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CONSUMER PREFERENCE OF VANILLA ICE CREAM

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CONSUMER PREFERENCE OF VANILLA ICE CREAM

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Agriculture, Food and Environment
at the University of Kentucky

By

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Chicago, Illinois

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ABSTRACT OF THESIS

CONSUMER PREFERENCE OF VANILLA ICE CREAM

Consumers have a variety of ice cream available for purchase through retail stores, including: standard commercial, specialty store, organic, and premium commercial options. This study used a sensory analysis to solicit responses from a group of adults to determine consumer preference and acceptance of four vanilla ice creams based on taste. Consumers preferred (i) organic ice cream to standard, commercial ice cream and (ii) specialty store ice cream to standard, commercial ice cream. Additionally, consumers could identify (i) the organic ice cream when compared to the standard, commercial ice cream and (ii) the premium, commercial ice cream had more overrun than the standard, commercial ice cream. Despite the preference for organic ice cream, it was unable to be determined if consumers were willing to pay a higher price for perceived higher quality organic ice cream. This research was unable to determine if organic ice creams offer additional nutritional benefits as compared to non-organic ice cream, but nutritional analysis was performed, and further research is warranted.

Keywords: Ice Cream, Vanilla, Organic vs. Non-Organic, Sensory Analysis, Nutrition

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December 2018

CONSUMER PREFERENCE OF VANILLA ICE CREAM

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Chapter 1: Introduction

Background

Ice cream is a sweet flavored food containing butterfat or cream and usually contains eggs (1). This cold, sweet flavored dessert is enjoyed by many and often associated with parties, holidays, and warm weather. According to the Simmons National Consumer Survey and United States Census data, 290.19 million Americans consumed ice cream and sherbet in 2018 (2). The average American eats more than 23 pounds of ice cream (3). While U.S. consumption at 23 pounds per capita was significant, it was discovered New Zealanders consume the most ice cream in the world at 23 liters (50.6 pounds) per capita per annum (4).

Vanilla is the most popular ice cream flavor consumed, but is not considered a healthy food due to its high fat and high sugar content (5, 6). Overconsumption of high fat and high sugar foods, such as ice cream, has resulted in 71.6% of the U.S. population being overweight or obese as of 2015-2016 (7). As a result of the obesity epidemic there is an increase in health awareness. This increased health awareness has led to the introduction of perceived healthier ice cream options, such as smaller servings of frozen novelties, organic options, nondairy varieties, and packaged frozen yogurt (6). In 2018, nonfat and low-fat ice cream varieties are estimated to comprise 10.4% of the ice cream industry revenue (6).

The ice cream industry, which includes large national brands all the way to small producers, contributes more than $39.0 billion to the United States national economy (5). In 2017, the United States produced 901,733,000 gallons of regular ice cream and 459,814,000 gallons of low-fat ice cream, and sales in the ice cream market

have been increasing (8). From October 2016 to October 8, 2017, ice cream and sherbet sales were $6.8 billion (9). This 2.7% increase was reported by Information Resources, Inc., a leading provider of retail data (9). One market research company estimates the industry will deliver a 4.1% compound annual growth rate (CAGR) from 2018 to 2023 (10). Ice cream consumption is so popular that it is celebrated on National Ice Cream Day, the third Sunday in July.

As the overweight and obesity epidemic worsens, but the ice cream market continues to improve, an increased awareness is needed to help consumers make informed food choices. It is known, the overconsumption of calories and excess sugar is closely linked with weight gain and other diet related conditions, so every year during the month of March, the Academy of Nutrition and Dietetics conducts the National Nutrition Month campaign for educational purposes. National Nutrition Month focuses on educating consumers to make informed food choices, developing sound eating habits, and introducing positive physical activity habits (11). Health and wellness professionals have continued to provide consumers with the ability to make informed food choices, and industry groups have also attempted to persuade manufacturing companies to create foods that appeal to health-conscious consumers.

Problem Statement

The number of vanilla ice cream options in a grocery store is substantial. In this researcher's large metropolitan grocery store in the Lincoln Park neighborhood of Chicago, Illinois there were thirty-six variations of vanilla ice cream to purchase. Variations included: homemade, natural, full-fat, reduced-fat, low-fat, light, no-sugar added, organic, French vanilla, vanilla bean, and extra creamy. The thirty-six

variations did not include vanilla flavored frozen yogurt, gelato, or lactose-free frozen desserts that may appeal to lactose-intolerant individuals. Due to the high variety of options, consumers can be overwhelmed to select an ice cream for purchase. This overwhelming sensation may result in the consumer repeatedly selecting the same brand without sampling another for fear of a lesser flavorful option. Investigation into ice cream differences and consumer flavor preferences of vanilla ice cream options would provide the food industry and sensory researchers with valuable information.

Purpose

The large number of vanilla ice creams at a grocery store, convenience store, specialty ice cream shop, or restaurant is overwhelming. Consumers may not have the time nor energy to select the ice cream they prefer the most. An investigation of flavor profiles and preferences of varying test subject demographics may encourage consumers to try different options. The purpose of this study is to determine consumer acceptance and preference of standard, premium, organic, and specialty store vanilla ice creams utilizing sensory analysis testing. This information will help manufacturers market to health-conscious consumers and allow suppliers to adjust their inventory to maximize sales based on consumer preferences.

Research Questions

1) Do consumers have preference to commercial non-organic ice cream or organic ice cream?
2) Do consumers have a preference for commercial ice cream or specialty shop ice cream?
3) Are consumers able to distinguish between commercial non-organic and organic ice cream in a blind taste test?
4) Are consumers able to tell a difference in overrun between standard, commercial and premium, commercial ice cream?
5) Are consumers willing to pay a higher price for perceived higher quality ice cream?
6) Do organic ice creams offer additional nutritional benefits as compared to commercial non-organic ice cream?

Hypothesis

1) Consumers have a preference to organic ice cream.
2) Consumers have a preference to commercial ice cream.
3) Consumers are able to distinguish between organic ice cream and commercial ice cream.
4) Consumers are able to distinguish a difference in overrun between standard, commercial and premium, commercial ice cream.
5) Consumers are willing to pay a higher price for a freshly made ice cream than frozen ice cream.
6) Organic ice cream does not provide additional nutritional benefits.

Justification

A large number of consumers enjoy frozen desserts, especially ice cream. Consumers can select from an abundance of ice cream varieties and flavors. Consumers of ice cream continue to seek great tasting products, but at the same time have shifted their focus to healthy options. This research is intended to continue providing consumers with the ice cream they enjoy, while giving manufacturers insight into consumer preference so they can focus research and development on new products that broaden availability of healthier ice cream options with the same taste consumers enjoy.

Chapter 2: Literature Review

Ice Cream

According to the United States Food and Drug Administration (U.S. FDA), ice cream is a combination of milkfat, nonfat milk solids, and water (12). The composition of ice cream varies based on where it is created, but there are standards for its composition. In the United States, the U.S. Government standards define ice cream as containing at least 10% milkfat, 20% total milk solids, and minimum weight of 0.54 kg per liter or 4.5 lbs. per gallon (6, 13, 14). In the United Kingdom, frozen food items are required to contain at least 5% fat and 2.5% milk protein (14).

In recent years, sales of standard ice cream have been declining due to increased consumer preference for premium and specialty ice creams (10). The difference between standard and premium ice cream is the amount of overrun, or air added during production. Frozen dessert products have air added to the mix during food production and overrun is the calculated percent volume increase of the added

air (15). The manufacturing of vanilla ice cream uses the following equation (Figure 1) for determining overrun by volume for no particulates (15):

Figure 1. Ice Cream Overrun Calculation by Volume for No Particulates

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

Standard ice cream meets the federal amount of overrun required for ice cream, and premium ice cream has lower overrun, less air, and higher fat content than standard ice cream (3).

Over the next five years, regular ice cream sales are expected to continue declining at an annualized rate of 0.6% to $8.4 billion (5). Despite a fall in regular ice cream sales, an increase is expected for premium ice cream (5). The expected increase for premium ice cream is driven by development of innovative flavors, more super premium options, smaller single serve portions, and nutritious frozen treats (5).

Health-Conscious Consumers

Ice cream is not typically considered a healthy food due to its high sugar and high fat content; nonetheless, consumers still desire to consume ice cream. New alternatives to ice cream are being created that are considered healthier options for the increasing number of health-conscious Americans. Healthier options are being created so individuals can still consume ice cream while (i) trying to lose weight, (ii) suffering from a medical condition that impacts ice cream consumption, such as lactose intolerance, (iii) suffering from food allergies, or (iv) choosing to follow an organic diet.

Overweight and Obesity Epidemic

According to the U.S. Centers for Disease Control and Prevention (CDC), in 2015-2016, 71.6% of U.S. adults aged 20 and older were overweight and 39.8% of those individuals were obese (7). Overweight is considered to have a body mass index (BMI) of 25.0-29.9 and obese is 30.0 or higher (16). BMI is calculated for adults and is a measure of body fat based on height and weight (17). A BMI in the overweight or obesity range puts an individual at risk for cardiovascular disease, gallstones, high blood pressure, joint problems, and type 2 diabetes (18). To help combat an increase in weight, Americans often attempt weight loss regimens. Between 2013 and 2016, a study found 49% of Americans had attempted to lose weight within the 12 months prior to taking the survey (19). The highest demographic groups that attempted weight loss include: females, adults age 40-59, high income individuals, white, black, and Hispanic adults (19). A significant percentage – 66.7% of obese adults, 49.0% of overweight adults, and 26.5% of underweight or normal weight adults – attempted to lose weight from 2013-2016 (19).

Lactose Intolerance

Lactose intolerance is the body's inability to break down lactose into glucose and galactose; this inability is caused by the body's failure to produce adequate amounts of the enzyme lactase (20-22). It is estimated thirty to fifty million Americans (21) and 65% of the global population have a form of lactose intolerance (20, 21). Infants can be born with lactose intolerance or the condition can develop in adulthood (20). Lactose malabsorption increases with age, and is more prevalent in older adults than younger adults (23-25). Research suggests there is a genetic

component based on the prevalence of lactose intolerance in specific populations. The following ethnicities are most commonly impacted: 80-100% of American Indians, 90% of Asians, 60-80% of African Americans and Ashkenazi Jews, 60-80% of Hispanics, and only 2-5% of northern Europeans (20, 21). A self-reported study in Canada, found that 16% of the survey population experienced lactose intolerance (26). There are three types of lactose intolerance: congenital lactase deficiency, primary lactose intolerance, and secondary lactose intolerance (21). Congenital lactase deficiency is present at birth and is the body's inability to make any lactase due to a mutation in the LCT gene; galactosemia is an example (20). Finland has the highest incidence rate and this condition is estimated to affect 1 in 60,000 newborns (20). Individuals with primary lactose intolerance were once able to digest lactose, but developed digestive discomfort symptoms overtime and do not have an underlying intestinal disease (21). Symptoms include: abdominal pain, bloating, diarrhea, flatulence, and borborygmic (21, 26). Secondary lactose intolerance is caused by a gastrointestinal disease (21). Lactose intolerance symptoms are subjective from person to person and can change over time.

Organic Food

Organic has several definitions; according to *Merriam-Webster's Dictionary*, organic is "of, relating to, yielding, or involving the use of food produced with the use of feed or fertilizer of plant or animal origin without employment of chemically formulated fertilizers, growth stimulants, antibiotics, or pesticides" (27). In the past twenty years (1997-2017), organic sales (both non-food and food sales) have increased from $3.6 billion to $49.4 billion (28, 29). In 2017, $45.2 billion of the $49.4

billion industry was contributed by the organic food market (28). In the U.S., the organic food market increased by 6.4% from 2016 to 2017 (28) to represent 5.5% of total retail food sales (30). All demographics include purchasers of organic food, but one study indicated females, young people, and liberal- to moderately-religious respondents were more likely to purchase organic food (31). According to the Organic Trade Commission, 82% of U.S. households buy organic food, 14% of produce is sold organic, and 8% of all dairy products are sold organic (30). Food is labeled organic by obtaining a United States Department of Agriculture (USDA) certified seal which requires at least 95% organic content (32). Due to the prevalence of preservatives in food, ice cream included, 68% of consumers state they are willing to pay more for food and beverages that do not contain objectionable ingredients (33). Organic food was found to be 47% more expensive than commercial foods in 2015 (34).

Healthy Ice Cream and Alternatives

Due to the overweight and obesity epidemic, frequency of lactose intolerance, and personal choice to follow an organic diet, food manufacturers have an opportunity to create new ice creams that tailor to these consumer preferences. Healthier options, such as smaller servings of frozen novelties, increased organic options, increased nondairy varieties, and packaged frozen yogurt are being created (6). In 2018, nonfat and low-fat ice cream varieties are estimated to comprise 10.4% of the ice cream industry revenue (6). Another option to increase the nutritional value of ice cream is to alter or add items to the ice cream ingredient list. One study replaced the sugar in ice cream with stevia, an alternative natural sweetener. The

results found that stevia lowered the melting rate and therefore lasted longer in the mouth than typical ice cream, while also providing fewer calories (35). Other studies have attempted to alter ice cream by adding probiotics, enriching with spirulina powder, adding dietary fiber, adding whey and whey products, or substituting vegetable milk (36). One company has created vegan ice cream and vegan frozen treats (37). Other popular brands, such as Halo Top®, are also developing vegan ice creams for sale.

Halo Top® is a low-calorie ice cream and is the best-selling pint of ice cream in the United States (38). From 2016 to 2017, U.S. sales increased 691%, from $44.3 million to $350.6 million, in part due to consumers seeking healthier ice cream options.

Vanilla Ice Cream Popularity

Vanilla is the most popular ice cream, followed by chocolate, cookies n' cream, mint chocolate chip, and chocolate chip cookie dough, in descending order (5, 6). Vanilla ice cream is typically flavored with real vanilla or vanilla extract. There are four main types of vanilla bean, named for where it is grown: Bourbon Vanilla, Tahitian Vanilla, Indonesian Vanilla, and Mexican Vanilla. Bourbon vanilla is known for a sweet, rum-like flavor; Tahitian Vanilla is known for floral characteristics; Indonesian Vanilla is known for smoky characteristics; and Mexican Vanilla is known for spicy and woody characteristics (39). 80% of the world's vanilla bean supply is harvested in Madagascar (40, 41). Madagascar has experienced a decline in production of vanilla beans, primarily due to the impact of Cyclone Enawo which devastated Madagascar in March 2017. Due to declining supply and increased

demand for vanilla beans, prices increased 2900% from $20 per kilogram in 2013 to a peak of over $600 per kilogram in 2018 (6, 40-42). The sharp increase in vanilla beans, a key ingredient in vanilla ice cream, may cause manufacturers to increase the cost of ice cream to offset the raw material price impact. Accordingly, consumers may currently or in the future experience an increase in the retail price of vanilla ice cream.

Sensory Analysis

Sensory analysis is defined as "a scientific discipline used to evoke, measure, analyze, and interpret those responses to products that are perceived by the senses of sight, smell, touch, taste, and hearing" (43). Sensory analysis is a method to provide answers to questions regarding product quality or questions concerning descriptive, discrimination, or preference (44).

Two types of sensory analysis testing exist: objective testing and subjective testing (45). The two types of sensory analysis testing are often referred to as analytical tests and affective tests (46). Objective or analytical testing uses a selected or trained panel to evaluate a product's sensory attributes, while subjective or affective testing uses consumers reactions to measure a product's sensory properties (44, 46).

Two types of analytical tests exist: difference / discriminative test or descriptive test (46). The purpose of a sensory difference test is to detect discernible differences in testing samples, and two kinds of difference tests exist: overall and attribute (46). Overall difference tests are simpler than attribute difference tests and include the triangle test and duo-trio test (46). Attribute difference tests are

performed to detect a difference in a single attribute; this test utilizes a paired comparison test, ranking test, and rating difference test (46). Descriptive tests are the most informative and comprehensive sensory analysis test and require a trained and often expensive panel and should not be utilized by untrained consumers due to lack of consistent and reproducible data (46).

Two types of affective tests exist: acceptance test or preference test (46). Acceptance testing uses an application of a rating acceptance test that will compare acceptance of two samples or more than two samples (46). Whereas, preference testing uses an application of a paired preference test for two samples and the application of a ranking preference test for more than two samples (46). The main purpose of the acceptance test is to rate the samples and the main purpose of the preference test is determining favorite choice (46).

Chapter 3: Methods

Participant Sample

A consumer panel was recruited for the study. The researcher recruited participants by asking college professors, work place managers, and local organizations for participants. Test subjects were recruited from large metropolitan areas due to the higher likelihood of the subjects being exposed, on a frequent basis, to organic, commercial, and specialty shop ice creams. Test subjects covered a wide range of demographics. Examples of specific groups represented included: college students, new and experienced parents, unmarried individuals, and working professionals in variety fields of employment. Test subjects with at least one dietary

restriction or potential allergic reaction to ice cream makeup were excluded from participant tasting and statistical analysis.

The researcher generated a Research Electronic Data Capture (REDCap) account. "Study data were collected and managed using REDCap electronic data capture tools hosted at the University of Kentucky (47). REDCap is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources" (47).

Four types of vanilla ice cream were used for the study. Three vanilla ice creams were purchased from local grocery stores: premium commercial vanilla ice cream, standard commercial vanilla ice cream, and organic vanilla ice cream. A fourth vanilla ice cream was purchased from a local specialty ice cream shop. The grocery stores, Mariano's (a large chain owned by Kroger) and Whole Foods Market, were selected due to familiarity of the researcher with the store and prevalence in the local market where the majority of subjects were surveyed. The local specialty ice cream shop is sold at its own store and not sold in grocery stores; it was selected due to its proximity to the grocery stores.

Survey Instrument

The survey instrument was investigator developed and not validated. It was provided to participants in a paper format to be completed during sampling. Participants were also given the opportunity to directly submit responses

electronically into REDCap via electronic mail. The survey instrument was a thirty-one-question survey and all questions were closed ended. The survey utilized a combination of multiple choice, ordering / ranking, and comparison question types. The participants were asked about their preference of ice creams using a Likert-type scale. The survey was separated into three sections: 1) tasting information, 2) purchasing information, and 3) demographics. A copy of the survey instrument is provided in Appendix A.

Informed consent of research participants was obtained as instructed and study protocol approved by the Institutional Review Board (IRB) at the University of Kentucky. To begin the survey, each participant was provided four ice cream samples. Each sample was placed in a unique individual container and paired with a unique tasting spoon. Each sample was provided a unique number; numbers were randomly assigned and no number repeated to decrease confusion during data entry. SAMPLE 15 was standard, commercial vanilla ice cream. SAMPLE 39 was specialty store vanilla ice cream. SAMPLE 62 was organic vanilla ice cream. SAMPLE 84 was premium, commercial vanilla ice cream.

Participants were provided an unopened eight-ounce bottle of unflavored water to rinse the mouth between samples. Prior research indicated mixed results if palate cleansing actually affects the taste of a sample; one article suggested it more likely mentally prepares us for the next sample rather than cleansing the palate (48). Participants did comment they appreciated the water to wash out their mouth between samples.

After completion of sampling, the researcher entered the paper survey responses into REDCap and statistical analysis was performed. Statistical analysis was completed utilizing the Microsoft Excel statistical software program. A nonparametric F-test was performed and if found to be significant, then a post-hoc multiple comparisons test was performed to determine 95% Bonferroni Confidence Intervals. Z-tests were used to compare two samples, a population mean to the sample's mean. A p-value of 0.05 or below was used to determine significance.

Chapter 4: Results

Demographics

Forty-nine participants completed the survey. One participant answered "Yes" to question number one indicating they had an allergy to a milk product or were told not to consume ice cream. The participant did not complete the sensory analysis. See Table 1.

Table 1. Determination of Acceptable Survey Participants

	N (n=49)	%
Yes, has allergy or unable to consume ice cream	1	2.0%
No, does not have allergy and is able to consume ice cream	48	98.0%

The sample consisted of thirty-five (72.9%) females, thirteen (27.1%) males, and one participant did not indicate gender. Thirteen participants were 18-24 years of age (26.5%), twenty-seven participants were 25-34 years of age (55.1%), three participants were 34-44 years of age (6.1%), and six participants were above 55 years

of age (12.2%). One participant identified as American Indian or Alaska Native (2.0%), one participant identified as Asian (2.0%), one participant identified as Hispanic (2.0%), and forty-seven participants identified as White (95.9%). Participants were able to identify with one or more race options. Thirty-one participants indicated their highest level of education as a Bachelor's degree (64.6%), fifteen participants a Master's degree (31.3%), two participants greater than a Master's degree (4.2%), and one participant did not indicate a level of education. Nineteen participants were single or never married (38.8%) and thirty participants were married or in a domestic partnership (61.2%). Thirteen participants were students (26.5%), twenty-eight participants were employed (57.1%), two participants were self-employed (4.1%), two participants were unemployed (4.1%), and four participants were retired (8.2%). Two participants used a type of tobacco (4.3%), forty-four participants did not use a type of tobacco (95.7%), and three participants did not indicate tobacco use. See Table 2 for participant demographics.

Table 2. Demographic Characteristics of Survey Participants

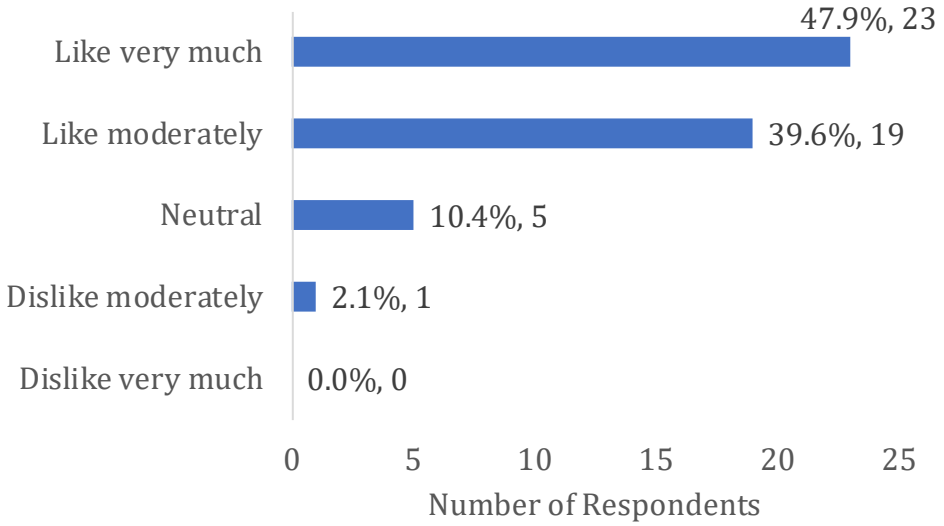
	N	%
Age (n=49)		
18-24	13	26.5%
25-34	27	55.1%
35-44	3	6.1%
45-55	0	0.0%
Above 55	6	12.2%
Gender (n=48)		
Female	35	72.9%
Male	13	27.1%
Race (n=50)		
American Indian or Alaska Native	1	2.0%
Asian	1	2.0%
Black/African American	0	0.0%
Hispanic	1	2.0%
Pacific Islander	0	0.0%
White	47	95.9%
Other	0	0.0%
Education Completion (n=48)		
Less than high school diploma	0	0.0%
High school diploma or equivalent degree	0	0.0%
Some college, no degree	0	0.0%
Bachelor's degree	31	64.6%
Master's degree	15	31.3%
Greater than master's degree	2	4.2%

Table 2. Demographic Characteristics of Survey Participants (continued)

	N	%
Marital Status (n=49)		
Single, never married	19	38.8%
Married or domestic partnership	30	61.2%
Divorced	0	0.0%
Separated	0	0.0%
Widowed	0	0.0%
Employment Status (n=49)		
Student	13	26.5%
Employed	28	57.1%
Self-Employed	2	4.1%
Unemployed	2	4.1%
Retired	4	8.2%
Tobacco Consumption (n=46)		
Yes, Do Consume Tobacco	2	4.3%
No, Do Not Consume Tobacco	44	95.7%

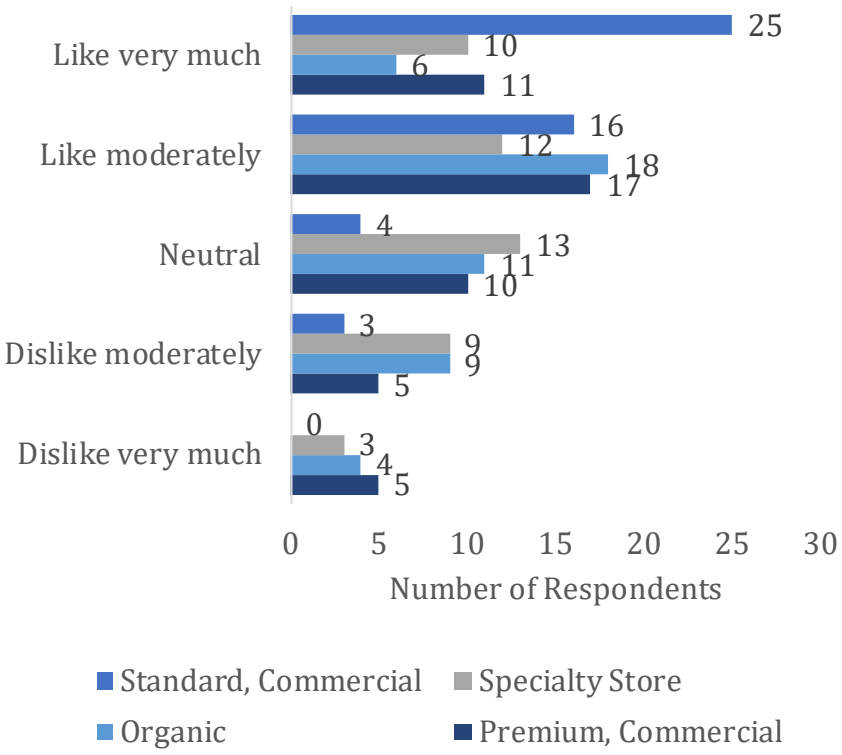
Prior to tasting the survey samples, participants were asked to indicate on a scale of "like very much" to "dislike very much" how well they enjoyed the experience of consuming vanilla ice cream. Forty-eight participants answered the question. Twenty-three (47.9%) indicated "like very much," nineteen (39.6%) indicated "like moderately," five (10.4%) indicated "neutral," one (2.1%) indicated "dislike moderately," and zero indicated "dislike very much." See Figure 2 for results.

Figure 2. Participant Level of Enjoyment Consuming Vanilla Ice Cream (n = 48)



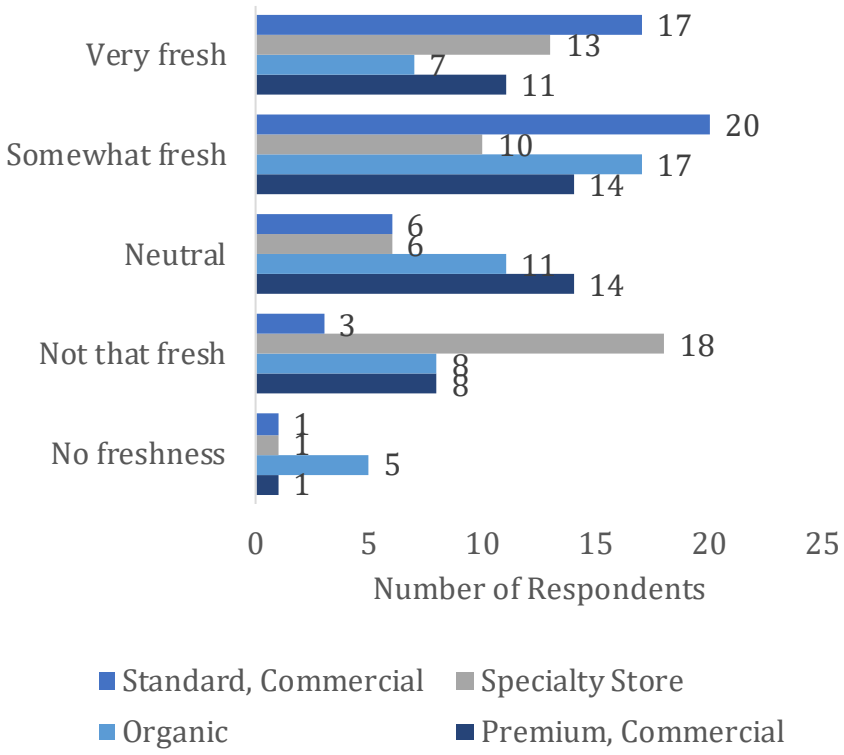
Participants answered a series of Likert-type scale questions to determine how well they liked the taste of vanilla ice cream and how fresh they believed the ice cream tasted. Factors affecting ice cream taste could include, but are not limited to: bitterness, freezer burn, temperature, and vanilla flavor. Factor affecting taste were included on the survey instrument. Questions determining how well participants liked the taste of vanilla ice cream utilized answers "like very much," "like moderately," "neutral," "dislike moderately," and "dislike very much." See Figure 3 for results.

Figure 3. Participant Indication of How Well They Like the Taste of Vanilla Ice Cream (n = 48)



Questions determining how fresh the vanilla ice cream tasted utilized answers "very fresh," "somewhat fresh," "neutral," "not that fresh," and "no freshness." See Figure 4 for results.

Figure 4. Participant Indication of How Fresh the Vanilla Ice Cream Tastes (n=48)



Subjects tasted and compared standard, commercial ice cream and organic ice cream and were asked to determine which was branded organic. Thirty subjects (62.5%) correctly selected the branded organic ice cream. See Table 3 for results.

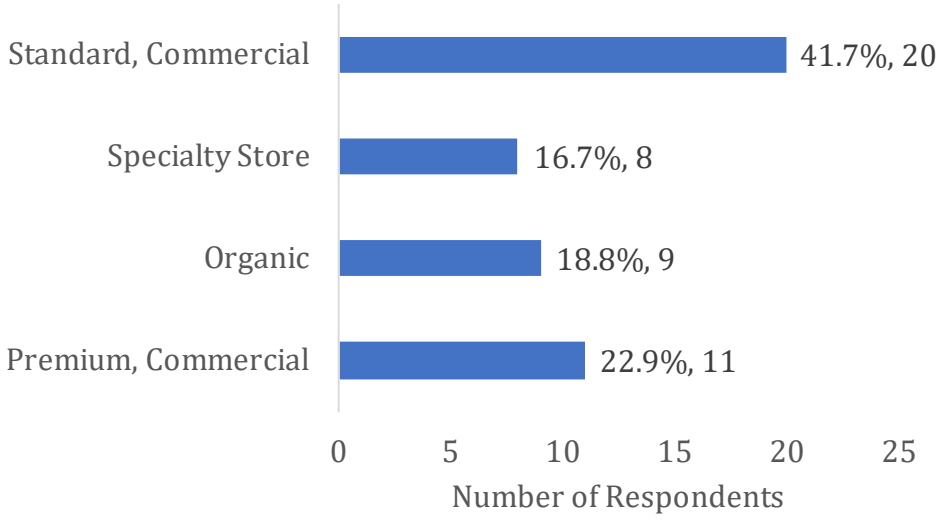
Table 3. Participant Selection When Asked to Determine Which Ice Cream Was Branded Organic

	N (n=48)	%
Standard, Commercial	18	37.5%
Organic	30	62.5%

A z-test was performed and there is evidence that participants could identify the organic ice cream was organic when compared to the standard, commercial ice cream (p-value: 0.038353).

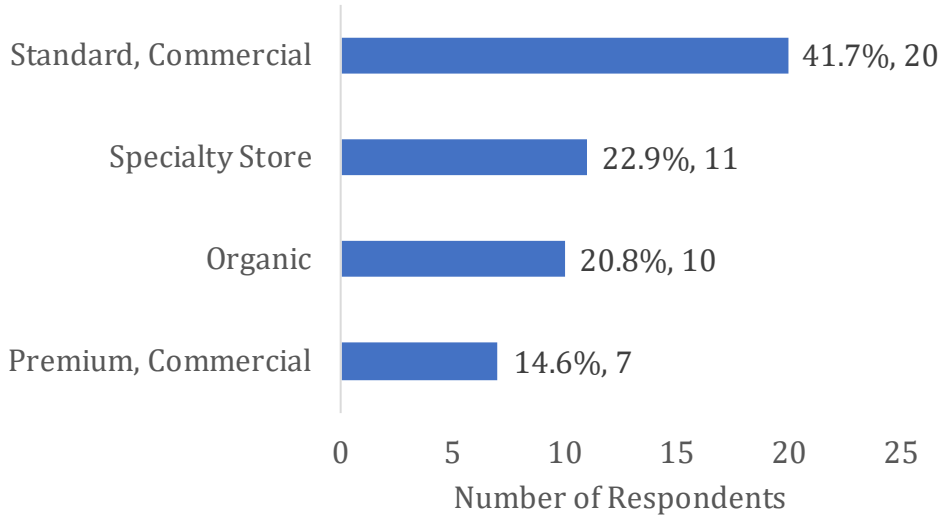
Subjects tasted four ice creams and ranked vanilla flavor. Twenty subjects (41.7%) indicated standard, commercial ice cream contained the most vanilla flavor, followed by premium, commercial ice cream (n=11, 22.9%), organic ice cream (n=9, 18.8%), and specialty store ice cream (n=8, 16.7%). See Figure 5 for results.

Figure 5. Participant Indication of Most Vanilla Flavored Ice Cream (n = 48)



Subjects tasted four ice creams and ranked them on flavor preference. Twenty subjects (41.7%) indicated standard, commercial ice cream as the most preferred sample, followed by specialty store ice cream (n=11, 22.9%), organic ice cream (n=10, 20.8%), and premium, commercial ice cream (n=7, 14.6%). See Figure 6 for results.

Figure 6. Overall Preference of Vanilla Ice Cream (n = 48)



A nonparametric rank F-test was performed to determine preference to commercial non-organic ice cream or organic ice cream. The F-test found consumers preferred organic ice cream to standard, commercial ice cream (F statistic: 4.931709, p-value: 0.002748). Post-hoc multiple comparisons were then performed. There was no difference in the ranking of organic ice cream compared to specialty store ice cream or premium, commercial ice cream. See Table 4 for results.

Table 4. 95% Bonferroni Confidence Intervals

Comparison	Confidence Interval	Significance
Standard, Commercial – Specialty Store	(-1.23029, -0.18637)	Yes
Standard, Commercial – Organic	(-1.25113, -0.20721)	Yes
Standard, Commercial – Premium, Commercial	(-1.41779, -0.37387)	Yes
Specialty Store – Organic	(-0.54279, 0.501128)	No
Specialty Store – Premium, Commercial	(-0.70946, 0.334462)	No
Organic – Premium, Commercial	(-0.68863, 0.355295)	No

Table 4 tells us that the ranking of standard, commercial ice cream is lower than specialty store ice cream, organic ice cream, or premium commercial ice cream.

The rankings of specialty store ice cream, organic ice cream, and premium, commercial ice cream were not significantly different.

A nonparametric rank F-test was performed to determine preference to commercial ice cream or specialty shop ice cream. The F-test found consumers preferred specialty shop ice cream to standard, commercial ice cream (F statistic: 4.931709, p-value: 0.002748). Post-hoc multiple comparisons were then performed. There was no difference in the ranking of specialty shop ice cream compared to organic ice cream or premium, commercial ice cream. See Table 4 for results.

Subjects tasted and compared standard, commercial ice cream and premium, commercial ice cream and were asked to determine which has more overrun. Thirty-one (64.6%) incorrectly selected the premium, commercial ice cream to have more overrun. See Table 5 for results.

Table 5. Participant Selection When Asked to Determine Which Ice Cream Had More Overrun

	N (n=48)	%
Standard, Commercial	17	35.4%
Premium, Commercial	31	64.6%

A z-test was performed and there is evidence that participants could not identify more overrun in standard, commercial ice cream compared to premium, commercial ice cream (p-value: 0.018288).

Subjects tasted and compared specialty store ice cream and premium, commercial ice cream and were asked to determine which had the higher price point. Twenty-seven subjects (56.3%) incorrectly indicated the specialty store ice cream

had a higher price point than the premium, commercial ice cream. See Table 6 for results.

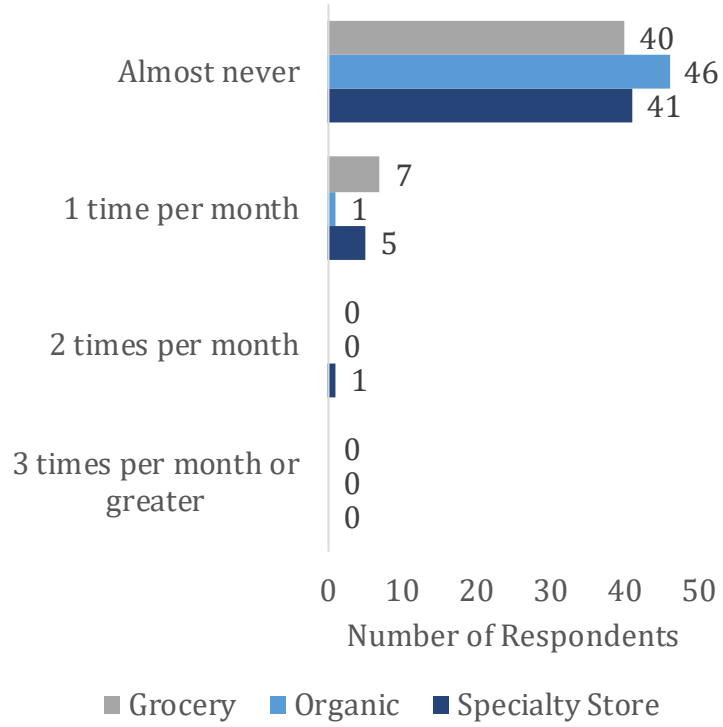
Table 6. Participant Selection when Asked to Determine Which Ice Cream Had a Higher Price Point

	N (n=48)	%
Specialty Store	27	56.3%
Premium, Commercial	21	43.8%

A z-test was performed and determined there is no evidence that participants could identify the difference between the price points (p-value: 0.193868).

Subjects were asked how often they purchase vanilla ice cream from the grocery store. Forty subjects (85.1%) indicated "almost never" and seven (14.9%) indicated "one time per month." Subjects were asked how often they purchase organic ice cream. Forty-six subjects (97.9%) indicated "almost never" and one (2.1%) indicated "one time per month." Subjects were asked how often they purchase ice cream from a specialty store. Forty-one subjects (87.2%) indicated "almost never," five (10.6%) indicated "one time per month," and one (2.1%) indicated "two times per month." See Figure 7 for results.

Figure 7. Purchase Frequency of Grocery, Organic, and Specialty Store Vanilla Ice Cream (n = 47)



Nutritional value was evaluated and compared for the four vanilla ice creams. Each nutrition label indicated a serving size of ½ cup, but the weight differed due to overrun. Comparison for this study was calculated at 66 grams each. The standard, commercial ice cream had the least number of calories, fat, calories from fat, saturated fat, trans fat, and cholesterol. Organic ice cream had the least amount of sodium. Premium, commercial had the least amount of carbohydrates and sugar. Premium, commercial and specialty store had the most protein at 3 grams per serving. Standard, commercial and specialty store had the most calcium at 8% of daily value for 2,000 calories per day diet for healthy adult. See Figure 8 for results.

Figure 8. Nutrition Facts Label Comparison of Four Ice Creams

Nutrition Facts

	Organic	Standard, Commercial	Premium, Commercial	Specialty Store
Serving Size (1/2 cup)	66g	66g	66g	66g
Calories	151	130	172	178
Calories from Fat	85	60	96	110
Total Fat	9g	7g	10g	12g
Saturated Fat	6g	4g	7g	7g
Trans Fat	0g	0g	0.3g	0g
Cholesterol	33mg	20mg	48mg	42mg
Sodium	28mg	35mg	34mg	47mg
Total Carbohydrate	16g	14g	13g	15g
Dietary Fiber	0g	0g	0g	0g
Sugars	13g	14g	12g	14g
Protein	2g	2g	3g	3g
Calcium	5%	8%	6%	8%

Chapter 5: Discussion

Summary

The purpose of this study was to determine consumer acceptance and preference of four different vanilla ice creams utilizing sensory analysis testing. This information will help manufacturers market to health-conscious consumers and allow suppliers to adjust their inventory to maximize sales based on consumer preferences. Objectives of this study were to determine, 1) consumers preference to commercial non-organic ice cream or organic ice cream, 2) consumer preference to commercial ice cream or specialty shop ice cream, 3) consumer ability to distinguish between commercial non-organic ice cream and organic ice cream, 4) consumer ability to distinguish a difference in overrun between standard, commercial ice cream and premium, commercial ice cream, 5) consumer willingness to pay a higher price

for perceived higher quality ice cream, and 6) if organic ice cream offers additional nutritional benefits as compared to non-organic ice cream.

Objective 1: *Do consumers have preference to commercial non-organic ice cream or organic ice cream?*

It was hypothesized consumers have a preference to organic ice cream. Statistical analysis indicated the hypothesis to be partially true. When the four ice creams were compared to each other in the taste testing, the standard, commercial ice cream had the most "number 1" selections, indicating it to be the most preferred among the samples, but statistical analysis determined consumers actually preferred organic ice cream to standard, commercial ice cream. When the organic ice cream was compared to the specialty store and premium, commercial ice cream, there was no ranking difference.

These results are aligned with previous research indicating there is a lack of research supporting a taste difference between organic foods and conventional foods. If a food manufacture wants to make an organic option, they now know consumers have a more difficult time deciphering between an organic and commercial option based on taste. There is limited evidence suggesting organic milk has higher omega-3 fatty acid levels (49, 50). The food industry would be better served to research omega-3 fatty acid levels in ice cream and then market organic ice cream to consumers if there is an increased level found.

Objective 2*: Do consumers have preference to commercial ice cream or specialty shop ice cream?*

It was hypothesized consumers have a preference to commercial ice cream. Statistical analysis indicated the hypothesis to be not true. As stated above, standard, commercial ice cream had the most "number 1" selections, indicating it to be the most preferred, but specialty store ice cream was the second most preferred ice cream. Statistical analysis determined consumers preferred the specialty store ice cream to standard, commercial ice cream. There was no difference in ranking of specialty store ice cream to organic or premium, commercial ice cream.

A 2018 ice cream industry report found that sales among small premium ice cream manufactures outperformed the ice cream industry as a whole, and the number of ice cream manufacturers increased by 2.5% from 2013 to 2018 (6). There were 424 ice cream manufacturers in the U.S. at the time the report was published (6). The increase in small premium manufacturers may be due to the increased prevalence of non-traditional ice cream flavors. The specialty ice cream shop utilized in this study sells forty different ice cream flavors in their shop. Traditional flavors are sold, but non-traditional flavors are lining the freezer shelves. Non-traditional flavors include: mango pomegranate, espresso caramel chip, dark chocolate sea salt caramel, and brandy. Large ice cream manufactures could increase their sales by creating more non-traditional flavors with the addition of fresh fruits or nuts, increasing their opportunity to reach health-conscious consumers.

Objective 3*: Are consumers able to distinguish between commercial non-organic and organic ice cream in a blind taste test?*

It was hypothesized that consumers would be able to distinguish organic ice cream from non-organic ice cream. Statistical analysis indicated the hypothesis to be

true. Thirty subjects (62.5%) of the survey sample correctly selected the organic ice cream. A z-test was performed and there is evidence that subjects could identify the organic ice cream when compared to the standard, commercial ice cream (p-value: 0.038353). It is difficult to determine how each subject selected the organic option. Taste is personal and subjective, and there is a lack of research supporting a taste difference between organic foods and non-organic foods. Subjects may have correctly distinguished between the commercial and organic ice cream through a process of elimination. The commercial non-organic ice cream is one of the highest selling ice creams. As discussed in Objective 1, if food manufacturers want to increase sales for organic ice cream, they should consider marketing other benefits of organic ice cream, such as possible increased omega-3 fatty acids (49, 50). Omega-3 fatty acids are polyunsaturated and essential fatty acids that must be consumed through food (51). They are beneficial for the heart; they decrease risk of arrhythmias, decrease triglyceride levels, lower blood pressure, reduce bad cholesterol levels, and slow growth rate of atherosclerotic plaque (51, 52). Fish is a good source of omega-3 fatty acids and appears to provide the most heart-healthy benefits, other sources include: canola oil, flaxseed, flaxseed oil, soybeans, soybean oil, and walnuts (52, 53). Research has been completed adding chia seeds, ground flaxseed, and microencapsulated fish oil to increase omega-3s in ice cream by replacing the milk fat (54, 55). For current manufactures of organic ice cream, further research and development should be considered to adding omega-3 fatty acids to ice cream.

Objective 4*: Are consumers able to distinguish a difference in overrun between standard, commercial and premium, commercial ice cream?*

It was hypothesized consumers would be able to distinguish a difference in overrun between standard, commercial and premium, commercial ice cream. Statistical analysis determined the hypothesis to be not true. Only 35.4% of the survey sample correctly identified the standard, commercial ice cream to have more overrun than the premium, commercial ice cream. A z-test was performed and determined there is evidence (p-value: 0.018288) that survey participants could not identify more overrun in the standard, commercial ice cream when compared to the premium, commercial ice cream. Premium ice cream has a higher fat content, lower overrun, weighs more, and often uses higher quality ingredients than standard ice cream (3). The premium, commercial ice cream in this study weighed ninety-six grams and contained fifteen grams of fat per one-half cup and the standard, commercial ice cream weighed sixty-six grams and contained seven grams of fat per one-half cup. Figure 9 compares standard, commercial and premium, commercial nutrition labels. The ability for consumers to determine or not determine the amount of overrun in an ice cream could provide helpful information to food manufactures as they consider adjusting the composition, and resulting price, of an ice cream.

Figure 9. Nutrition Label Comparison of Weight and Fat Content in Standard, Commercial Ice Cream versus Premium, Commercial Ice Cream

Nutrition Facts

Standard Commercial Ice Cream
Serving Size 1/2 cup (66g)

Amount Per Serving		
Calories	130	
Calories from Fat	60	
		% Daily Value*
Total Fat	7g	11%
Saturated Fat	4g	20%
Trans Fat	0g	
Cholesterol	20mg	7%
Sodium	35mg	1%
Total Carbohydra	14g	5%
Dietary Fiber	0g	0%
Sugars	14g	
Protein	2g	
Vitamin A	4%	
Vitamin C	0%	
Calcium	8%	
Iron	0%	

*Percent Daily Values are based on a 2,000 calorie diet.

Nutrition Facts

Premium Commercial Ice Cream
Serving Size 1/2 cup (96g)

Amount Per Serving		
Calories	250	
Calories from Fat	140	
		% Daily Value*
Total Fat	15g	23%
Saturated Fat	10g	50%
Trans Fat	0.5g	
Cholesterol	70mg	23%
Sodium	50mg	2%
Total Carbohydra	19g	6%
Dietary Fiber	0g	0%
Sugars	18g	
Protein	4g	
Vitamin A	10%	
Vitamin C	0%	
Calcium	10%	
Iron	0%	

*Percent Daily Values are based on a 2,000 calorie diet.

Objective 5*: Are consumers willing to pay a higher price for perceived higher quality ice cream?*

It was hypothesized consumers would pay a higher price for specialty store ice cream than commercial ice cream. Unfortunately, the researcher did not appropriately ask this question on the survey instrument to determine if this were true. The survey sample was asked to taste the two ice creams with the highest price per ounce cost, specialty store ice cream and premium, commercial ice cream, and

determine which had the higher price point. 56.3% of participants incorrectly believed the specialty store had the higher price point, but the premium, commercial cost more per ounce, $0.356 per fluid ounce verses $0.218 per fluid ounce. Table 7 provides a cost comparison of all four vanilla ice creams.

Table 7. Cost Comparison of Four Ice Creams

	Price Per Fluid Ounce
Standard, Commercial	$0.083
Premium, Commercial	$0.356
Organic	$0.166
Specialty Store	$0.218

After analysis, there was no evidence that participants could identify the difference between price points of the specialty store ice cream and premium, commercial ice cream. Organic food was found to be 47% more expensive than commercial foods in 2015 (34). The research stated that individuals were willing to pay more for organic and/or locally grown produce (56-58). In future research, the researcher would benefit from asking, 1) if a participant is willing to pay more for organic ice cream and 2) how much a participant is willing to pay for ice cream. To prevent over pricing a new ice cream, the food industry could ask study participants these pricing questions. The food manufacturer would then be able to determine if it is profitable to introduce new ice creams.

Objective 6: *Do organic ice creams offer additional nutritional benefits as compared to non-organic ice cream?*

It was hypothesized that organic ice cream does not provide additional nutritional benefits. Based on the survey instrument questions, the hypothesis was unable to be deemed true or not true. A review of the nutrition labels of the four ice creams was investigated to determine nutritional differences. All four ice creams had a serving size of ½ cup, but the weight differed based on the overrun, air added during production. The researcher calculated the nutrition information for each ice cream based on 66 grams. 66 grams was selected because a ½ cup serving size of standard, commercial ice cream weighed 66 grams.

When comparing organic ice cream to the non-organic ice creams, the only category it ranked best in was having the least amount of sodium. Organic ice cream had 28mg sodium compared to 34mg, 35mg, 47mg. After reviewing the nutrition facts of the four ice creams, it appears the standard, commercial is the healthiest ice cream of the four evaluated. It has the least number of calories, fat, calories from fat, saturated fat, no trans fat, and cholesterol. It only has one more gram of carbohydrate than premium, commercial ice cream (14 grams vs. 13 grams), only two more grams of sugar than premium, commercial ice cream (14 grams vs. 12 grams), and only one less gram of protein than premium, commercial or specialty store ice cream (2 grams vs. 3 grams). If an individual were looking to consume the healthiest ice cream, the standard, commercial would be the best option. It should be remembered that when asked about overall preference of vanilla ice cream, refer to Figure 6, the standard, commercial ice cream was selected the most. Future research could look into why the healthiest of these four ice creams was liked the most. At this time, information

regarding added sugar was unable to found by the researcher. Refer to Figure 8 for nutrition facts label comparison.

Four meta-analysis studies have been completed since 2009 and there is little evidence to support organically grown crops to be "healthier" than conventionally grown crops. Five differences in nutritional makeup have been found between organically and conventionally grown crops in the studies, but these differences were not applied to ice creams. Differences include: higher nitrogen content in conventionally grown crops (59), higher phosphorus content in organically grown crops (18, 59), higher antioxidant levels in organically grown crops (60), lower Cadmium levels in organically grown crops (60), and limited evidence suggested organic milk had higher omega-3 fatty acids levels (49, 50). Further research could inquire if individuals purchase organic products and if they do, why and how often? Potential purchasing reasons could include: personal, ethical, or economical preferences.

Other Considerations

The question regarding tobacco use was asked to give insight into survey participants' tasting abilities. Smokers have a lower taste sensitivity than non-smokers (61, 62) and smoking cessation improves sense of taste (63). For further study, the researcher should ask survey participants frequency of tobacco consumption.

Ice cream is not often a healthy food item, and often consumed for pleasure. An individual's reason for consuming ice cream is often rooted in personal, emotional, and social contexts. It is often purchased for holidays, birthday celebrations, or

parties of any kind. Often at that time, individuals are not interested in a "healthier" ice cream. Individuals are consuming ice cream for the experience and not for its nutritional value.

The use of an untrained sensory panel allowed the researcher to utilize both affective tests: acceptance and preference. The acceptance test allowed the researcher to ask ranking questions and the preference test allowed the researcher to determine the survey samples' favorite ice cream. The result from the untrained panel provides the food industry with more relevant consumer data, as most ice cream consumers are not trained in sensory analysis. A food manufacture could use personal and emotional experiences to market a product. Also, since the majority of participants in this study did not regularly, if ever, purchase vanilla ice cream, future research would benefit from asking what flavor, if any, ice cream is purchased by participants. A trained survey panel would provide data for technical questions, specifically Objective 3 distinguishing between organic and non-organic ice cream and Objective 4 regarding overrun. In this study, the untrained sensory panel was the better choice, as more survey questions discussed preference and acceptance. If a food manufacturer were looking to adjust a current product, such as adjusting the vanilla content due to the production shortage in Madagascar, a trained panel would be able to recreate the flavor profile of the original ice cream.

Limitations

Limitations to this study include small sample size, food allergies, and increased health consciousness. The study consisted of a small sample size (n=49) and had limited diversity. The small sample was primarily white, female, and

educated which is not representative of the area, limits generalizability, and did not provide a randomized sample.

A second limitation to the survey sample was food allergies. An estimated 15 million Americans have food allergies (64-66). There are many ingredients in ice creams that are noted food allergens. Possible ingredients include: milk, cream, sugar, vanilla extract or flavoring, vanilla bean, soy lecithin, and sweetened condensed milk (67-69). The noted food allergies prevented one individual from participating in the study. Due to increased health consciousness, there were potential survey participants who declined to participant in the study because they did not know the ingredients in the ice cream or the brand.

For Objective 3, survey participants were asked to distinguish between organic ice cream and non-organic ice cream. The commercial non-organic ice cream is one of the highest selling ice creams, and subjects may have correctly distinguished between the commercial and organic ice cream through a process of elimination. Survey participants may have been able to determine the brand due to previous consumption and recognizing the taste and then selecting the other ice cream option, ultimately choosing the organic ice cream. In future research, a pre-study could be distributed to potential participants. The potential participants would indicate all the ice creams they have previously consumed and the researcher would be able to eliminate those who have previously consumed the study ice creams or study ice creams that have not be previously consumed.

Chapter 6: Conclusion

In recent years, there has been an increased focus on wellness and healthy living, particularly through dietary focus. Ice cream does not fall into a healthy food category and should be consumed in moderation due to its high fat and sugar content. Despite these concerns, individuals continue to purchase ice cream at high rates. Manufacturers are creating more premium, commercial ice creams as well as organic, low-fat, lactose-free, GMO-free, hormone-free, additive free, and/or preservative free options for the increasingly health-conscious consumer (10). The results of this sensory analysis to determine consumer preference and acceptance could provide food manufacturers with insight into current ice cream preferences of health-conscious consumers, leading to the creation of new products or improvements to existing products.

APPENDIX A

Confidential

Use of Sensory Analysis to Determine Consumer Preference and Acceptance of Four Vanilla Ice Creams

Thank you for taking the time to participate in this survery. During the survey, you will be tasting four different vanilla ice creams, then rating them on acceptance and preference. Please complete all questions. All survey responses are collected anonymously.

	Section 1 - Tasting Information	
1)	Indicate if you have ever been medically diagnosed with a food allergy to an ingredient listed in vanilla ice cream? Possible ingredients include, but are not limited to: milk, cream, sugar, vanilla extract or flavoring, vanilla bean, soy lecithin, sweetened condensed milk. Or if you have ever been told you should not consume vanilla ice cream.	☐ Yes ☐ No
2)	Prior to tasting the survey samples, indicate on the scale below how well you enjoy the experience of consuming vanilla ice cream.	◯ Like very much ◯ Like moderately ◯ Neutral like nor dislike ◯ Dislike moderately ◯ Dislike very much
3)	Taste SAMPLE "15" and indicate on the scale below how well you like the taste of the vanilla ice cream.	◯ Like very much ◯ Like moderately ◯ Neutral like nor dislike ◯ Dislike moderately ◯ Dislike very much
4)	Taste SAMPLE "15" and indicate on the scale below how fresh the vanilla ice cream tastes. Factors effecting taste could include but are not limited to: bitterness, freezer burn, temperature, vanilla flavor.	◯ Very fresh ◯ Somewhat fresh ◯ Neutral ◯ Not that fresh ◯ No freshness
5)	Taste SAMPLE "39" and indicate on the scale below how well you like the taste of the vanilla ice cream.	◯ Like very much ◯ Like moderately ◯ Neutral like nor dislike ◯ Dislike moderately ◯ Dislike very much
6)	Taste SAMPLE "39" and indicate on the scale below how fresh the vanilla ice cream tastes. Factors effecting taste could but are not limited to include: bitterness, freezer burn, temperature, vanilla flavor.	◯ Very fresh ◯ Somewhat fresh ◯ Neutral ◯ Not that fresh ◯ No freshness
7)	Taste SAMPLE "62" and indicate on the scale below how well you like the taste of the vanilla ice cream.	◯ Like very much ◯ Like moderately ◯ Neutral like nor dislike ◯ Dislike moderately ◯ Dislike very much
8)	Taste SAMPLE "62" and indicate on the scale below how fresh the vanilla ice cream tastes. Factors effecting taste could but are not limited to include: bitterness, freezer burn, temperature, vanilla flavor.	◯ Very fresh ◯ Somewhat fresh ◯ Neutral ◯ Not that fresh ◯ No freshness

APPENDIX A (continued)

Confidential

9)	Taste SAMPLE "84" and indicate on the scale below how well you like the taste of the vanilla ice cream.	◯ Like very much ◯ Like moderately ◯ Neutral like nor dislike ◯ Dislike moderately ◯ Dislike very much
10)	Taste SAMPLE "84" and indicate on the scale below how fresh the vanilla ice cream tastes. Factors effecting taste could include but are not limited to: bitterness, freezer burn, temperature, vanilla flavor.	◯ Very fresh ◯ Somewhat fresh ◯ Neutral ◯ Not that fresh ◯ No freshness
11)	Taste SAMPLE "39" and taste SAMPLE "62". Samples may be tasted in either order. Of the two samples you just tasted, which do you think has a higher price point? Please circle the sample you believe has a higher price point.	◯ SAMPLE 39 ◯ SAMPLE 62
12)	Taste SAMPLE "15" and taste SAMPLE "62". Samples may be tasted in either order. Of the two samples you just tasted, which do you think is branded organic? Please circle the sample you believe is branded organic.	◯ SAMPLE 15 ◯ SAMPLE 62
13)	Taste SAMPLE "15" and taste SAMPLE "84". Samples may be tasted in either order. Of the two samples you just tasted, which do you think has more overrun? Overrun is the amount of air added to ice cream. Please circle the sample you believe has more overrun.	◯ SAMPLE 15 ◯ SAMPLE 84

14-17. Taste each SAMPLE and rank the samples in descending order based on vanilla flavor. The sample that has the most vanilla flavor should be ranked 1. Order of tasting of samples may be varied.

		1	2	3	4
14)	SAMPLE 15	◯	◯	◯	◯
15)	SAMPLE 39	◯	◯	◯	◯
16)	SAMPLE 62	◯	◯	◯	◯
17)	SAMPLE 84	◯	◯	◯	◯

18-21. Taste each SAMPLE and rank the samples in overall descending order of preference. The most preferred sample should be ranked 1. Order of tasting of samples may be varied.

		1	2	3	4
18)	SAMPLE 15	◯	◯	◯	◯
19)	SAMPLE 39	◯	◯	◯	◯
20)	SAMPLE 62	◯	◯	◯	◯
21)	SAMPLE 84	◯	◯	◯	◯

APPENDIX A (continued)

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SECTION 2 - Purchasing Information

22) Indicate how many times per month you buy vanilla ice cream from the grocery story?
- ◯ Almost never
- ◯ 1 time per month
- ◯ 2 times per month
- ◯ 3 times per month
- ◯ 4 times per month
- ◯ Greater than 4 times per month

23) Indicate how many times per month you buy organic vanilla ice cream?
- ◯ Almost never
- ◯ 1 time per month
- ◯ 2 times per month
- ◯ 3 times per month
- ◯ 4 times per month
- ◯ Greater than 4 times per month

24) Indicate how many times per month you buy vanilla ice cream from an ice cream specialty store?
- ◯ Almost never
- ◯ 1 time per month
- ◯ 2 times per month
- ◯ 3 times per month
- ◯ 4 times per month
- ◯ Greater than 4 times per month

SECTION 3 - Demographics

25) Indicate your age range at time of survey completion.
- ◯ 18-24
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ Above 54

26) Gender
- ◯ Female
- ◯ Male

27) Race
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black / African American
- ☐ Hispanic
- ☐ Pacific Islander
- ☐ White
- ☐ Other

28) What is your highest education qualification at time of survey completion?
- ◯ Less than high school diploma
- ◯ High school diploma or equivalent degree
- ◯ Some college, no degree
- ◯ Bachelor's Degree
- ◯ Master's Degree
- ◯ Greater than Master's Degree

29) What is your marital status at time of survey completion?
- ◯ Single, never married
- ◯ Married or domestic partnership
- ◯ Divorced
- ◯ Separated
- ◯ Widowed

APPENDIX A (continued)

Confidential

30)	What is your current employment status at time of survey completion?	◯ Student ◯ Part-time employment ◯ Full-time employment ◯ Self-employed ◯ Unemployed ◯ Work at home ◯ Retired
31)	Indicate if you use a type of tobacco. Types of tobacco include: cigarettes, hookah, smokeless tobacco, cigars, electronic cigarettes.	◯ Yes ◯ No

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