	8.1023810	12.08	<.0001
Trt	3	2.3333333	0.7777778	1.16	0.3364

C6: Aftertaste

The ANOVA Procedure

Dependent Variable: Aftertaste

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	100.5833333	5.9166667	7.09	<.0001
Error	42	35.0666667	0.8349206		
Corrected Total	59	135.6500000			

R-Square	Coeff Var	Root MSE	Aftertaste Mean
0.741492	17.74252	0.913740	5.150000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	84.40000000	6.02857143	7.22	<.0001
Trt	3	16.18333333	5.39444444	6.46	0.0011

C7: Overall Liking

The ANOVA Procedure

Dependent Variable: OL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	76.7833333	4.5166667	5.77	<.0001
Error	42	32.8666667	0.7825397		
Corrected Total	59	109.6500000			

R-Square	Coeff Var	Root MSE	OL Mean
0.700258	16.53482	0.884613	5.350000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Block	14	67.40000000	4.81428571	6.15	<.0001
Trt	3	9.38333333	3.12777778	4.00	0.0137

C8: t Tests (LSD) for Color

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.469048
Critical Value of t	2.01808
Least Significant Difference	0.5047

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	5.2000	15	357
A			
A	5.2000	15	572
A			
B A	4.8000	15	569
B			
B	4.6000	15	489

C9: t Tests (LSD) for Appearance

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.600794
Critical Value of t	2.01808
Least Significant Difference	0.5712

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	5.7333	15	357
A			
A	5.6667	15	572

t Grouping	Mean	N	Trt
A			
A	5.4667	15	569
A			
A	5.3333	15	489

C10: t Tests (LSD) for Flavor

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.95
Critical Value of t	2.01808
Least Significant Difference	0.7182

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	5.9000	15	569
A			
A	5.8000	15	357
A			
B A	5.3333	15	489
B			
B	5.0000	15	572

C11: t Tests (LSD) for Taste

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.807143
Critical Value of t	2.01808
Least Significant Difference	0.662

Means with the same letter are not significantly different.

t Grouping		Mean	N	Trt
	A	5.5333	15	569
	A			
	A	5.3333	15	357
	A			
B	A	4.9333	15	489
B				
B		4.5333	15	572

C12: t Tests (LSD) for Texture

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.670635
Critical Value of t	2.01808
Least Significant Difference	0.6035

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	5.6000	15	357
A			
A	5.3000	15	572
A			
A	5.0667	15	569
A			
A	5.0667	15	489

C13: t Tests (LSD) for Aftertaste

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.834921
Critical Value of t	2.01808

Least Significant Difference 0.6733

Means with the same letter are not significantly different.

t Grouping	Mean	N	Trt
A	5.8000	15	569
A			
A	5.6000	15	357
A			
A	5.0667	15	489
B	4.3333	15	572

C14: t Tests (LSD) for Overall Liking

The ANOVA Procedure

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	42
Error Mean Square	0.78254
Critical Value of t	2.01808
Least Significant Difference	0.6519

Means with the same letter are not significantly different.

t Grouping		Mean	N	Trt
	A	5.9667	15	596
	A			
B		5.5000	15	357
B				
B	C	5.0000	15	489
	C			
	C	4.7667	15	572

PART D: CALCULATIONS

I. Calculation of price of chrysanthemum ice cream

Ingredients	Cost
3 Eggs	12 Baht
120 g Sugar	2.88 Baht (24.00 Baht/1000g Sugar)
250 ml Whipped cream	42 Baht (168 baht/1000 ml Foremost)
500 ml Full fat milk	15 Baht (60 Baht/2000 ml Pasteurized Milk Chokchai)
Total	71.88 Baht
+ 35% Production	25.16 Baht
+ 20% Promotion	14.37 Baht
Total	111.41 Baht/Batch

1 Batch ice cream => 870 g = 111.41 Baht

=> 1 g of ice cream = 0.128 baht

1 Scoop ice cream (Reference: Walls) = 55 g

1 Scoop of chrysanthemum ice cream = 55 x 0.128

= 7.04 Baht/scoop

1 Batch can produce 15.8 scoops ~ 15 scoops

II. Determination of %overrun of chrysanthemum ice cream

$$\% \text{ Overrun} = \frac{\text{Volume of ice cream} - \text{Volume of mix}}{\text{Volume of mix}} \times 100$$

$$= \frac{15.0\text{ g} - 12.21\text{ g}}{12.21.\text{g}} \times 100$$

$$= 22.85\%$$