

Influence of educational messages, delivered in nominal focus groups, on dairy purchasing and consumption behavior of inadequate dairy consumers

by

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Abstract

With the decline in fluid milk consumption, combined with nearly 90% of the U.S. population not consuming enough dairy (≤ 3 cups equivalent daily), there is growing interest in increasing dairy foods consumption amongst this inadequate dairy consumer (IDC) population. The objective of this study was to quantify the effectiveness of educational messages (EM), delivered in nominal focus groups (NFGs), to 1) increase dairy purchasing and 2) increase dairy consumption of IDC. Research participants were identified using a Food Choices and Intolerances (FCI) survey, with panelists recruited from the greater Manhattan, KS, USA area. Inadequate dairy consumers (n=101) were recruited to attend an NFG and received a primary EM or a combination of a primary and secondary EM. Secondary EM contained information relating to one of three different dairy foods nutritional topics. Panelists who received only the primary EM (n=15) were given an educational message in reading nutrition facts panels, while panelists who received the primary and a secondary EM also received one of the three secondary EM (n=65): lactose maldigestion (n=17), nine essential nutrients (n=20), or prebiotics and probiotics (n=28). During the NFG, panelists were asked to self-report their dairy purchasing and consumption behavior. One month after completion of the NFG, panelists were asked to complete a follow-up survey where they self-reported dairy purchasing and consumption in the time since receiving an EM. After data were collected, categorical responses on dairy foods purchasing and consumption were converted to servings/week/person. Using a Wilcoxon signed-rank test, the differences in servings/week/person were analyzed to determine significant differences in dairy foods (milk, yogurt, cheese, and ice cream) purchased and consumed before and one month after receiving an EM. Overall, this study found that the primary EM had little effect on increasing the purchasing of dairy foods but did have a significant effect ($p < 0.05$) on

dairy foods consumption. When secondary EM were analyzed individually, the prebiotics and probiotics EM had a significant effect on dairy purchasing and consumption, whereas the lactose maldigestion EM only had a significant effect on increasing dairy foods consumption. The nine essential nutrients of milk message had no significant effect on dairy foods purchasing or consumption.

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Chapter 1 - Introduction

The U.S. Department of Agriculture (USDA) and the Food and Drug Administration (FDA) legally define milk as, “the lacteal secretion, practically free from colostrum, obtained by the complete milking of one or more healthy cows” (FDA, 2021). For centuries, consumers have viewed milk as a staple food for a healthy lifestyle (Warinner et al., 2014). Despite this view, U.S. fluid milk sales have decreased from 24,890 million kg in 2010 to 21,057 million kg in 2019 (USDA, 2019). Further, USDA indicated that fluid milk consumption has remained constant at 350 mL person/day. Comparatively, *Dietary Guidelines for Americans 2020-2025*, recommends a daily per capita consumption of at least 709.8 mL of fat-free milk (USDA, 2020). Thus, when comparing actual versus recommended consumption, Americans are lacking a minimum of 359.8 mL of milk daily. Similarly, Mintel Reports (2019) showed a 22% decline in U.S. milk sales from 2014 to October 2019. However, during to the onset of the COVID-19 pandemic in the U.S. (March, 2020), demand for fluid milk actually increased. Decreasing demand for fluid milk may be attributed to 1) the growth in demand for milk alternatives (plant-based beverages), 2) the short shelf-life of bovine milk products, and 3) flavor concerns (McCarthy et al., 2017). Aside from advances in plant-based beverages, changes in consumer preferences and growing concerns for environmental sustainability and animal welfare have affected dairy foods consumption. These environmental and animal welfare concerns have contributed to negative perceptions of dairy farming, thus turning consumers away from consuming dairy foods. However, other dairy foods such as cheese, yogurt, and ice cream are increasing in consumption, yet many Americans still lack an adequate amount of dairy in their diet.

To increase the consumption of dairy foods amongst inadequate dairy consumers (IDC), groups such as Dairy Management Inc. (Rosemont, IL, USA) have developed a wide array of educational messages in formats including informational graphics (infographics), advertisements (print, fuel-up-and play 60, and media), and social influencers on various social media platforms (Facebook, Twitter, Instagram, Tic Tok). Of these formats, infographics are some of the most versatile, because they are easy to distribute, contain vivid colors and images, and possess brief, catchy information (Siricharoen & Siricharoen, 2015). The marketing theory behind these messages does not lie within the field of dairy science, but instead with social marketing. The purpose of social marketing is to motivate a behavior change. In the case of the present research, IDC were delivered infographics on dairy foods, along with an educational message, with the goal to increase dairy foods purchasing and consumption in this population. IDC are defined as consumers who consume less than the three recommended servings of dairy per day. Therefore, the objective of this study was to determine if educational messages, based on the nutritional attributes of dairy foods, delivered in nominal focus groups, which limit interaction between the panelists and the moderators, would increase IDC dairy food purchasing and consumption behaviors. A secondary objective was to investigate the impact of lactose and added sugar on ice cream acceptability by IDC.

Chapter 2 - Review of Literature

2.1 Milk's Nutritional Attributes

At a young age, milk is an essential food for life, but even in adulthood dairy foods provide essential nutrients to humans-nutrients that the body cannot manufacture yet must get from the diet. Milk composition varies among species, but even across domesticated species, management, environment, and genetics affect milk composition. All milk contains fat, protein, lactose, and minerals (Fox, et al, 2015). However, because of the milk pooling process in the U.S., the composition of bovine milk “evens out” and is typically presented as 87.7% water, 4.9% lactose, 3.4% fat, 3.3% protein, and 0.7% vitamins and minerals (Campbell and Marshall, 2016). Additional compounds in milk include enzymes, phospholipids, microorganisms, and saturated and unsaturated fatty acids (Haug et al, 2007). It is these components which give milk some of its unique nutritional and functional characteristics. Because dairy proteins can cause an allergic response, the FDA has declared milk as one of the nine foods allergens mandated to be listed on food labels in the United States (FDA, 2021), but fewer than 5% of adults have milk allergies (Warren et al., 2022).

2.2 Nutrition Facts Panels

As required by law, all food products sold in the United States must have food labels which are to consist of: 1) a list of ingredients, 2) allergen statement, and 3) a nutrition facts panel. However, just because this information is required to be on food products, it does not mean that consumers read or can understand this information. The U.S Food and Drug Administration (FDA), Food Safety and Nutrition survey, concluded that 87% of U.S consumers have looked at nutrition facts panels. However, just because consumers look at nutrition facts does not mean they understand them. Kim et al (2019), present findings on a 2019 study of 992

U.S adults. Overall, Kim's group discovered that 81.4% of their population knew how to read and comprehend the information on a nutrition fact panels. In May of 2016, the FDA announced a new nutrition facts panel, which includes the total amount of added sugars in a serving of food, was going to be mandated by 2020. Khandpur et al. (2020), sought to quantify consumer support of the added sugar statement on nutrition facts panels. Overall, in a study of 1,156 U.S adults, 85% supported the addition of an added sugar statement on the nutrition facts panels. Because of this new information, some consumers may not be able to interpret nutrition facts panels and the nutrients found within a food product.

2.3 Nine Essential Nutrients in Dairy

Milk naturally has nine essential nutrients: calcium, vitamin D (ergocalciferol), phosphorus, riboflavin, protein, vitamin B12 (cyanocobalamin), potassium, vitamin A (retinol), and niacin (Campbell & Marshall, 2016). Some of these components are secreted naturally from the bovine mammary gland, while others (ex. vitamins A and D) are incorporated into milk during the fortification step in milk processing, because they are removed. Further, from the skim milk portion, Vitamin D is fortified in skim milk because it aids in the absorption of calcium. Nutritionally, each of the nine essential nutrients provides an important health benefit. Presented in **Table 1** are the amounts of each nine essential nutrients found in a serving of milk and their percent daily values. **Table 2** contains the health benefits of each nine essential nutrients.

Milk proteins are considered high quality proteins, and one of the best protein sources, due to the presence of essential amino acids, bioavailability, and digestibility (Pereira, 2014). The protein found in milk can be fractionated into two separate groups: casein and whey, based on acid or heat denaturation. Casein can be fractionated into four different casein variants: α_{s1} ,

α_s2 , K- and β -caseins based on amino acid sequence (Swaisgood, 1993). Whey proteins consist of lactoferrin, α -lactalbumin, β -lactoglobulin, and serum albumin (Teixeira, et al, 2019). From a nutritional perspective, milk proteins have been shown to decrease the prevalence of metabolic disorders (ex. hypertension and hyperglycemia) (McGregor & Poppitt, 2013).

Willet & Ludwig (2021) claim that persons with a well-balanced diet can obtain the nutrients found in milk from other food sources. However, there are two exceptions to this: calcium and ergocalciferol. The most abundant micronutrient found in milk is calcium, at a concentration of 1,200 mg/L. However, other foods, such as leafy greens (ex. spinach and kale), contain calcium, but are only 20 to 40% as bioavailable when compared to calcium found in milk (Melse-Boonstra, 2020). Nutritionally, calcium intake has been recognized as critical factor to achieve peak bone mass and subsequently aids in preventing osteoporosis (Anderson et al., 1993). Ergocalciferol is the most abundant fat-soluble vitamin present in milk, primarily because it is added during the fortification process of skim milk processing.

Table 1. Nine essential nutrients and their amounts in 240 mL of milk¹

| Nutrient | Amount | Percent Daily Value |
|-------------------------------|---------|---------------------|
| Calcium | 300 mg | 25 |
| Vitamin D (scientific name) | 120 IU | 15 |
| Phosphorus | 138mg | 20 |
| Pantothenic Acid | 0.875 | 8 |
| Vitamin B12 (scientific name) | 1.2 mcg | 50 |
| Vitamin A (scientific name) | 500 IU | 15 |
| Protein | 8 g | 16 |
| Riboflavin | 0.4 mg | 35 |
| Niacin | 2 mg | 10 |

¹Adapted from National Dairy Council, 2021.

Table 2. Health benefits of the nine essential nutrients of milk.

| Common Name | Scientific Name | Amount in 236 mL of Milk (8 U.S. Fluid ounces). | Health Function | Source |
|------------------|-----------------|---|---|---------------------|
| Calcium | | 300 mg | Optimization of peak bone mass. | Bonjour et al, 2013 |
| Vitamin D | Ergocalciferol | 120 IU | Bone health; decreases the risk of type 2 diabetes, heart disease, autoimmune disorders, infectious diseases, and some cancers. Fortified if fat is removed. | Holick, 2012 |
| Phosphorus | | 138 | Energy balance, pH balance, cell structure. | Vorland et al, 2017 |
| Pantothenic Acid | | 0.875 mg | Formation of red blood cells. | Annous & Song, 1995 |
| Vitamin B-12 | Cobalmin | 500 IU | Development and myelination of nervous system | Stabler, 2013 |
| Vitamin A | Retinol | 500 IU | Maintains vision, aids in protein development and growth, protectant for epithelium cells in the body. Fortified if fat is removed. | Huag, et al, 2018 |
| Protein | | 8g | Suppresses tumor development, because of components such as lactoferrin, α -lactalbumin, β -lactoglobulin, and serum albumin. Promote muscle and bone mass. Aid in weight loss. | Parodi, 2007 |
| Riboflavin | | 0.4 mg | Prevents sepsis and ischemia. Aids in the metabolism of carbohydrates, fats, and protein to produce ATP. | Suwannasom, 2020 |
| Niacin | Nicotinic Acid | 2 mg | Aids in nutrient uptake metabolism of food. Decreases risk of high cholesterol by modifying low-density lipoprotein cholesterol (“bad cholesterol”) and high-density lipoprotein cholesterol (HDL), by binding to adipocytes. | MacKay, et al, 2012 |

2.4 Lactose Maldigestion

Ice cream is defined as a frozen mixture of air, water, milk fat, and milk solids-not-fat (MSNF) and can contain sweeteners, emulsifiers, and flavor, along with other functional ingredients (Goff & Hartel, 2013; Adapa et al., 2000). In the U.S., ice cream has a legal definition, which includes “a food produced by freezing, while stirring, a pasteurized mix containing one or more dairy ingredients” (21 C.F.R. § 135.110, 2021). The composition of ice cream must be $\geq 10\%$ milk fat and the product must contain 0.72 Kg total solids per 3.78 L (21 C.F.R. § 135.110, 2021).

When considering ice cream in the U.S, lactose is not a common ingredient. However, it is present because it is in the milk and cream that are legally-required components of ice cream. Therefore, lactose content in ice cream is approximately 5.7% percent. Over the last century, the presence of lactose in ice cream has been well documented. Whitaker (1933) presents some of the earliest work of lactose in ice cream, where the quality defect of crystallization was studied. Nickerson (1956) found, milk solids with lactose served as the initial nuclei for the development of lactose crystals. During the hardening of ice cream, unbound water freezes first, which causes the unfrozen lactose to become supersaturated. Nickerson (1965) discovered the temperature range optimal for the development of lactose crystals is -23.3 to -11.1°C . This supersaturation can subsequently lead to the formation of tomahawk shaped lactose crystals, which lead to an undesirable sensory attribute (Livney et al., 1995). Agitation during the manufacturing process of ice cream has been shown to increase the incidence of sandiness in ice cream (Livney et al., 1995).

However, many Americans do not consume dairy foods because of a compound called lactose, which is naturally present in non-fermented dairy foods, such as ice cream. Lactose is

the naturally occurring carbohydrate found in bovine and human milk, which provides the distinct sweetness to fluid dairy foods (ex. milk and flavored milk). Smaller concentrations of glucose and galactose may be present in milk. Lactose is comprised of a glucose molecule and a galactose molecule. Lactose maldigestion occurs when individuals lack the lactase-phlorizin hydrolase enzyme (EC no.: 3.2.1.108), which cleaves the lactose molecule into glucose and galactose during digestion, easing the metabolic process (Holsinger, 1997). Consumers who lack the ability to digest lactose, often experience discomfort in the gastrointestinal track after consuming a food product which contains lactose (Fassio et al., 2018). From a nutritional perspective, researchers have documented that lactose is a prebiotic and can replace glycogen after physical exercise (O'Dell & Wallis, 2021).

2.5 Prebiotics and Probiotics

Human gut health has interested scientists and consumers for centuries. Segments of the human digestive tract, particularly the colon, contain high concentrations of beneficial bacteria (Manning & Gibson, 2004). Cummings et al. (2001) defined a prebiotic as: “food ingredients that stimulate selectively in the growth and activity of specific species of bacteria in the gut.” Two well documented sources of prebiotics are fructans (fructooligosaccharides and inulin) or branched polysaccharides (onions or chicory roots) (Rosa et al., 2020). Rosa et al. (2020), documented that inulin added to ice cream lowered triglyceride levels and milk beverages with acacia gums lowered LDL cholesterol levels.

Havenaar & Huis (1992) describe a probiotic as: “A product containing viable, defined microorganisms in sufficient numbers, which alter the microflora (by implantation or colonization) in a compartment of the host and by that exert beneficial health effects in this host.” Salminen (1994) described cultured dairy foods (ex. yogurt and sour cream) as common

vectors to deliver probiotics. From a health perspective, probiotics are essential in the improvement of intestinal health, reduction of various disease risks, and can ameliorate the effects of lactose maldigestion (Kechangi et al., 2013). Further research also suggests prebiotics and probiotics found in dairy foods can help reduce the risk of type 2 diabetes (Zepeda-Hernandez et al., 2021).

2.6 Consumer Perceptions of Dairy Foods

Although studies have presented various reasons for the decline of milk consumption in the U.S society, no one cause has been identified as the definitive driver. Some view the disconnect between farmers and consumers, and negative perceptions surrounding dairy farming practices, or the consumer's unfamiliarity with dairy farming practices to be responsible (Wolf et al., 2020). However, there are more beverage options available to consumers today than has been in prior decades. With milk having one of the shortest shelf-life (~14 days) amongst beverages available to consumers.

Mahon & Haas (2013), surveyed college students to assess the number of dairy foods consumed on a daily basis in the U.S. To collect data, students enrolled at U.S universities were sent an anonymous link for a survey. Based upon survey results, 28 participants were recruited to share their perceptions of dairy foods. From the data, researchers determined that students were not consuming an adequate amount of calcium (<1,300 mg daily), and that few understood the nutritional importance of dairy foods. However, students indicated that they preferred health campaigns targeted directly to them, and that messages should focus on overall health and processes to encourage healthy changes.

Redding et al., (2021), presented work to try to change consumer attitudes about dairy foods. To do so, 804 customers were surveyed. Eighty-six percent of consumers participating

indicated that they thought dairy foods in the U.S were of high quality, but shared concerns about animal welfare, pesticides, hormones, and antibiotics. Participants (n= 804) were then assigned to one of three educational interventions: 1) reading of dairy nutrition information on USDA's MyPlate (<https://www.myplate.gov>), 2) reading a brochure on preventing antibiotic traces in milk, and 3) watching a video on the process of testing for antibiotic traces in milk. After consumers were given one of the three interventions, those who received the brochure had a significant ($p < 0.05$) decrease in concerns about pesticides, hormones, and antibiotics in milk (-0.20 on a Likert scale). Further, consumers who viewed the video as an intervention had a -0.29 Likert decrease of concern on chemicals in milk.

Schiano & Drake (2021) presented findings on consumer understanding of the manufacturing processes associated with cultured dairy foods (ex. cheese and yogurt) and fluid milk. One thousand two hundred ten consumers were surveyed with 54 selected for in-person interviews. During the interview, participants were asked to define milk-based foods and cheese processing terms such as evaporated milk, ultrafiltered milk, microfiltered milk, and their understanding of definitions on pasteurized milk and nonfat milk. Consumers who were unaware of terms like ultra-pasteurized or ultrafiltered were more likely to express concern when purchasing foods processed with these technologies. Further, these processing terms may be overlooked when making a purchase. However, Ortez et al., (2021) show that consumers with children bought more milk and with a higher fat content (whole vs. skim), compared with consumers without children. Additionally, consumers with children purchased more yogurt, as a snack food, and served milk and cheese with meals.

2.7 Dairy Marketing and Purchasing Behaviors

Around the turn of the last century, dairy processors (ex. Borden, Carnation, and Foremost) assumed marketing roles for their own products; however, no generic program existed, other than the work of city-based health departments, to encourage the consumption of milk based upon its health benefits (Zurborg, 2005). Since then, farmers have held the belief that they share the responsibility of promoting the consumption of dairy foods (Novakovic, 2022). In 1983, the dairy checkoff program was established to promote the consumption of dairy foods, based upon their health benefits (Kaiser, 1998). Initially, the check-off program was a voluntary system, but as of 2022 all U.S. dairy farmers are mandated to pay \$0.15 for every hundredweight (cwt. or 45.5 kg) of milk sold. Collected funds are then distributed to national and regional dairy organizations to fund academic research and/or consumer education programs (Wilde et al., 2012). However, collected funds are not used to support research to increase dairy production. One of the most recognized dairy marketing campaigns launched by the check-off was the *Got Milk?* Campaign. Although the campaign spent \$110 million to promote milk consumption from 1993 through 2014, it was considered a failure (Smith, 2006). To quantify the decline in milk consumption over the duration of the *Got Milk?* Campaign, the U.S. annual per capita fluid milk consumption decreased from 94.3 kg in 1993 to 71.7 kg in 2014 (Smith, 2006). Novakovic (2022) describes that although dairy checkoff organizations have historically funded large-scale, media-based advertising campaigns (ex. Got Milk, Milk Life, etc.), the last two decades' funds have been directed towards social media, new product development, or to expand dairy sales and exports.

Because food purchasing behavior can be influenced by demographics, it important to understand the impact of different demographics. Sanlier & Karakus (2010) found that women

were more likely to pay attention to nutritional information provided on food labels. In a similar study, 53% of women reported using the information on nutrition facts panels when making a food purchase (Blitstein & Evans, 2006). However, Tam et al., (2017) report no differences between females and males in the food purchasing behaviors on the attributes of taste, value, cost, and convenience. Torres-Gonzalez et al. (2020), reported that the consumption of dairy foods varies greatly amongst age and ethnic groups. In a nation-wide survey of 33,472, people of age 71 or older consumed 37% less milk when compared to those between the ages 9 and 18 (Torres-Gonzalez et al. 2020). From a cultural perspective, Hispanics purchase more dairy foods compared with Caucasian and African American consumers (Cullen, et al., 2007). Further, Gonzalez's group claimed that on average, Mexican Americans consume approximately 66.2% more milk per day than African Americans. Glanz et al. (1998) conducted a nation-wide survey of 3,835 adults, which found women vs. men, young adults vs. older adults, and Caucasians vs. non-Caucasians consume the greatest amount of cheese per day. Lastly, Ortez et al. (2021), sought to quantify dairy purchasing amongst households with children and those without children. Ortez's group surveyed 1,440 adults in the greater Cleveland area (Ohio, USA), and found those living with children bought larger quantities of milk and yogurt, and read the nutrition facts panels of eggs, meat, and milk than out of any other food product.

One technique that may be considered effective in communicating the benefits of dairy may be infographics. Informational graphics (or infographics) combine stylistic elements such as charts, maps, graphics, and photos to visualize information in a clear and concise message (Naparín & Saad, 2017), and therefore lend themselves to agricultural commodity groups to convey information. LaCour et al. (2019) surveyed 810 people using Amazon's Mturk Service (Seattle, WA, USA), of which 416 panelists were shown an infographic before responding to

questions. Six different infographics covering topics like antibiotics, hormones, vaccines, genetically modified crops, sustainability technology, and animal welfare were viewed.

Participants who saw an infographic were more likely to have statistically lower risk perceptions and positive attitudes towards antibiotic resistance (z score = 5.06), hormones (z score = 5.05), vaccines (z score = 6.45), GMO crops (z score = 6.89), sustainable technology (z score = 2.77), and animal welfare (z = 4.91) than those who were not shown the infographic. Notably, infographics had the largest impacts on increasing attitude and decreasing risk perceptions for hormones, vaccines, GMO crops, sustainable technology, and animal welfare.

A second example of infographics related to food production is described by Lochner et al. (2021). Researchers developed infographics based on livestock species (beef cattle, dairy cattle, equine, poultry, and swine) information available online from the University of Minnesota Extension (St. Paul, MN, USA) and shared them via the university extension Facebook page. Interactions with posts were monitored at seven intervals after posting. Posts containing infographics, compared to those with posts containing links to webpages, were higher in mean interactions (**Table 3**).

Table 3. Specific species infographic results from Lochner, et al. (2021)

| Species | Infographic | Webpage |
|--------------|-------------|---------|
| Equine | 15,778.5 | 1,643.5 |
| Beef Cattle | 1,416.0 | 356.0 |
| Dairy Cattle | 1,322.0 | 191.3 |
| Swine | 340.9 | 55.8 |
| Poultry | 89.8 | 36.3 |

2.8 Social Marketing Theory

Social marketing theory is defined as; “facilitating a social change through the adoption of a positive behavior, and ceasing a negative behavior, by altering an individual’s negative preference towards a positive one” (Dann, 2009). The primary goal of social marketing is to incite a positive change at an individual and/or population level. Since the term was originally phrased in the 1970s, there have been numerous applications of social marketing theory as a mechanism to improve society on various topics such as safe teen driving (Smith, 2006), smoking and drinking cessations (Hastings & McLean, 2006; Glassman & Braun, 2010), and healthy diets to lifestyles (Gordon et al., 2006). Some social marketing programs have proven hugely successful, while others have not. An example of a successful social marketing campaign resulted in smoking cessation in pregnant and non-pregnant women in the Sunderland Region of the United Kingdom (Lowry et al., 2004). In the study, women from lower social classes participated in one of nine focus groups, where participants received information to overcome nicotine withdrawal. After attending the focus groups, participants decreased smoking by 15%.

Because of the wide array of issues social marketing has been applied to, there are a variety of methods that have proven successful. Kim et al. (2020) developed a social marketing campaign which sought to decrease food waste. The study recruited Redland (Southeast Queensland, AU) residents to attend educational sessions, which offered cooking demonstrations by a local chef, recipe cards designed to limit food waste, and preparation of culinary dishes that could be made from food products in a refrigerator. Overall, Kim et al. (2020) concluded participants who attended an educational session, self-reported a decrease in household waste and an increased level of cooking efficiency. Velema et al. (2018) developed a social marketing program to increase healthy eating habits of employees at Dutch businesses with worksite

cafeterias. The study included 30 worksite cafeterias, which were assigned as a control or intervention group. In groups that received an intervention, the four P's of social marketing (product, place, price, and promotion) we applied to products that were deemed a "healthier" or "better choice". Further, prices were increased for food products labeled as "snacks", while prices were decreased on food which were deemed as healthier (ex. sandwiches, fruit, salads). Overall, Velema et al. (2018) was successful at their social marketing campaign, as healthy food purchases increased during duration of the study. Further, three of the seven groups showed a significant increase in healthy food purchases.

In another social marketing campaign, Cohen et al. (2011) recruited 1,000 Louisiana (USA) businesses (health clinics, mental health centers, and local businesses) to distribute condoms for free, with the primary goal of increasing condom uses. A statewide educational program made condoms available freely at 29 public health centers, 29 substance abuse centers, 39 community-based health centers, and 1,000 businesses in areas where the rates of sexually transmitted disease rates were high. Condom use rates were then tracked over a three-year period. During this time period, 33 million condoms were distributed, and self-reported condom use increased from 28% to 36%. The greatest impact was in African American women with more than two sex partners, who reported that condom use increased from 30% to 48%.

Researchers have also used social marketing to reduce negative stigma around people with medical issues pertaining to mental health (Sampogna et al., 2020). The study examined the efficacy of the "Time to Change" program, which was directed at people who ranged from their mid-twenties to mid-forties. Participants completed an online questionnaire to evaluate three mental health community programs: Mental Health Knowledge Schedule (MAKS), Community Attitudes Towards Mental Health Illness (CAMI), and Reported and Intended Behavior Scale

(RIBS). Overall, the researchers observed that among the 10,526 UK residents, those most familiar with the social marketing campaign, were likely to have reduced mental health stigma, than those who were unfamiliar with the campaign.

Bogueva et al. (2017) applied social marketing theory with infographics, to reduce red meat consumption in consumers located in Sydney (New South Wales, AU). The study was designed to decrease red-meat consumption, but largely only informed consumers of health risks, misconceptions, and environmental impacts. Participants were sent an anonymous survey covering demographic information, diet trends, meat consumption trends (frequency and portion sizes). From an initial sample, 132 Sydney residents were surveyed about meat preference and environmental impacts of animal production concerns. Forty-seven percent recognized the importance of meat as part of a healthy diet. However, Bogueva's group was successful as increasing consumer awareness of the environmental impacts of red meat from 56 to 81% in the sample population.

Conversely, some social marketing campaigns have not been as successful. One study reported that a positive correlation existed between alcohol marketing and consumption amongst teens (Hastings et al., 2015). Similarly, Kuo et al., (2003) presented survey results from 10,000 college students showing that alcohol specials and promotions were prevalent around college campuses and that low sale prices on large volumes (24 and 30 can cases of beer) were associated with 0.42 correlation to binge drinking rates. The U.S National Anti-Drug Campaigns of the late 1990s and early smoking cessation programs also failed (Smith, 2006).

Even though some social marketing campaigns have been successful, some have not. The reason some social marketing campaigns have failed is because of human decision behavior.

2.9 Human Decision Behavior

Human decision making is based on four steps: identify the problem, list the alternatives, make a decision, and evaluate the decision (Pomeroy, 1997). To control the decision-making process in the human brain, four lobes control 1) physical movements, 2) cognitive thinking, 3) decision-making, and 4) sensory motor skills. The prefrontal cortex and hippocampus serve as the two critical areas for the human brain to decide to make a decision on the four steps aforementioned, typically involving a four-step process (Moghadam, 2019). Aside from the anatomical and physiological aspects of the human brain, Rodrigues and Carlos (2020) demonstrated how personality traits affected a person's psychological decision making to motivate individuals to donate blood. In the study, the researchers categorized five personality traits in the participants: extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience. The researchers discovered that potential donors who were "open to experience" and "agreeable" were more likely to donate blood when compared with people who were "conscientious", "extraversion", and "emotional stable".

In contrast, motivators for selecting a given food item often center on social, cultural, and economic statuses (Turrell & Kavanagh, 2007). In a sample of 108 adolescents, aged 11 to 18 years, researchers interviewed participants individually to determine why they selected given lunch options from a menu (Contento et al., 2006). Researchers reported that adolescents made their decisions based on taste, familiarity, and satiety. However, adolescents also made food choices based upon the decisions and behaviors of their peers, given that if one's peers were more "health conscious", they too would make healthier food choices.

Extrinsic factors affect food choices and decision-making as well. One of the primary extrinsic factors that has affected food purchasing since 2020, has been the COVID-19

pandemic. Powell et al. (2021) presented findings from nine online focus groups of U.S. college students who discussed the impact of COVID-19 on food purchasing during the spring of 2020. The researchers reported that household roles and food availability were primary drivers of food choices. Because of supply chain disruptions, students indicated an increase in consumption of foods with longer shelf lives. None of the students indicated that they experienced food insecurity during the pandemic. Overall, students who opted to live independently purchased more shelf stable and processed foods, whereas students who remained at home increased healthy eating habits. Culinary skills increased healthy eating habits, when compared to living independently. Because of the unique purchasing and consumption of college students, it is important to understand the characteristics of their generation.

College students of today, traditionally defined as being between the ages of 18-25, are considered Generation Z. Generation Z is the term used to describe persons born between the years of 1997 and 2012. The group of individuals that precedes Generation Z has been defined as Millennials, whereas those who succeed Generation Z are in Generation Alpha. Generation Z has been described as the first generation that has been consistently surrounded by digital communication. Research suggests this generation spends nearly 11 hours per day reading, sharing, and liking material, which is more than any other age group (Adobe, 2018). Because of the need to read and share information, research has shown that Generation Z prefers to communicate with images (Priporas et al., 2017). It is widely accepted that Generation Z is prone to making impulse purchases, but also strives to research thoughts, ideas, and opinions (Djafarove & Bowes, 2021). From an educational perspective, Generation Z is described as viewing learning as hands-on and view instructors to college-level course as “facilitators” rather than traditional lecturers and demand they (Generation Z) play an active role in their learning

(Adamson et al., 2018). Su et al. (2019) presented a study with 500 males and 500 females to determine participants' views on sustainability of food products. Overall, 92.8% of research participants were concerned about the environment, and thought that food products should be more sustainable. However, the researchers recognized that 75% participants were Caucasian, and if data were collected on a more demographically diverse group, results may vary. Because Generation Z wants to take an active role in learning and to receive information in a facilitated manner, one of the most appropriate ways to deliver a social marketing campaign to them is in a focus group.

2.10 Focus Groups

A focus group is a research technique that collects qualitative data via group interaction, on a topic selected by the researcher (Gibbs, 1997). Depending on the design, focus groups allow participants to express their opinion, thoughts, or stories on the selected topic, all while a moderator facilitates discussion (Alder, 2019). Focus groups can be accompanied with adjoining surveys and individual interviews (Morgan, 1996). Seven types of focus groups have been identified in literature: single focus groups, two-way focus groups, dual moderator focus group, dueling moderator focus group, respondent moderator focus group, mini focus groups, nominal focus group, and online focus groups (Nyumba et al., 2018). More details delineating the differences are shown in **Table 4**.

Fergus et al. (2021) conducted three single style focus group discussions with low-income Louisiana parish residents. During the focus groups, participants completed a survey with demographic questions regarding beliefs, barriers, eating habits, etc. The results indicated that healthy eating habits were influenced by family and friends in both negative and positive manners. For example, results indicated that family often wanted older residents to eat healthy

but often encouraged young children to eat sweets. Similarly, friends would want panelists to be healthy, but would often question their motive to do so.

Focus groups have been heavily utilized in the health and food industries to collect qualitative consumer feedback and opinions. To quantify adolescent perceptions on food choices and eating behaviors, Neumark-Sztainer et al. (1999) utilized 21 single style focus groups with 141 adolescents who were enrolled in the 7th to 10th grade in the greater Minneapolis (MN, USA) area. Researchers found that adolescents made food choices based upon hunger, timing, availability, and parental influence. The responses were categorized into three separate levels, 1) food cravings and appeal, 2) parental influence and availability, and 3) mood, body image, and cost. Overall, the researchers concluded the food choices amongst adolescents was a function of food availability and their parents and peers.

Table 4. Types of focus groups used in literature.

| Focus Group Type | Description | Source |
|----------------------|--|-------------------------|
| Single | Single group interacts by discussing a topic, facilitated by a moderator. | Morgan, 1998 |
| Two-way | Two sets of participants are involved: one activity engaged in the topic of discussion and the other overserving t and moderator can be hidden by a one-way glass. | Morgan, 1998 |
| Dual moderator | Two moderators work together with the same focus group, with each performing a different role. | Nyumba, 2018 |
| Dueling moderator | The two moderators take opposing sides on the topic, with the goal of obtaining more in-depth information. | Kamberelis, et al, 2005 |
| Respondent moderator | Recruit participants to serve in the role as moderator, with the goal of increasing the variety of responses. | Morgan, 1998. |
| Mini | Two to five people are recruited, with individuals having a high level of knowledge on the topic. | Hauge, 2002 |
| Nominal | A moderator facilitates data collection from individuals with limited to no interactions amongst panelists. | Vander Laenen, 2015 |
| Online | Panelists interact on an online platform. | Dubrovsky et al., 1991 |

McGee et al. (2008) utilized nine single style focus groups with 91 participants (85 females and 6 males, which 71 were African Americans, 17 Caucasians, and 3 Hispanics) from the Lower Mississippi Delta region to identify healthy eating perceptions and nutritional interventions. Participants indicated that information addressing health concerns and the nutritional profiles were needed to make informed food choices. Further, these panelists indicated an interest in learning about eating healthy, food portion control, and food preparation skills. Overall, the researchers found adults were interested in healthy eating, but were only likely to make a dietary change after being diagnosed with a disease.

Howse et al. (2018) conducted focus groups with young adults between the ages 18-30 in Glasgow (Scotland, UK) and Sydney (New South Wales, AU), who were identified as at risk for poor dietary choices. The researchers identified three main narratives: food value, food appeal, and emotional connections with food. However, Howse et al. (2018) group concluded that young adults were aware of healthy eating habits they should be adapting, but were often limited by socio-demographic status.

In all the studies mentioned, focus groups were utilized to deliver information which may lead to healthy lifestyle, but also to collect information from panelists. However, no study has used a nominal focus group to deliver information to a targeted audience with specific information on the nutritional attributes of dairy foods.

2.11 Conclusion

With the current decline in U.S fluid milk consumption, dairy farmers and processors stand to lose a large market segment of fluid milk sales to other beverages. Although cheese, yogurt and ice cream categories are strong overall, some consumers still do not consume the recommended 3 to 5 daily servings. Given the noted health benefits that consuming all dairy

foods offers, inadequate dairy consumption is not acceptable. Inadequate dairy consumers need tailored information to help them understand the nutritional profile of dairy foods. Applying the theory of social marketing, through providing dairy nutrition information in the form of infographics and lessons, as part of nominal focus groups, it is hoped that dairy purchasing behavior of consumers can be improved.

Chapter 3 - Research Objective

The objective of this research was to apply social marketing theory, and to use surveys and infographics in nominal focus groups to deliver educational messages (EMs) to inadequate dairy consumers to increase the purchasing and consumption of dairy foods. Inadequate dairy consumers (IDC) were invited to attend nominal focus groups (NFGs) to receive one of four combinations of EMs, of which one message served as a control group (“primary”: reading nutrition facts panel and ingredients lists, and learning about the ice cream they tasted, which contained different levels of lactose and added sugar) and three that discussed dairy foods nutrition topics (“secondary”: lactose maldigestion, nine essential nutrients of milk, prebiotics and probiotics). During the NFG, panelists were asked to self-report the quantity of dairy foods purchased and consumed. One month later, panelists were again asked to report on dairy purchasing and consumption.

A second objective of this study was to determine consumer liking of three ice cream samples with 3.8, 5.8, and 7.8% lactose with added sugar content decreasing as lactose percent increased. Consumers were asked to evaluate the samples of ice cream during the NFG, which also coincided with them receiving an EM on reading nutrition facts panels. A portion of the population received a secondary message on one of three additional topics. The primary purpose for the ice cream sensory evaluation during the NFG was to 1) increase potential participation, and 2) determine if tasting a dairy food with added lactose would motivate them to purchase products with added lactose.

Chapter 4 - Materials and Methods

4.1 Experimental Design

To determine if social marketing is an effective tool to change dairy foods purchasing and consumption behaviors, a social marketing campaign was directed at inadequate dairy consumers (IDC) (self-reported consuming less than the recommended 3 cups equivalent of dairy foods/day). The social marketing campaign consisted of providing one of four educational messages to IDC. EM were nutrition-related lessons, associated with the “positives” of milk consumption and incorporated into pre-written scripts with accompanying colorful infographics. The EM were delivered during nominal focus groups (NFG), consisting of 7 to 10 IDC/session. NFG were designed to limit interaction between the panelists and the moderators. Further, NFG ranged from 55 to 70 minutes and included an experiential component, in which attendees rated acceptability of three ice cream samples with varying lactose and added sugar contents. Via electronic surveys, total dairy foods servings purchased and consumed were calculated and compared to determine if a change occurred.

4.2 Institutional Review Board (IRB) Approval

This study was a cooperation between Iowa State University (ISU) and Kansas State University (K-State), and ISU served as the primary institution. The study was approved for human subject participation by the ISU IRB #20-227 (**Appendix A**). To follow IRB protocol, panelists' identities were not attached to any research data. To disclose any potential risks of this research, participants were presented with three consent forms during this study: 1) during the Food Choices and Intolerances screening survey (FCI) (**Appendix B**), 2) during the NFG

(**Appendix C**), and 3) during the one-month follow up survey (**Appendix D**). Per the IRB, all panelists needed to be 18 years of age or older.

4.3 Electronic Surveys

In conjunction with ISU, four surveys, Food Choices and Intolerances screening survey, NFG pre-survey, NFG post-survey, and 1-month follow-up survey (**Appendices B, E, F, G**, respectively), were developed and housed in Qualtrics® (Provo, UT, USA). Qualtrics® software is compatible and accessible through university licensing at both institutions. **Table 5** shows the details of the four surveys and their use in the research stage.

Table 5. Details of the Qualtrics® surveys used in the data collection process.

| Name of Survey | Research Stage | Months Launched | Data Collection |
|--|---|---------------------------|---|
| Food Choices and Intolerances screening Survey | Approximately, one month prior to scheduling nominal focus groups (NFG) | June and September, 2021 | Questions related to demographics, intentional and food choices and avoided foods, and dairy food purchasing and consumption. |
| NFG Pre-survey | At the start of each NFG | July and October, 2021 | Questions related to demographics and dairy food purchasing and consumption in the past month. |
| NFG Post-survey | Prior to completing NFG | July and October, 2021 | Questions related to lessons presented and intentions to purchase and consume dairy foods. |
| 1-Month Follow-Up Survey | One-month after completing a NFG | August and November, 2021 | Questions related to dairy food purchasing and consumption in the past month. |

4.4 Food Choices and Intolerances Screening Survey (FCI)

The target audience for this study was IDC. To recruit research participants, the FCI was the initial outreach to the K-State community. The K-State Registrar approved access to all student emails, whereas the 2020-2021 K-State faculty senate president (Dr. Laura Littrell) approved access to all faculty emails. The FCI was delivered to students, faculty, and staff via the K-State email messaging system that contained an anonymous embedded link. The FCI (**Appendix B**) consisted of 15 questions on food purchasing behaviors, food packaging knowledge, medically diagnosed food allergies and intolerances, and demographics. Some questions were imperative to understand purchasing behaviors of the consumer, while other questions were designed to identify the target audience for the NFG. To identify the target audience, the answers were “filtered” as depicted in **Figure 1**. Answers to the FCI questions were extracted from Qualtrics® and placed into Microsoft Excel® (Redmond, WA, USA) spreadsheets for ease of data logging. To compensate participants for their time to complete the FCI, two randomly selected individuals received a \$25 Amazon gift card.

From the collected data, potential panelists were identified as those willing to participate in a NFG, completed the FCI in ≥ 80 seconds, resided in the greater Manhattan (KS, USA) area, did not go out of their way to consume dairy foods (because IDC were sought), did not have a medically diagnosed allergy or intolerance to dairy foods (because the follow-up study involved consuming ice cream), and were IDC (< 3 servings of dairy foods/day). Thus, the data from these 267 eligible IDC were extracted to a separate spreadsheet.

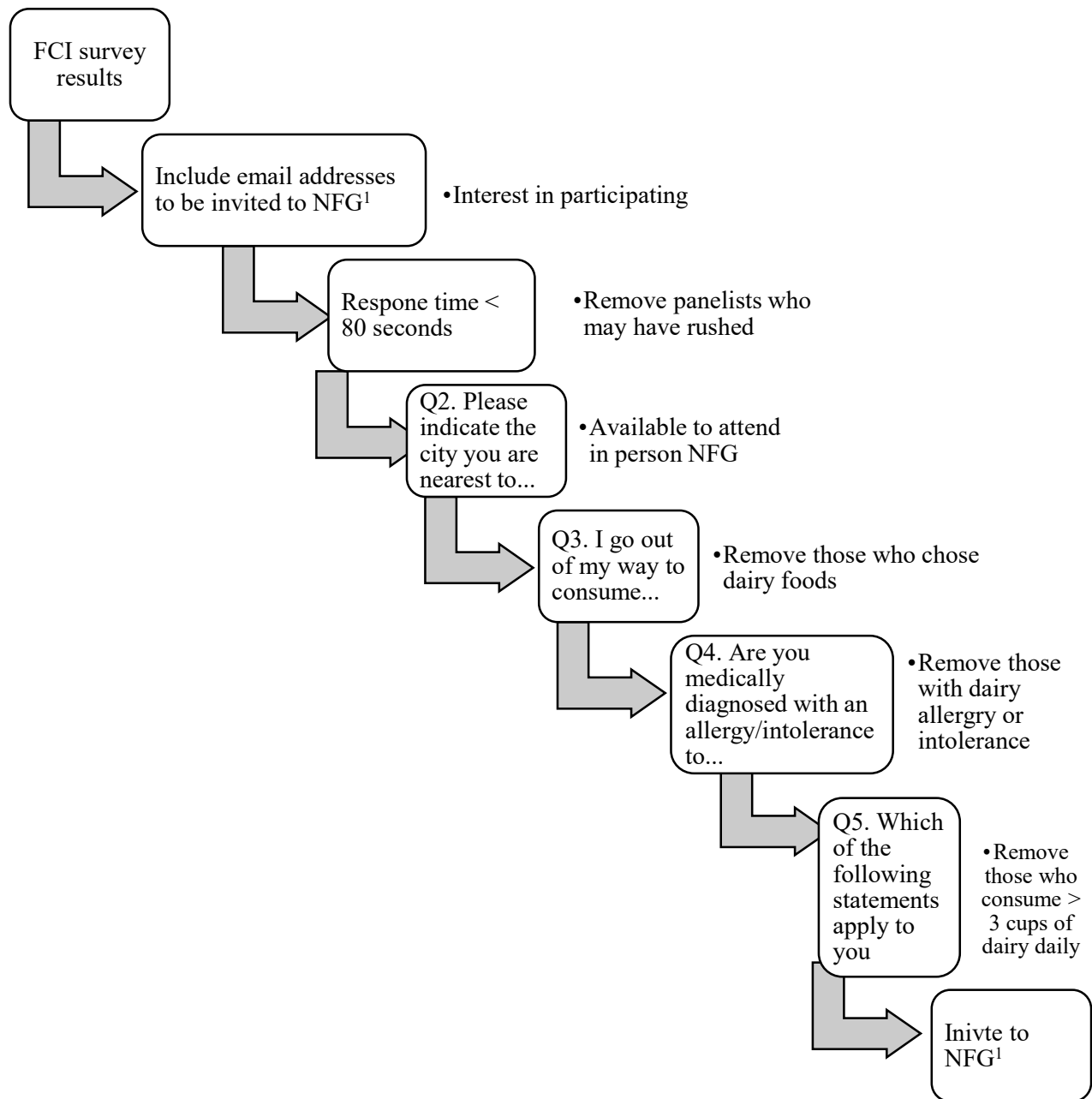


Figure 1. Selection criteria to identify inadequate dairy consumers.

¹NFG= Modified Focus Group

4.5 NFG Pre-Survey

The NFG pre-survey (**Appendix E**) consisted of 33 questions, which included eight about dairy foods purchasing and consumption, five about panelist demographics, four about purchasing influencers, and three topic-specific questions related to the secondary EM. The collected data on dairy foods purchasing and consumption were used to quantify the dairy foods purchasing and consumption patterns the panelists had prior to receiving EM.

4.6 NFG Post-Survey

The NFG post-survey (**Appendix F**) consisted of 22 questions related to the topics presented during the primary NFG (reading nutrition facts panels and ingredients lists). Additionally, panelists who received a secondary EM, received a series of three specific questions directly related to information presented in the secondary EM. A skip-logic was built into the Qualtrics system, but sometimes panelists who did not participate in a given EM answered questions related to the specific EM they did not attend.

4.7 One-Month Follow-Up Survey

Three weeks after completing the NFG, panelists were emailed an invitation to complete the final survey, the one-month follow-up survey (**Appendix G**), which consisted of 21 total questions with eight concerning dairy foods purchasing and consumption, as well as one question to investigate retention of information presented in the primary NFG lesson. The eight questions asked about dairy foods purchasing and consumption were used to measure behavior change IDC made after participating in the NFG and receiving the EM.

4.8 Scheduling of the of NFGs

IDC who fit the criteria to be potential panelists were invited via email to attend a NFG, and provided multiple date and time combinations for the NFG. Respondents were asked to

indicate their availability for any time slot by typing “yes” or “no”. This process was repeated until all respondents were scheduled for NFGs. Confirmations were emailed approximately one week after the initial invitation and reminder emails were sent the day before the sessions. Within these emails, participants were informed of the specific day, time and location of the NFG, with the reminder email requesting each panelist to bring a cellular device to access two surveys in Qualtrics® via QR codes that would be distributed during the NFG (**Appendix H & I**).

The, for NFG were scheduled to contain seven to 10 people. The EM to be delivered during the NFG was randomized, with the caveat that equal numbers of IDC would receive each message. Even though panelists chose the NFG date and time, and received an email reminder 24-hours before the event, some panelists did not attend, which caused differences in the numbers of IDC who heard a specific EM.

4.9 Educational Messages

Four different EMs were possible. Every panelist received the primary (P) EM; approximately 1/4 of participants received the P and one of the three secondary messages. The secondary EM topics included: lactose maldigestion, nine essential nutrients in milk, and prebiotics and probiotics. The P and P + secondary EM were delivered in verbal and visual (**Figures 2, 3, 4, and 5**) forms during the NFG. **Table 6** includes more details on the verbal topic content (**Appendix Q**) and timing. The visual EM were delivered in the form of colorful infographics, which were developed at ISU, with assistance from an intern in the dietetics program. The four infographics included: 1) reading the nutrition facts panel (P) (**Figure 2**), lactose maldigestion (LM) (**Figure 4**), nine essential nutrients (N) (**Figure 3**), and prebiotics and probiotics (PP) (**Figure 5**). EM were delivered by a male or female facilitator between the ages

of 20 and 25. However, because some panelists were delivered by a male or female, there may have been some bias in the outcome.

Key components of the primary message included a walk-through of the Nutrition Facts panel on the infographic, for instance “The first thing I want to point out is the list of ingredients. You can find this UNDER or to the RIGHT of what is called the Nutrition Facts panel.” and “Ingredients must be listed in order from highest to lowest amount in the food. So, for this particular product, milk is the main ingredient, followed by cream. Many times, a company will write “contains less than 2% of” for ingredients that are used sparingly. Note that there are several of those ingredients in this ice cream...” Another key message included: “The last thing I want to tell you about is the Nutrition Facts panel. That panel is there to help consumers make good nutritional choices. At the top, it tells you a serving size and how many servings there are in the package. Serving size is based on a “reference amount customarily consumed”...” Time spent on each of the secondary EM was much less (97/3) compared to the time spent on the P (**Table 6**).

Key elements of the lactose maldigestion EM included “Lactose maldigestion is the insufficient breakdown of lactose in the small intestine. It is caused by consuming more lactose than the lactase enzyme can keep up with, so some of the lactose reaches the large intestine without being broken down.” and “Lactose intolerance is a term that should only be used for extreme cases, where people get discomfort from even a little lactose. About 25% of the population in the United States and 75% of the world have some form of lactose maldigestion so it is actually very common.” and “Cutting out dairy can result in various nutrient deficiencies if they are not adequately provided in the diet. Ice cream has the same 9 essential nutrients as found in milk, cheese and yogurt.”

Key elements of the nine essential nutrients EM included “Dairy products are an important food group that should remain a part of our diet. Dairy products naturally provide us with nine essential nutrients, nutrients we must get from foods because our bodies cannot produce them.

Key elements of the prebiotics and probiotics EM included “During normal digestion, an enzyme produced in our small intestine, called lactase helps us digest lactose. Lactose maldigestion is the insufficient breakdown of lactose in the small intestine caused by consuming more lactose than the lactase enzyme can keep up with and prebiotic means food for bacteria. Lactose is actually a prebiotic because it feeds beneficial probiotic bacteria in your gut. Lactose allows an increase of “good” bacteria, as well as suppression of “bad” bacteria, promoting an environment for digestive health. Even lactose maldigesters may benefit from small doses of lactose” (Tomar, 2014).

UNDERSTANDING

NUTRITION FACTS PANELS

YOUR DAILY TOOL FOR MAKING
NUTRITIONAL CHOICES

| Nutrition Facts | |
|-------------------------------|----------------------|
| 9 servings per container | |
| Serving size | 2/3 Cup (87g) |
| Amount per serving | |
| Calories | 170 |
| % | |
| Total Fat 9g | 12% |
| Saturated Fat 6g | 30% |
| Trans Fat 0g | |
| Cholesterol 35mg | 12% |
| Sodium 50mg | 2% |
| Total Carbohydrate 20g | 7% |
| Dietary Fiber 0g | 0% |
| Total Sugars 18g | |
| Includes 13g Added Sugars | 26% |
| Protein 3g | |
| Vitamin D 0mcg | 0% |
| Calcium 120mg | 8% |
| Iron 0mg | 0% |
| Potassium 160mg | 4% |

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Ingredients
Milk, Cream, Skim Milk, Buttermilk, Sugar, Whey, Corn Syrup, Contains 2% or less of Natural Flavors (with Vanilla Extract), Mono and Diglycerides, Carob Bean Gum, Guar Gum, Carrageenan, Tara Gum, Cellulose Gel, Cellulose Gum, Annatto Extract for Color.

Allergy Information
Contains Milk.

% DAILY VALUE

How much the nutrient contributes to the daily diet, per serving. For general guidance, 5% Daily Value or less in a serving is **low** and 20% Daily Value or more of a nutrient in a serving is **high**.

LACTOSE

Lactose is a natural component of dairy; it is not an added sugar. To calculate grams of lactose per serving just subtract **added sugars** from **total sugars**. Other natural sugars may be present, such as fruit or 100% fruit or vegetable juice.

ADDED SUGARS

Sugars are added to sweeten, preserve, and improve functional attributes. Examples of added sugars: cane sugar, corn syrup, honey, concentrated fruit juices.

Produced for Iowa State University Lactose Education Project

Adapted from FDA.gov/nutritioneducation

Contact milkmade@iastate.edu

Figure 2. Primary educational message on reading the nutrition facts panels.

NINE ESSENTIAL NUTRIENTS IN DAIRY

Health benefits: building and maintaining strong bones and teeth, and aiding nutrient metabolism



DAIRY REDUCES THE RISK OF CERTAIN DISEASES

Consumption of yogurt may reduce the risk of type 2 diabetes & consumption of low-fat dairy products may reduce the risk of hypertension.*

Produced for Iowa State University Lactose Education Project
Contact milkmade@iastate.edu

*Thorning TK, Bertram HC, Bonjour JP, de Groot L, Dupont D, Feeney E, Ipsen R, Lecerf JM, Mackie A, McKinley MC, Michalski MC, Remond D, Riserus U, Soedamah-Muthu SS, Tholstrup T, Weaver C, Astrup A, Givens I. Whole dairy matrix or single nutrients in assessment of health effects: current evidence and knowledge gaps. *Am J Clin Nutr.* 2017;105:1033-1045.

Figure 3. Secondary educational message on the nine essential nutrients in milk.

LACTOSE

Naturally found in most dairy products.



LACTOSE MALDIGESTION

occurs when a person has low lactase enzyme activity. Undigested lactose is not absorbed, and is fermented by bacteria in the large intestine.



LACTOSE INTOLERANCE

the clinical condition when lactose maldigestion causes digestive discomfort or pain.

Produced for Iowa State University Lactose Education Project
Contact milkmade@iastate.edu

Figure 4. Secondary educational message on lactose maldigestion.

Prebiotics & Probiotics in Dairy

Probiotics are live **bacteria** that are beneficial for human health.

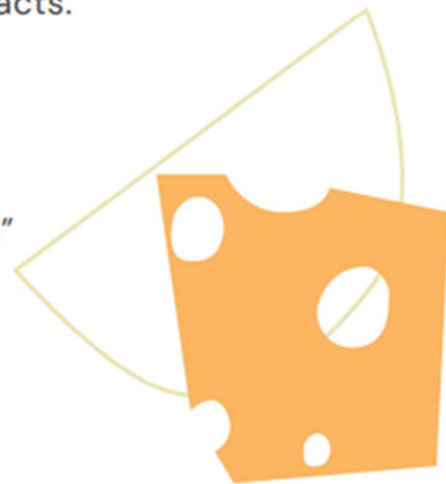
Prebiotics are **food** for beneficial gut bacteria.



Even for people with lactose maldigestion, low levels of **lactose** is **prebiotic** because it feeds probiotic bacteria in their digestive tracts.

Lactose allows an increase of “good” bacteria, as well as suppression of “bad” bacteria.

Together, probiotics and prebiotics **promote an optimal environment** for digestive health.



Lactose maldigesters may benefit from small amount of lactose.

Produced for Iowa State University Lactose Education project.
Contact milkmade@iastate.edu

Figure 5. Secondary educational message on prebiotics and probiotics.

4.10 Nominal Focus Groups

All NFG were held in Room 205, Leland Call Hall (K-State), which has a traditional classroom setting with tables and chairs, with an even floor. Unlike traditional single-style focus groups where data are collected from interacting panelists, the goal was to efficiently deliver educational information to the participants. Thus, interactions between the panelists were limited, but panelists were encouraged to ask questions of the moderators during the NFG. This style of focus group is referred to as a nominal focus groups (Dobbie et al. 2004)). Members of the K-State research team served as moderators, which included combinations of Mr. Jack Myers, Ms. Janaye Young, and Dr. Karen Schmidt. Prior to the start of each NFG, the room was prepared following the current Covid-19 protocols, which included (in order): 1) sanitize tables, 2) designate places at minimum ≥ 1.8 meters apart, and 3) set placings with sanitized pens, spoons, napkins, a plastic cup, and a 236 to 295 mL bottle of water. Due to changes in the Covid-19 policies at K-State, Fall 2021 IDC were asked a series of Covid-19 screening questions before participating (**Appendix J**).

Upon entering the room, panelists were handed pre-assembled folders, asked to keep the folder closed until instructed to open it, and were welcomed to sit at any prepared place setting in the room. Each folder cover contained a unique, randomly generated 3-digit identifier. Inside the folder were various papers, which included (and in this order) consent form (**Appendix K**), pre-survey QR code, the P (**Appendix L**), ice cream sensory evaluation ballots, ice cream nutrition facts infographic, post survey QR code and a cash receipt (**Appendix M**). If the randomization scheme included a secondary EM (**Appendix N, O, P**), this additional infographic was between the ice cream nutrition facts infographic and the post-survey QR code. Stop signs were placed at key locations to help ensure that panelists would not read ahead but would listen to the verbal

lesson. Participants were instructed when to move the stop sign over to look at the information provided.

To start the NFG, panelists were welcomed as a group and the K-State research team was introduced. The next topic to cover was reading aloud the consent form while panelists read the paper copy, which they signed before proceeding with the remainder of the session. The consent form covered four primary topics: 1) research overview, 2) potential risks and discomforts panelists might experience, 3) participants rights, and 4) contact information disclosure. The NFG script/s were written in collaboration between researchers at K-State and ISU. Each script segment was designed to deliver specific information as a part of the research process. The script section topics and their approximate minutes of delivery are shown in Table 6. After the completion of each NFG, consent forms, ice cream ballots, and cash receipts were copied. Ice cream responses were entered into a spreadsheet shared between both academic institutions.

Table 6. Timing of script section topics presented in the nominal focus group.

| Running Time ¹ | Script Section Topic |
|---------------------------|--|
| 1 min. | Welcome |
| 7 min. and 4 sec. | Read the consent form/answer questions |
| 17 min and 34 sec. | Instruct for and complete the pre-survey. |
| 27 min and 7 sec. | Deliver primary educational message |
| 31 min and 29 sec | Conduct sensory testing on ice cream samples |
| 35 min and 34 sec. | Discuss ice cream samples |
| 37 min and 14 sec. | Deliver secondary educational message (selected sessions) |
| 45 min. | Instruct for and complete the post-survey. |
| 55 min. | Distribute payments, closing remarks and field final questions |

¹Script was based on a 55-minute running time, but some nominal focus group went longer because of delays in survey delivery, latecomers, etc.

4.11 Ice Cream Samples

Three ice creams, which varied in lactose and added sugar contents, were manufactured at ISU (Ames, IA, USA) (**Appendix R**) in March, 2021 (**Table 7**). Sample 236 contained 7.8%

lactose. Sample 434 contained 5.8% lactose, which was the same lactose content as a Blue Bunny (Le Mars, IA, USA) vanilla flavored ice cream. The third sample, 976, contained 3.8% lactose. The lactose in these ice cream formulations was primarily sourced from a whey permeate ingredient called Versilac[®] (Proliant Dairy Ingredients, Ankeny, IA, USA) but also naturally a part of the milk, heavy cream and nonfat dry milk. Ice creams were balanced for total sugar content. In April, 2021, 3-gallon containers of ice cream were transported to K-State at -23°C in insulated cold packs (**Appendix S**) containing dry ice, then stored in the K-State Dairy Processing Plant (Manhattan, KS, USA) for 2 – 5 months. When needed for the NFG, ice creams were removed from cold storage at least 48 hours prior to the tasting event, tempered in a -12°C freezer (Model: 178A49FHC, Advanco Refrigeration[®], Harrisburg, PA, USA) and scooped into 59 mL plastic sample cups with lids (Monogram, Cisco[®], San Jose, CA, USA). The cups of ice cream samples were maintained in a cooler with foam refrigerant ice packs (R-Freez-R-Brix[®], Polar Tech[®], Genoa, IL, USA), in the room where the NFG was held. Ice cream samples were distributed one at a time to panelists, in a randomized order. However, due to the change in K-State's Covid-19 protocols, during fall semester, panelists received all three ice cream samples, simultaneously, in Styrofoam[®] (DuPont, Willington, DE, USA) trays (**Appendix T**) made by J. Myers, which maintained the temperature of the ice cream during the tasting segment. Panelists were encouraged to taste one sample at a time, and not “compare” samples. Panelists rated their liking of appearance/color, sweetness, flavor, texture/mouthfeel, and overall liking on a 5-point scale (**Appendix U**).

Table 7. Ice cream base mix formulations with varying lactose contents.

| Ingredient | 3.8% Lactose | 5.8% Lactose (blended 50% 3.8% lactose mix with 50% 7.8% lactose mix) | 7.8% Lactose |
|---|-----------------|---|-----------------|
| Whey Protein Concentrate (WPC) 80 | 1.25 | 0.63 | 0.00 |
| Versilac® whey permeate powder ¹ | 0.00 | 1.65 | 3.30 |
| Non-Fat Dry-Milk (MFDM) | 2.25 | 3.56 | 4.87 |
| Whole Milk | 50.20 | 49.65 | 49.10 |
| Heavy Cream | 28.10 | 28.10 | 28.10 |
| Sugar (sucrose) | 17.35 | 15.30 | 13.25 |
| Danisco® Premium IC ² stabilizer/emulsifier | 0.48 | 0.48 | 0.48 |
| Water | 1.00 | 1.15 | 1.30 |

¹Dairy solid replacer for whey or nonfat dry milk.

²Stabilizer and emulsifier blend from Danisco® (International Flavors and Fragrances Inc, New York, New York, USA).

4.12 Data Mining

Purchasing and consumption data from the NFG pre- and follow-up surveys were extracted from Qualtrics® and placed into an Excel spreadsheet (Microsoft®, Redmond, WA, USA). To measure the effectiveness of EMs on dairy purchasing and consumption behavior, categorical responses (e.g., *consumed <1 gallon of milk or >1 gallon of milk*) were converted into quantitative answers, based upon the recommended servings of dairy foods as described in 21 CFR Part § 135.110 Food For Human Consumption (CFR Title 21, 2021). Standardized serving sizes were, for milk: 8 fluid oz.; for yogurt: 6 oz.; for cheese: 1.5 oz.; and for ice cream: 3.35 oz. For purchasing and consumption conversions, some assumptions needed to be made (**Table 8**). For instance, when panelists selected the highest consumption category (e.g., “more than 1 lb”, “more than 1 quart”) for the dairy product purchased or consumed in the 4-week period, the upper value ended up as the same as the previous level (e.g., (1 – 2 packages (1 lb)),

“about 32 ounces”). This is a limitation of the study that would need improvement in the future, to more accurately account for purchasing and consumption behavior.

Table 8. Conversions of categorical responses from dairy purchasing and consumption in the nominal focus group (NFG) pre-survey and one-month follow-up survey.

| Dairy Food | Pre-Survey Options | One-Month Follow-Up Options | Servings/Week/Person |
|-------------------|---------------------------|------------------------------------|-----------------------------|
| Cheese | None | None | 0 |
| | up to 1 package (8 oz) | One Package (8 oz) | 1.3 |
| | 1 - 2 packages (1 lb.) | Two packages (1 lb.) | 2.6 |
| | more than 1 lb. | More than 1 lb. | 2.6 |
| Ice Cream | None | None | 0 |
| | 1-3 scoops | 1-3 scoops | 0.89 |
| | About 16 ounces (1 pint) | About 16 ounces (1 pint) | 1.2 |
| | About 32 ounces | About 32 ounces | 2.38 |
| Milk | More than 1 quart | More than 1 quart | 32 ounces |
| | None | None | 0 |
| | <1 gallon | Less than one gallon | 0 |
| | 1 Gallon | A gallon | 4 |
| | >1 gallon | More than one gallon | 4 |
| Yogurt | None | None | 0 |
| | Up to 3 servings | Up to 3 servings | 0.33 |
| | 3-5 Servings | 3-5 servings | 1.25 |
| | More than 5 servings | More than 5 servings | 1.25 |

In dairy purchasing behavior, categorical responses were converted to servings of dairy foods on a four-week basis then divided by the number in the household to obtain servings/week/person. Dairy consumption data were mined in a similar process, but not divided by household size. Consumption data are presented as dairy foods servings/week/person. Data of interest included total dairy foods, and cheese, ice cream, milk, and yogurt on servings/week/person basis.

4.13 Data Analysis

To analyze the converted purchasing and consumption data, the qualitative difference in servings/week/person, the amounts converted from responses in the NFG pre-survey were subtracted from the amounts converted from responses in the one-month follow-up survey.

Differences in total dairy foods servings were analyzed using a Wilcoxon signed-rank test. Results were reported as a two-tail test (consumption/purchasing could increase as well as decrease) and significance was set at $p \leq 0.05$. Following analysis of the entire dataset (to determine overall effect of participation), each of the four EM (P, P+N-9, P+LM, P+PP) were analyzed individually. Servings/week/person of cheese, ice cream, milk, and yogurt were analyzed for significance using a paired t-test.

To determine if age group, ethnicity, household size, and gender affected the change in total dairy foods purchased, logistic regression was run in SAS® (**Appendix V**).

Ice cream sensory data were analyzed using a means comparison with a Bonferroni adjustment test because of the small sample size (**Appendix W**).

All data were analyzed using SAS® Studio (Cary, NC, USA) and all significance was set for ($p \leq 0.05$). SAS code for the Wilcoxon signed-rank tests can be found **Appendix T**, whereas **Appendix U** for the SAS code for the paired t-test.

Chapter 5 - Results and Discussion

5.1 Demographics of Inadequate Dairy Consumers (IDC)

A total of 2,411 people completed the Food Choices and Intolerances Screening survey. However, while 421 IDC were identified in the filtering process, only 101 attended a NFG and completed the sensory analysis. As in many studies utilizing human subjects as experimental units, there are some limitations. Only 80 completed all portions of the study (the NFG pre-survey, NFG post-survey, and the one-month follow-up survey). This is not atypical for research studies involving human subjects, which have an average response rate of 50% (Baruch & Holton, 2008). Presented in **Figure 7** are the demographics (gender, age category, and race) of the 80 IDCs who completed all portions of the study. When these data were analyzed in a logistical regression for their effect on servings of dairy foods purchased, no significant effects were observed ($p \geq 0.05$). However, the study was not designed to target certain demographics, but rather IDC, thus, significant effects were not expected. Craig & Florida (1988) claimed that for social marketing to be effective, the EM must be designed for a specific audience. Therefore, if the objective of the study was to target dairy purchasing and consumption by gender, age, and race, those would have been the filtering criteria used for the study.

When comparing the target audience of the 80 IDC to the K-State population, some trends were noticed. The IDC consisted of 70% female and 30% male, whereas the population at K-State is 47.5% female and 52.5% male. Thus, more women were involved in the study when compared to the female population at K-State. This is also not surprising. Bärebring et al. (2020) reported that when 2,000 Swedish individuals were surveyed, 35% of women prioritized a healthy lifestyle, whereas only 25% of men did so. Therefore, perhaps more women than men may volunteered for the study because of the nature and introduction to the FCI survey.

Specifically, the invitation to participate in the survey requested that panelists self-report their purchasing and consumption patterns of food and the importance of healthy eating to them.

Additionally, from the cohort of all IDC, 75%, 13.5%, 6.3%, 2.5% and 1% identified as white, Hispanic/Latin American, Asian, African American, and Native American, respectively. Considering the K-State population, the current makeup is 78.7%, 7.4%, 2.8%, 1.7% and <1% white, Hispanic/Latin American, African American, Asian, and Native American, respectively. Based on volunteers, ethnicities of the IDC were not surprisingly comprised of mostly Caucasians.

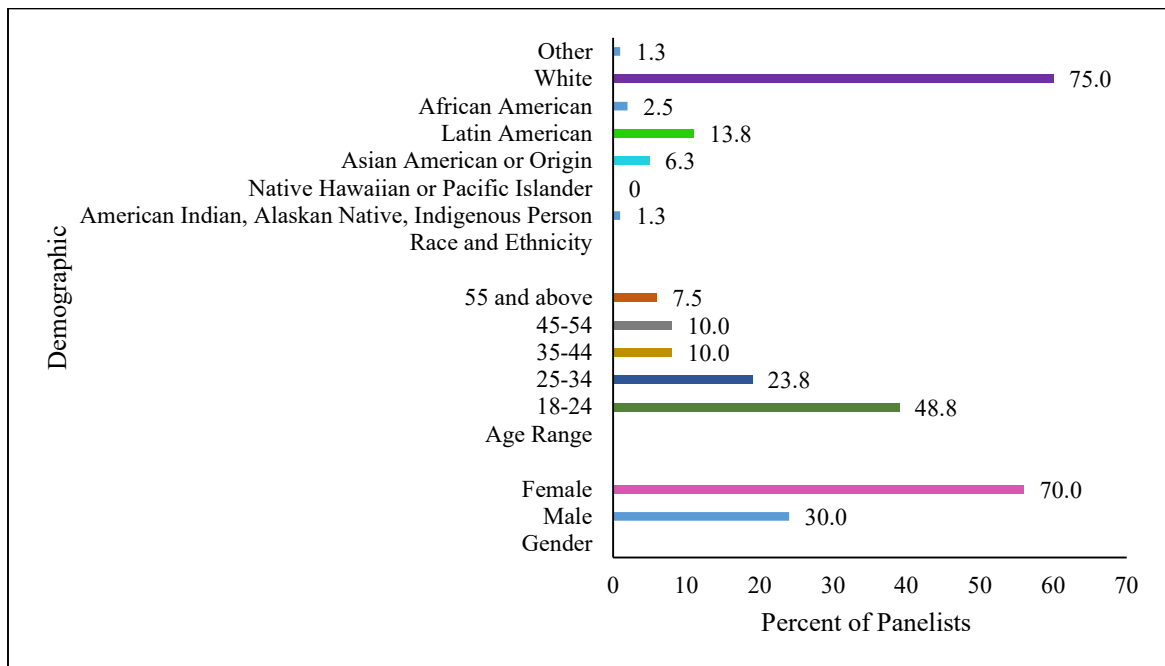


Figure 6. Demographics of inadequate dairy consumers (IDC).

5.1 Validation of Inadequate Dairy Consumers

Dairy foods consumption data were self-reported by panelists three different times: 1) in the FCI survey, 2) in the NFG pre-survey, and 3) in the NFG follow-up survey. Using the 2020-

2025 Dietary Guidelines for Americans (USDA, 2022), IDC were defined as consuming less than three servings of dairy foods per day, or 21 servings per week. Survey responses allowed researchers to roughly quantify the servings of dairy foods purchased and consumed before and after attending the NFG. Before the NFG (from the NFG pre-survey results), panelists consumed between less than three to not more than 12 servings of dairy foods/week, with an overall average of 6.91 ± 2.14 servings of dairy foods/week (**Table 9**). Panelists were not asked many questions about why they did not eat dairy foods, in part to keep the survey short. Additionally, the primary goal of the research was to investigate the impact of EM on behavior change (dairy purchasing and consumption). Some of these questions asked in NFG Pre- and follow-up survey were: “*How much milk did you purchase for home use this month*” or “*How much milk did you personally consume this month*”.

Dann (2010) stated that a successful social marketing campaign must target the appropriate audience. In the present study, no one reported that they consumed more than 12 servings of dairy foods/week, thus they meet the definition of IDC, and the appropriate target audience participated in the study.

Table 9. Total servings/week/person of dairy foods purchased and consumed.

| Inadequate Dairy Consumer Behavior | Total Servings/Week/Person | |
|------------------------------------|----------------------------|------------------------------|
| | Pre ¹ | One-Month Later ² |
| Dairy Purchasing | 3.50 + 1.61 | 4.25 ± 0.63 |
| Dairy Consumption | 6.91 ± 2.14 | 8.51 ± 1.30 |

¹Pre=Purchasing data collected from the nominal focus group (NFG) pre-survey.

²Post=Purchasing data collected from the one-moth follow up survey.

5.2 Dairy Purchasing Behavior

Panelists reported their dairy foods purchasing in the NFG pre-survey and in the NFG follow-up survey. In the NFG pre-survey, panelists self-reported that they purchased 3.50 ± 1.61 dairy foods servings/week/person into the household, whereas one month later, panelists reported that they purchased 4.25 ± 0.63 dairy foods servings/week/person into the household (**Table 10**). The total change in servings/week/person for all panelists between pre-survey and the one-month follow-up survey increased significantly ($p \leq 0.05$) between surveys.

The message received also had an impact (**Table 10**). Panelists who received the P+PP EM significantly ($p \leq 0.05$) increased the purchasing of dairy foods by 0.65 servings/week/person. However, no other EM yielded a significant change in dairy product purchasing. Two reasons may explain the increase resulting from the P+PP message. Cunningham et al. (2021) presented that recent publicity around the human microbiome, coupled with consumer interest in prebiotics and probiotics, have led to their incorporation into many different food products (e.g., yogurt, fermented foods). Therefore, perhaps the health benefits of prebiotics and probiotics discussed during this EM, triggered IDC to re-consider prebiotics and probiotics in their diets, and motivated them to purchase more dairy foods. Second, the number of IDC who heard this message was greater ($n=28$) compared with the audience numbers who received the other EM (15, 17 and 20 for P, P+LM and P+N, respectively) and as sample size increases, the statistical power, and likelihood to find differences if they exist, increases simultaneously (Baugley, 2004).

To understand which individual dairy foods had a significant increase as a function of the P+PP, paired t-tests were conducted on the servings/person/week of the individual dairy foods, and these results are displayed in **Table 11**. Milk was the only dairy food purchased in

significantly greater quantities after the NFG-an increase of 0.43 servings/week/person. Panelists who received the other EM did not change their dairy foods purchasing habits significantly. When considering the 95% confidence interval, some panelists who received the P and P+N decreased the amount of dairy foods purchased (**Table 11**).

Table 10. Wilcoxon signed-rank test statistics for change in purchased dairy foods servings per person per week as a function of attending a nominal focus group and receiving different educational messages (EM).

| EM | N | DF | Wilcoxon p-value | t-statistic | 95% CI ² |
|---------------------|----|----|------------------|-------------|---------------------|
| P ¹ | 15 | 14 | 0.107 | 1.39 | -0.20 to 1.19 |
| P + LM ¹ | 17 | 16 | 0.093 | 2.42 | 0.26 to 2.48 |
| P + N ¹ | 20 | 19 | 0.114 | 1.24 | -0.26 to 1.16 |
| P + PP ¹ | 28 | 27 | <0.0001 | 4.11 | 0.41 to 1.14 |

¹P= Nutritional Facts Panel; P + LM= P + Lactose Maldigestion; P + N= P + Nine Essential; P + PP= P + Prebiotics and Probiotics.

²95% CI from the paired t-test.

Table 11. Mean servings per person per week of purchased cheese, ice cream, milk and yogurt from before (pre-survey) and one month after (follow-up) receiving different educational messages.

| Dairy Food | Educational Message | | | | | | | |
|------------|---------------------|------------------------|-------------------|------------------------|------------------|------------------------|-------------------|------------------------|
| | P ² | | P+LM ² | | P+N ² | | P+PP ² | |
| | Pre ³ | One-Month ⁴ | Pre ³ | One-Month ⁴ | Pre ³ | One-Month ⁴ | Pre ³ | One-Month ⁴ |
| Cheese | 0.91 ± 0.56 | 0.87 ± 0.63 | 0.72 ± 0.66 | 0.92 ± 1.00 | 1.00 ± 0.71 | 1.30 ± 0.90 | 1.00 ± 0.70 | 1.00 ± 0.73 |
| Ice Cream | 0.63 ± 0.40 | 0.90 ± 0.81 | 0.88 ± 0.36 | 1.00 ± 1.00 | 0.73 ± 0.42 | 0.74 ± 0.60 | 0.70 ± 0.60 | 0.90 ± 0.81 |
| Milk | 1.79 ± 0.91 | 2.30 ± 1.31 | 1.80 ± 1.05 | 2.50 ± 1.60 | 1.60 ± 0.92 | 2.10 ± 1.51 | 1.31 ± 0.81* | 1.74 ± 1.20* |
| Yogurt | 0.36 ± 0.38 | 0.31 ± 0.43 | 0.40 ± 0.35 | 0.30 ± 0.50 | 0.33 ± 0.33 | 0.35 ± 0.34 | 0.24 ± 0.22 | 0.31 ± 0.31 |
| Total | 3.71 ± 0.60 | 4.34 ± 0.74 | 3.80 ± 0.53 | 4.70 ± 0.82 | 3.60 ± 0.50 | 4.44 ± 0.64 | 3.20 ± 1.66* | 3.84 ± 2.21* |

¹Mean + SD.

²P= Nutritional facts labeling; P + LM= P + Lactose Maldigestion; P+N=P + Nine Essential Nutrients; P + PP: P + Prebiotics and Probiotics.

³Consumption data collected from the nominal focus group (NFG) pre-survey.

⁴Consumption data collected from the one-month follow up survey.

⁵Significant changes in dairy foods within the row represented by *.

5.3 Dairy Consumption Behavior

Panelists reported their dairy foods consumption in the NFG pre- and follow-up surveys. In the pre-survey, panelists self-reported that they consumed 6.91 ± 2.14 servings of dairy foods on a week/person basis. In the follow-up survey, panelists consumed 8.51 ± 1.30 servings/week/person (**Table 10**). For all panelists, the difference in total dairy servings consumed was statistically significant.

The discrepancy between servings of dairy foods purchased (4.15 ± 1.61) and consumed (6.91 ± 2.14) by IDC may be surprising, but two factors may have contributed to the difference. First, some of this cohort may have resided in university dormitory housing and this living situation may preclude them from purchasing foods (Sibylle-Kranz, 2012). Additionally, the majority of IDC participants were college-age (18-25). Second, the National Labor Statistics report (2022) show that consumers under the age of 25 spent nearly half of their food expenditures for foods eaten outside of the home (**Figure 6**), thus some IDC from this age group may be consuming dairy foods outside of the home.

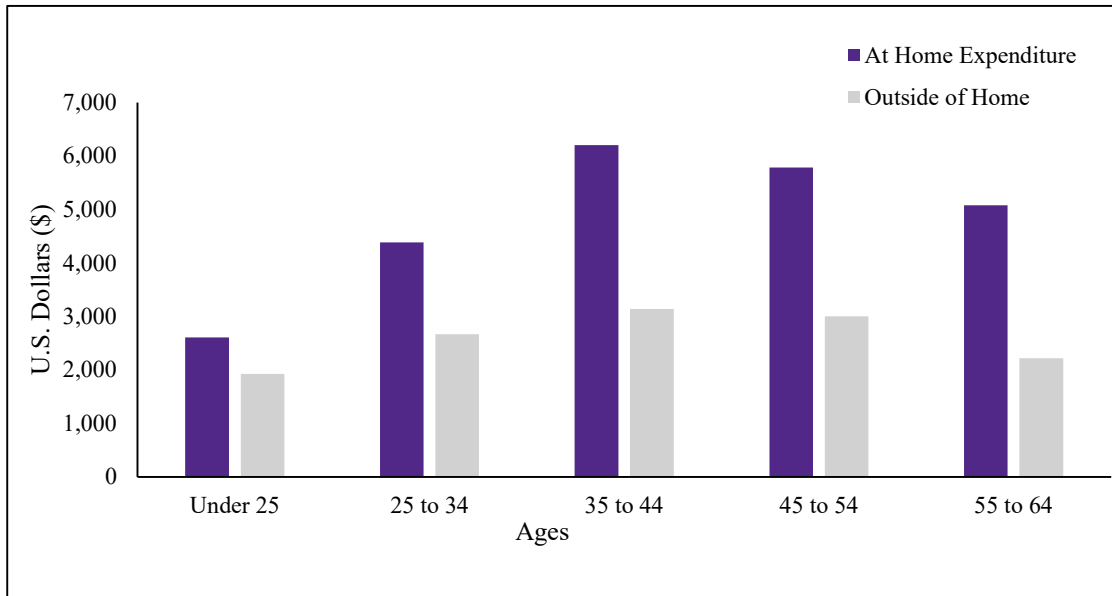


Figure 7. Per capita expenditures, in dollars, for at-home and outside-of-home food purchases (Source: National Labor Statistics, 2022)

Panelists who received the P, P+LM, and P+PP messages significantly ($p \leq 0.05$) increased their consumption of dairy foods by 1.27, 2.02 and 2.06 servings/week/person, respectively (**Table 12**). The P+N message did not have a significant impact on dairy foods consumption. When considering the P+LM, many marketing programs and products have exposed consumers to lactose-free dairy products (e.g., milk, ice cream) (Vera et al., 2022). Further, some Americans who believe they have lactose intolerance, may be misdiagnosed. Therefore, when IDC heard the line, “lactose is not considered an added sugar”, consumption of dairy milk may have increased because panelists were concerned about the added sugar in other non-dairy beverages.

When considering the increase due to the P+PP message, prebiotic and probiotics information has been in the scientific and popular press in recent years. Yilmaz-Ersan et al. (2020) claimed that probiotic dairy foods is one of the fastest growing segments in the functional food industry. Jackson et al. (2019) estimated the growth in the prebiotic industry to be 7%

annually. The phrase in our script, “Some people avoid ice cream and other dairy products because they suffer lactose intolerance or lactose maldigestion, but this does not mean they should stop eating dairy products” may have encouraged some IDC to consume milk, cheese, or ice cream, if they previously thought that dairy foods should be limited in their diet.

Paired t-tests were conducted on the cheese, ice cream, milk and yogurt data from the converted pre- and follow-up survey data. On average, milk consumption significantly increased by 1.00, 1.48, and 1.29 servings/week/person for the panelists who received the P, P+LM, and P+PP messages, respectively (**Table 13**). However, as indicated by the 95% CI (**Table 12**), some panelists in the P and P+N groups decreased their consumption of dairy foods (**Table 13**).

Those who received the P+LM significantly increased their cheese consumption by 0.46 servings/week/person. On the other hand, those who received the P+PP significantly increased their cheese and ice cream consumption by 0.31 and 0.44 servings/week/person, respectively. It is possible that the impression of these dairy foods became more favorable during these particular focus group EMs.

Table 12. Wilcoxon signed-rank statistics for the change in dairy foods servings consumed per person per week as a function of receiving differing educational messages (EM).

| EM | N | DF | Wilcoxon p-value | t-statistic | 95% CI ² |
|---------------------|----|----|------------------|-------------|---------------------|
| P ¹ | 15 | 14 | 0.015 | 1.53 | -0.35 to 2.87 |
| P + LM ² | 17 | 16 | 0.004 | 2.96 | 0.68 to 3.36 |
| P + N ³ | 20 | 19 | 0.20 | 0.96 | -0.63 to 1.91 |
| P + PP ⁴ | 28 | 27 | <0.0001 | 4.29 | 0.32 to 3.96 |

¹P= Nutritional Facts Panel; P+LM= P+Lactose Maldigestion; P+N= P+Nine Essential; P+PP= P + Prebiotics and Probiotics.

²95% Confidence Interval from the paired t-test.

Table 13. Mean servings per person per week of consumed cheese, ice cream, milk and yogurt from before (pre-survey) and one month after (follow-up) receiving different educational messages.

| Dairy Food | Educational Messages | | | | | | | |
|-----------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------|------------------------|--------------------------|--------------------------|
| | P ² | | P+LM ² | | P+N ² | | P+PP ² | |
| | Pre-survey ³ | Follow-up ⁴ | Pre-survey ³ | Follow-up ⁴ | Pre-survey ³ | Follow-up ⁴ | Pre-survey ³ | Follow-up ⁴ |
| servings/week/person ¹ | | | | | | | | |
| Cheese | 1.85 ± 0.65 | 1.88 ± 1.18 | 1.71 ± 0.88 ^a | 2.17 ± 1.21 ^b | 1.72 ± 0.85 | 1.77 ± 1.10 | 1.90 ± 0.74 ^a | 2.21 ± 0.74 ^b |
| Ice Cream | 1.36 ± 0.83 | 1.54 ± 0.89 | 1.14 ± 0.68 | 1.31 ± 0.97 | 1.11 ± 0.75 | 1.27 ± 0.90 | 1.10 ± 0.55 ^a | 1.54 ± 0.90 ^b |
| Milk | 4.00 ± 0.00 ^a | 5.00 ± 1.32 ^b | 3.52 ± 1.28 ^a | 5.00 ± 1.24 ^b | 3.20 ± 1.60 | 3.45 ± 2.52 | 2.71 ± 1.86 ^a | 4.00 ± 2.30 ^b |
| Yogurt | 0.81 ± 0.53 | 0.91 ± 0.78 | 0.71 ± 0.50 | 0.63 ± 0.83 | 0.63 ± 0.51 | 0.81 ± 0.72 | 0.75 ± 0.50 | 0.88 ± 0.71 |
| Total | 8.02 ± 1.68* | 9.28 ± 3.00 ^b | 7.09 ± 1.75 ^a | 9.11 ± 2.39 ^b | 6.67 ± 0.96 | 7.30 ± 0.99 | 6.44 ± 2.21 ^a | 8.59 ± 2.73 ^b |

^{a-b}Denotes a significant increase in consumed servings as a results of hearing a given educational message in a row between pre-survey and follow-up survey responses

¹Mean ± SD

²P= Nutritional facts panel; P+LM= P + Lactose Maldigestion; P+N=P + Nine Essential Nutrients; P+PP: P + Prebiotics and Probiotics

³Consumption data collected from the nominal focus group (NFG) pre-survey

⁴Consumption data collected from the NFG one-month follow up survey

5.4 Success as A Social Marketing Campaign

When IDC were analyzed together, regardless of EM, there was a 19.4% and 20.7% increase in the servings of dairy foods purchased and consumed, respectively. As described in literature, Hanson (2006) defined success of social marketing campaign as having a 15% reduction in teenage drunk driving. Therefore, if this benchmark is applied to this present research, the social marketing campaign was successful at increasing total dairy foods purchasing and consumed among all IDC.

However, when IDC were analyzed by EM received, success was dependent on the EM. Social marketing campaigns can fail for a variety of reasons. Cook et al. (2021) interviewed 100 social marketing researchers, 58 of whom were involved with a study that failed. When researchers were asked why their social marketing campaigns failed, and the top three reasons were: poor strategy development, external influences, and the program and/or behavioral program was poorly designed. In the present study, P+N failed to incite a change (increase or decrease) in dairy foods purchasing and consumption behaviors. This may have been because little new was presented. Smith et al. (2022) documented that a large percentage of the Western population is aware of the health benefits of consuming dairy foods. In 2021, Willet & Ludwig claimed that all of the nutrients found in dairy foods, except for calcium, can be obtained from eating a healthy balanced diet and/or from other food sources. If these statements are true, it stands to reason that the IDC participants already knew the nutritional value of consuming dairy foods and it did not matter to them, so the information shared did not motivate a change in their purchasing or consumption behaviors.

Another consideration may be information flow. With the focus on using the example of ice cream to understand the concept of added sugars in the P lesson everyone received, perhaps

that information did not connect as well with the lesson about essential nutrients of milk. Although all participants were told about how the ice cream formulations differed, the differences did not specifically relate to essential nutrients in dairy, so there was no reinforcement of that lesson. To improve the nine essential nutrients message effectiveness, the script needs to be changed to better resonate with IDC or to reinforce other concepts covered in the P message. Examples of potential changes to the script or lesson could be to expand on the bioavailability of dairy nutrients over other non-dairy foods, elaboration on the bioavailability of whey protein when explaining the ingredient differences in the ice cream samples, or developing EM even more to stress the health benefits of specific dairy foods.

Because there were some reported increases in dairy foods consumption and purchasing, it was natural to want to know which ones. Typically, there was a significant increase in milk consumption between the pre-survey and the follow-up survey ($p \leq 0.05$). On average, in the NFG pre-survey, IDC self-reported consuming 4.00 servings of milk per week and the follow-up survey showed that IDC increased milk consumption to 4.43 servings/person/week, a 10.2% increase. However, in individual messages milk consumption increased by 15%, 25%, 9% and 28% in IDC who heard the P, P+LM, P+N, and P+PP EM, respectively. Phrases like, “The last thing I want to tell you about is the Nutrition Facts panel. That panel is there to help consumers make good nutritional choices. At the top, it tells you a serving size and how many servings there are in the package. Serving size is based on a “reference amount customarily consumed..” for the P. Because this line taught IDC how to read nutrition facts panels, they may have increased dairy consumption based just simply reading the information found on the nutrition facts panels of dairy foods. Further, quotes like, “about 25% of the population in the U.S. has lactose intolerance” in the P+LM, or “some people avoid ice cream and other dairy products

because they suffer from lactose intolerance, or lactose maldigestion, but that does not mean they should stop eating dairy products”, may have given IDC information about consuming a dairy food, which they thought they could previously not eat. Lastly, the P+PP message could have influenced panelists to consume more milk because of the prebiotic attributes of lactose that they learned about. Milk purchasing may have also increased because has a shorter shelf-life when compared to the other dairy foods.

For consumption, the IDC who heard the P, P+LM and P+PP increased milk consumption on average by 1.00, 1.00 and 1.29 servings/week/person, respectively. The IDC who heard the P+LM and P+PP increased cheese consumption on average by 0.46 and 0.44 servings/week/person, respectively. Finally, the IDC who received the P+PP increased ice cream servings on average by 0.44 servings/week/person. Overall, changes in individual dairy foods consumed was a function on the EM received during the NFG. Quotes from the oral script such as, “lactose allows an increase of “good” bacteria, as well as suppression of “bad” bacteria, promoting an environment for digestive health”, may have encouraged panelists to consume more dairy foods based in the prebiotic and probiotic health benefit.

Although some EM incited increases in dairy purchasing and/or consumption behavior, no IDC became an adequate dairy consumer after the intervention. However, behavioral changes as a result of a social marketing campaign take time to come to fruition. For example, Drope et al. (2018) reported prevalence of U.S. adults smoking cigarettes decreased from 42% in 1982 to 15% in 2015. This decline has come after decades of smoking cessation programs, bans on public smoking, and social marketing campaigns directed on targeting smokers and non-smokers. Perhaps, over time, with repeated messaging about dairy products nutrition, increases will be seen in the purchasing and consumption as well.

5.5 Sensory Evaluation of Vanilla Ice Cream

The second objective of the present study was to quantify consumer liking of three samples of vanilla ice cream with lactose contents at 3.8% (sample number 976), 5.8% (sample number 434), and 7.8% (sample number 236). This portion of the study allowed panelists to share their perspectives on the samples so to gain insight into if consumers would purchase dairy foods with added lactose. All ice cream sensory results are presented in **Table 14**. Mean scores for ice cream attributes ranged between liked slightly (4.0/5.0) to neither disliked nor liked (3.0/5.0). The liking of the appearance, flavor and overall, of the ice creams were similar ($p > 0.05$).

For sweetness, ice cream with 7.8% lactose was liked as much as the ice creams with either 3.8 or 5.8% lactose. However, IDC had a greater liking for the 5.8% lactose ice cream sweetness than the sweetness of the 3.8% lactose ice cream ($p \leq 0.05$). Although the total sugar was the same in the formulations, these results are not surprising because the 5.8% lactose sample was most similar to the typical amount of sucrose (added sugar) in commercial ice cream. Lactose is naturally less sweet than sucrose-about 40% less sweet. The ice cream with 3.8% lactose had more sucrose than typical, and the 7.8% lactose ice cream had less sucrose than typical.

In texture, there was no statistical difference in liking between the 5.8% and 3.8% lactose samples or between the 3.8% lactose and the 7.8% samples. However, the texture of the ice cream with 5.8% lactose was liked more than the ice cream with 7.8% lactose. Again, this may have had something to do with familiarity. Another possibility is that the sandy defect may have started to be notable in the ice cream with 7.8% lactose, leading to lower acceptability. By the time the second set of panelists participated in the NFG, the ice cream had been stored seven

months and had gone through at least one freeze-thaw cycle. Nonetheless, all ice creams were acceptable (scores close to 4.0).

Overall, these results indicate the content of lactose did not significantly affect the acceptability of the ice cream samples. Because all ice creams were equally liked overall (mean score close to 4.0), these data show that lactose can be manipulated in ice cream, and potentially other dairy foods, with potentially little effect on acceptability by consumers.

Because panelists were asked to not go back and forth between samples, they may have scored earlier samples with a higher or lower liking in anticipation that a better or worse sample may be coming. However, overall panelists had similar liking in nearly all sensory attributes in the ice cream samples.

Table 14. Effects of varying lactose concentrations on the sensory attributes of vanilla ice cream¹.

| Sensory Attribute ² | Lactose Concentration | | |
|--------------------------------|---------------------------|--------------------------|---------------------------|
| | 7.8% | 5.8% | 3.8% |
| Appearance | 3.90 ± 1.09 ^a | 4.14 ± 0.92 ^a | 4.04 ± 1.04 ^a |
| Sweetness | 3.90 ± 1.04 ^{ab} | 4.13 ± 0.99 ^a | 3.78 ± 1.11 ^b |
| Flavor | 3.83 ± 1.11 ^a | 3.97 ± 1.04 ^a | 3.68 ± 1.20 ^a |
| Texture | 3.74 ± 1.13 ^b | 4.15 ± 1.13 ^a | 3.84 ± 1.16 ^{ba} |
| Overall Liking | 3.78 ± 1.05 ^a | 4.02 ± 1.06 ^a | 3.73 ± 1.09 ^a |

¹n=101.

²Rated on a 5-point hedonic scale, where: 1, very much dislike; 2, dislike slightly; 3, neither dislike nor like; 4, like slightly; 5, like very much.

^{a-b} Means with different superscripts in the same row indicate a significant difference (p≤0.05).

5.6 Limitations to the Study

One limitation of this research is the seasonal variation of food purchasing. Although this research occurred during two seasons (summer and fall), we did not account for seasonal variations in the purchasing and consumption of dairy foods, such as increase in ice cream

purchasing and consumption during summer months, because the sample size may have been too small (Palka, 2018). We also did not account for quality deterioration that may have occurred in the ice cream during storage.

Sociodemographic (income, education level, housing type) data, which are known to be factors in the purchasing behavior for foods (Cranfield et al., 2012), were not collected. Though data collected on demographics show no significant effect on dairy purchasing, if surveys had asked which type of housing our panelists resided in, the information could then be analyzed based on housing type, as those who live in university dorms may not be large food purchasers.

Unfortunately, panelists were not asked to specify if it was dairy milk or a non-dairy beverage, so we cannot be 100% sure that numbers reflect changes in dairy milk purchasing and consumption. Paul et al., (2019) reported a 6% increase in non-dairy beverage sales, with 58% of these sales driven by soy milk. Perhaps, some of the IDC in this study may have purchased and/or consumed non-dairy beverages.

Finally, the research team created the infographics and scripts, with little to no input or review by nutritional science or sociology or psychology colleagues. Perhaps tools would have been more effective with more collaboration with such colleagues.

Chapter 6 - Conclusions

There were two primary objectives for this research: 1) direct a social marketing campaign at inadequate dairy consumers, using EM, to incite an increase in dairy purchasing and consumption, and 2) quantify consumer acceptability of ice cream with varying levels of lactose.

When all IDC were analyzed collectively, the group significantly increased dairy foods purchased and consumed (servings/week/person) by 19.5 and 20.5%, respectively. When the effectiveness of individual EMs were analyzed, only panelists who received the P+PP EM significantly increased servings/week/person of dairy foods purchased (by 18.5%). Only IDC who received the P, P+LM, and P+PP EM significantly increased servings/week/person of dairy foods consumed (by 15, 25, and 28%, respectively). IDC who received the P+N EM had no significant change in dairy foods purchased or consumed. When the individual dairy foods were analyzed, milk was the product which significantly increased across all statistically significant EM. To increase the effectiveness of the P+N EM and in individual dairy foods, EM should be tailored to present specific health benefits which can be derived from any one of the nine essential nutrients found in dairy foods.

In the second objective, panelists indicated they either “*neither liked not disliked*” or “*liked slightly*” the sensory attributes of the three samples of vanilla ice cream. There was no significant difference in overall liking between samples, indicating that consumers may be willing to purchase dairy foods with varying levels of lactose.

This study shows how social marketing theory can potentially be utilized by the dairy industry to increase purchasing and consumption of dairy products, based upon their nutritional attributes. Further, this study shows that EM can be delivered in a nominal focus group setting and have an impact on dairy purchasing and consumption. Overall, the study was effective at

increasing the dairy food purchasing and consumption among inadequate dairy consumers. However, only the P+PP EM significantly increased dairy foods purchasing, while the P, P+LM, and P+PP significantly increased dairy foods consumption. When looking at individual dairy foods, EM were most influential at increasing milk purchasing and consumption. Overall, this study effectively used the principles of social marketing (target audience, educational messages, and a delivery method) to increase dairy purchasing and consumption among sample population inadequate dairy consumers. Based upon the findings of this research, social marketing stands to have an impact on the attitudes towards dairy foods among inadequate dairy consumers.

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Appendix A - Iowa State University Institutional Review Board

Approval

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office of Research Ethics
Vice President for Research
2420 Lincoln Way, Suite 202
Ames, Iowa 50014
515 294-4566

Date: 12/22/2020
To: Stephanie Clark
From: Office of Research Ethics
Title: Expanding the use of prebiotic lactose in ice cream
IRB ID: 20-227
Submission Type: Modification **Review Type:** Expedited
Approval Date: 12/22/2020 **Approval Expiration Date:** N/A

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- **Use only the approved study materials** in your research, including the **recruitment materials and informed consent documents that have the IRB approval stamp.**
- **Retain signed informed consent documents** for 3 years after the close of the study, when documented consent is required.
- **Obtain IRB approval prior to implementing any changes** to the study or study materials.
- **Promptly inform the IRB of any addition of or change in federal funding for this study.** Approval of the protocol referenced above applies only to funding sources that are specifically identified in the corresponding IRB application.
- **Inform the IRB if the Principal Investigator and/or Supervising Investigator end their role or involvement with the project** with sufficient time to allow an alternate PI/Supervising Investigator to assume oversight responsibility. Projects must have an [eligible PI](#) to remain open.
- **Immediately inform the IRB of (1) all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) **any other unanticipated problems involving risks** to subjects or others.
- IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. **Approval from other entities may also be needed.** For example, access to data from private records (e.g., student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of

IRB 07/2020

Appendix B - Food Choices and Intolerances Survey NFG Pre-Survey

Consent form for participation in Qualtrics Survey about Food Choices and

Intolerances Thank you for your willingness to participate in our Qualtrics Survey about Food Choices and Intolerances. This research is being carried out by the team of Dr. Stephanie Clark, department of Food Science and Human Nutrition at Iowa State University, and Dr. Karen Schmidt, department of Animal Sciences and Industry at Kansas State University, with a goal to understand consumers' food and beverage purchasing and consumption behavior, with particular attention to food allergies and intolerances. Your participation is voluntary; if you agree to participate in the survey, you can change your mind later or quit at any time. There will be no penalty or loss of services or benefits if you decide to not take part or quit later. If you are an employee or student of the researchers, your decision to participate or not will have no bearing on your status or your relationship with the researchers. This study has been approved for human subjects participation by the Iowa State University Institutional Review Board (ISU IRB). You are eligible to participate in this study if you are an adult, age 18 or older, and are a regular (i.e., monthly) consumer/purchaser of food products. You will be asked some demographic questions and questions regarding your current food and beverage purchasing and consumption habits, along with inquiries about allergies, intolerances, and digestive conditions. You may skip any question you are not comfortable answering. The survey is expected to take approximately 6 minutes to complete. For your time needed to participate in the survey, you will be entered in a drawing for 1 of 2 \$25 AMAZON gift cards. You may elect to drop out of the survey at any time, without any negative feelings, but must complete the survey to be entered in the drawing. If you agree to participate and provide your email address, you may be contacted for a follow up study. There is no direct benefit to you from being in this study except the financial compensation you may receive if you win the drawing. The potential risk from taking part in this study is potential stress in filling out the survey questions. It is hoped that the information gained in this study will help food producers communicate more effectively with consumers. Research records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available without your permission. However, it is possible that other people and offices responsible for making

sure research is done safely and responsibly will see your information. This includes federal government agencies, the Midwest Dairy Foods Research Center (the study's sponsor), auditing departments of ISU, and the IRB (a committee that reviews and approves human subject research studies), which may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information. However, no published results will identify you, and your name and e-mail address will not be associated with the survey responses. Information about you, collected for this study may be shared with other researchers. It may also be used for other research studies. These studies may be similar to this study or completely different. We will make sure that your identity cannot be linked to the information we share. We will not ask you for additional permission before sharing the information. If you have questions about this study or the information in this form, please contact the principal investigator of the project, Dr. Stephanie Clark, at 515-294-7346 or milkmade@iastate.edu. If you have questions about your rights related to research participation, please contact the ISU IRB, at 515-294-4215 or IRB@iastate.edu. Agreeing to continue means: You understand the information given to you in this form. You believe you understand the research study and the potential benefits and risks involved. Upon request, you will be given a copy of this consent document for your records. If you agree to the terms, please type your name and continue to the survey. We sincerely thank you for your time, Stephanie Clark.

Q0: If you agree to the terms, please type your name and continue to the survey.

1. Please indicate the neat city you are located.

- Ames, IA (1)
- Ankeny, IA (2)
- Nevada, IA (3)
- Des Moines, IA (4)
- Iowa City, IA (5)
- Manhattan, KS (6)
- Junction City, KS (7)
- Topeka, KS (8)
- Salina, KS (9)
- Outside of Iowa and Kansas (10)

2. Eating healthy is _____ to me.

- Not important (1)
- Somewhat important (2)
- Moderately important (3)

- Important (4)
- Very important (5)

3. I go out of my way to consume food containing (check any and all response that are true for you at this point in time):

- I don't go out of my way to consume any of the listed options (12)
- Cereal grains (e.g. oat, rice, wheat) (1)
- Dairy (e.g., milk, yogurt, ice cream, etc.) (2)
- Eggs (3)
- Meat (e.g., beef, pork, poultry) (4)
- Peanuts (5)
- Pulses (e.g., beans, peas, lentils, etc.) (6)
- Seafood (including shellfish) (7)
- Soy (including tofu) (8)
- Tree nuts (e.g., almonds, pecans) (9)
- Vegetables (e.g., zucchini, broccoli, etc.) (10)
- Fruits (e.g. kiwi, banana, avocado) (14)
- Other not listed (11) _____

4. I go out of my way to avoid foods containing (check any and all responses that are true for you at this point in time):

- I do not avoid any of the listed options (12)
- Cereal grains (e.g. oat, rice, wheat) (1)
- Dairy (e.g., milk, yogurt, ice cream, etc.) (2)
- Eggs (3)
- Meat (e.g., beef, pork, poultry) (4)
- Peanuts (5)
- Pulses (e.g., beans, peas, lentils, etc.) (6)
- Seafood (including shellfish) (7)
- Soy (including tofu) (8)
- Tree nuts (e.g., almonds, pecans) (9)
- Vegetables (e.g., zucchini, broccoli, etc.) (10)
- Fruits (e.g. kiwi, banana, avocado) (14)
- Other not listed (11) _____

5. I have been medically diagnosed with an allergy/intolerance to (check any and all responses that are true for you at this point in time):

- I have not been diagnosed with a food allergy or food intolerance (12)
- Cereal grains (e.g. oat, rice, wheat) (1)
- Dairy (e.g., milk, yogurt, ice cream, etc.) (2)
- Eggs (3)
- Meat (e.g., beef, pork, poultry) (4)
- Peanuts (5)
- Pulses (e.g., beans, peas, lentils, etc.) (6)
- Seafood (including shellfish) (7)
- Soy (including tofu) (8)

- Tree nuts (e.g., almonds, pecans) (9)
- Vegetables (e.g., zucchini, broccoli, etc.) (10)
- Fruits (e.g. kiwi, banana, avocado) (13)
- Other not listed (11) _____

6. I avoid these foods because I experience digestive discomfort, not from a medically diagnosed condition, after consuming (check any and all responses that are true for you at this point in time):

- I experience no digestive discomfort or issues from any of these foods (12)
- Cereal grains (e.g. oat, rice, wheat) (1)
- Dairy (e.g., milk, yogurt, ice cream, etc.) (2)
- Eggs (3)
- Meat (e.g., beef, pork, poultry) (4)
- Peanuts (5)
- Pulses (e.g., beans, peas, lentils, etc.) (6)
- Seafood (including shellfish) (7)
- Soy (including tofu) (8)
- Tree nuts (e.g., almonds, pecans) (9)
- Vegetables (e.g., zucchini, broccoli, etc.) (10)
- Other not listed (11) _____

7. In the past week, I have experienced (check any and all responses that are true for you at this point in time):

- I experienced none of these symptoms (1)
- Bloating (2)
- Constipation (3)
- Cramping (4)
- Diarrhea (5)
- Flatulence (6)
- Other digestive discomfort or issue not listed (7)
- Prefer not to answer (8)

8. Other reasons for avoiding foods are listed below. Which of the following reasons explain why you avoid ANY of the food products selected in question 4 (check any and all responses that are true for you at this point in time):

- I do not avoid any of these foods (18)
- I generally do not like the taste of it/them (1)
- I do not like the texture of it/them (2)
- I had a bad experience with it and won't eat it anymore (3)
- I am a vegetarian (4)
- I am a vegan (5)
- Follow a diet that excludes one or more food category (e.g. Keto, Paleo, Whole30) (6)
- Doctor recommendation (7)
- Registered Dietitian Nutritionist recommendation (8)
- Friend recommendation (9)
- Website recommendation (10)

- Cost is prohibitory (11)
- Religious reason (12)
- Culture/ethnicity reasons (19)
- Concern for environment (13)
- Concern for animal welfare (14)
- Weight control (15)
- Nutrition concern (16)
- Other not listed (17) _____

9. I go out of my way to eat, drink or consume (check any and all responses that are true for you at this point in time):

- Not applicable (11)
- More calcium (1)
- More protein (2)
- More vitamin D (3)
- More prebiotics (10)
- More probiotics (9)
- Less added sugar (4)
- Less carbohydrates (5)
- Less fat (6)
- Less sodium (7)
- Less sugar (8)

10. I go out of my way to (check any and all responses that are true for you at this point in time):

- Buy local (1)
- Buy lactose-free (2)
- Buy probiotic foods (3)
- Buy prebiotic foods (10)
- Buy organic foods (4)
- Buy more plant-based foods (5)
- Buy more nutrient-dense foods (11)
- Cook for myself (6)
- Move regularly (7)
- Learn about what I put in my body (8)
- Reduce my carbon footprint (9)
- I don't pay attention to any of these things (14)

11. I look at the Nutrition Facts panel when buying a new product:

- Never (1)
- Rarely (2)
- Sometimes (3)
- Always (4)

12. I can **read** and **easily** understand Nutrition Facts panels:

- Cannot (1)
- Not easily (2)

- Moderately easily (3)
- Easily (4)
- Very easily (5)

13. I look at the ingredients label when buying a new product:

- Never (1)
- Rarely (2)
- Sometimes (3)
- Always (4)

14. I can read and easily understand ingredients labels:

- Cannot (1)
- Not easily (2)
- Moderately easily (3)
- Easily (4)
- Very easily (5)

15. Which of the following statements apply to you (check all that apply)?

- I consume at least 5.5 ounces of protein each day (1)
- I consume at least 2 cups (2 servings) of fruits each day (2)
- I consume at least 2.5 cups (2 1/2 servings) of vegetables each day (3)
- I consume at least 3 cups (3 servings) of dairy each day (NOT including plant-based milk alternatives) (4)
- At least half of the grains that I consume are whole grains (5)
- I limit my consumption of added sugars, solid fats and salt (6)
- I drink more water than sugary drinks (7)

16. Would you like to be invited to participate in an in-person follow-up study that involves ice cream?

- Yes (4)
- No (2)

Appendix C - NFG Consent

Consent form for participation in ice cream consumption study

Thank you for your willingness to participate in this research, being carried out by the team of Dr. Stephanie Clark, department of Food Science and Human Nutrition at Iowa State University and Dr. Karen Schmidt, department of Animal Sciences and Industry at Kansas State University. This form explains the study and your part in it if you decide to join the study. This research study is being done to understand consumer dairy product purchasing and consumption behavior, liking of three samples of ice cream, and response to an educational message, as part of our ongoing effort to learn how to provide information to consumers that helps them to make informed purchasing decisions.

This study has been approved for human subjects participation by the Iowa State University Institutional Review Board (ISU IRB). Your participation is voluntary and you may decide not to participate for any reason. If you do join the study, you can change your mind later or quit at any time. There will be no penalty or loss of services or benefits if you decide to not take part in the study. If you are an employee or student of the researchers, your decision to participate or not will have no bearing on your status or your relationship with the researchers. You may also skip responding to questions, or quit later. However, you must remain in the room during the focus group in order to earn the \$15. The entire process is expected to take 60 minutes and will not exceed 75 minutes.

As part of this study, you will be asked to taste three samples of ice cream (approximately a $\frac{3}{4}$ -cup in total). If you have been diagnosed with a dairy allergy or lactose intolerance, you are discouraged from participating because you will likely feel discomfort (e.g., gas, bloating) after eating the ice cream. Similarly, you should not participate if you are not a dairy consumer.

You will first be handed a packet with several pieces of paper. All of the paperwork is labeled with a unique 3-digit number, which will be your unique identifier throughout this study; your

name will not be directly associated with any data. All of the pages in the packet will be explained to you as part of the study, and you may ask questions of the researchers at any time.

As part of today's study, you will be guided through a process involving five steps:

1. Demographic, purchasing and consumption behavior questionnaire
2. Ice cream tasting and an acceptability survey
3. Educational message
4. Post-consumption survey
5. Invitation to participate in a follow-up survey one month later

For your time needed to participate in the study, and willingness to provide sensory evaluation of the ice cream and information about your purchasing behavior, you will earn \$15. You may elect to drop out of the study at any time, without any negative feelings, but must participate in the sensory evaluation part of the study in order to earn the \$15. The compensation will be paid to you at the end of the study. If you participate in the follow-up survey, you will have another chance at a randomly-selected \$25 Amazon gift certificate.

There is no direct benefit to you from being in this study except the financial compensation you will earn for your time and sensory evaluation. The potential risks from taking part in this study are potential stress in filling out the survey, distaste for the ice cream, or stress or discomfort if you are uncomfortable in the room we are in. To minimize these issues, you do not have to complete the survey within the session period and you may discontinue eating the ice cream at any time. The researchers may be able to assist you with locating emergency treatment, if appropriate, but you or your insurance company will be responsible for the cost. By agreeing to participate in the study, you do not give up your right to seek payment if you are harmed as a result of being in this study. However, claims for payment sought from the University will only be paid to the extent permitted by Iowa law, including the Iowa Tort Claims Act (Iowa Code Chapter 669).

It is hoped that the information gained in this study will help food producers communicate more effectively with consumers.

Research records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available without your permission. However, it is possible that other people and offices responsible for making sure research is done safely and responsibly will see your information. Agencies like the Midwest Dairy Foods Research Center, auditing departments of ISU, and the IRB (a committee that reviews and approves human subject research studies). They may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information. However, no published results will identify you, and your name and e-mail address will not be directly associated with the data. Information about you, collected for this study may be shared with other researchers. It may also be used for other research studies. These studies may be similar to this study or completely different. We will make sure that your identity cannot be linked to the information we share. We will not ask you for additional permission before sharing the information.

If you have questions about this study or the information in this form, please contact the principal investigator of the project, Dr. Stephanie Clark, at 515-294-7346 or milkmade@iastate.edu. If you have questions about your rights related to research participation, please contact the ISU IRB, at 515-294-4215 or IRB@iastate.edu.

Signing this form means that:

- You understand the information given to you in this form
- You have been able to ask the researcher questions and state any concerns
- The researcher has responded to your questions and concerns
- You believe you understand the research study and the potential benefits and risks

involved

If you agree to the terms of this form, please sign this form. Upon request, you will be given a copy of this consent document for your records.

We sincerely thank you for your time.

Stephanie Clark (ISU)

Karen Schmidt (KSU)

Statement of Consent

I give my voluntary consent to take part in this study. Upon request, I will be given a copy of this consent document for my records.

_____ Signature of Participant _____ Date

_____ Printed Name of Participant

Appendix D - Consent Form in One Month Follow-Up Survey

Thank you for your willingness to participate in our follow-up survey after participating in the focus group a month ago. This research is being carried out by the team of Dr. Stephanie Clark, department of Food Science and Human Nutrition at Iowa State University, and Dr. Karen Schmidt, department of Animal Sciences and Industry at Kansas State University, with a goal to understand consumers' food and beverage purchasing and consumption behavior after a focus group.

Your participation is voluntary; if you agree to participate in the survey, you can change your mind later or quit at any time. There will be no penalty or loss of services or benefits if you decide to not take part or quit later. If you are an employee or student of the researchers, your decision to participate or not will have no bearing on your status or your relationship with the researchers. This study has been approved for human subjects participation by the Iowa State University Institutional Review Board (ISU IRB).

You are eligible to participate in this study if you are an adult, age 18 or older, and are a regular (i.e., monthly) consumer/purchaser of food products. You will be asked some demographic questions and questions regarding your current food and beverage purchasing and consumption habits, along with inquiries about allergies, intolerances, and digestive conditions. You may skip any question you are not comfortable answering.

The survey is expected to take approximately 10 minutes to complete. For your time needed to participate in the survey, you will be entered in a drawing for a \$25 AMAZON gift card. You may elect to drop out of the survey at any time, without any negative feelings, but must complete the survey to be entered in the drawing. If you agree to participate and provide your email address, you may be contacted for a follow-up study.

There is no direct benefit to you from being in this study except the financial compensation you may receive if you win the drawing. The potential risk from taking part in this study is potential stress in filling out the survey questions. It is hoped that the information gained in this study will help food producers communicate more effectively with consumers.

Research records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available without your permission. However, it is possible that other people and offices responsible for making sure research is done safely and responsibly will see your information. This includes federal government agencies, the Midwest Dairy Foods Research Center (the study's sponsor), auditing departments of ISU, and the IRB (a committee that reviews and approves human subject research studies), which may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information. However, no published results will identify you, and your name and e-mail address will not be associated with the survey responses. Information about you, collected for this study may be shared with other researchers. It may also be used for other research studies. These studies may be similar to this study or completely different. We will make sure that your identity cannot be linked to the information we share. We will not ask you for additional permission before sharing the information.

If you have questions about this study or the information in this form, please contact the principal investigator of the project, Dr. Stephanie Clark, at 515-294-7346 or milkmade@iastate.edu. If you have questions about your rights related to research participation, please contact the ISU IRB, at 515-294-4215 or IRB@iastate.edu.

Agreeing to continue means: You understand the information given to you in this form You believe you understand the research study and the potential benefits and risks involved. Upon request, you will be given a copy of this consent document for your records.

We sincerely thank you for your time.

Stephanie Clark

Appendix E - NFG Pre-Survey

0. Please type the 3-digit code (on your folder) into the box and continue to the survey.
1. What best describes your gender?
- Prefer not to answer (2)
 - Male (3)
 - Female (4)
 - Prefer to self-describe as: (5)
2. Within what range does your age fall?
- 18-24 (1)
 - 25-34 (2)
 - 35-44 (3)
 - 45-54 (4)
 - 55 and above (5)
 - Prefer not to answer (6)
3. Which of the following best describe(s) your race and ethnicity? (check all that apply)
- Prefer not to answer (12)
 - American Indian, Alaskan Native, Indigenous Person of Americas (1)
 - Native Hawaiian or Other Pacific Islander (2)
 - Asian American or Asian Origin (3)
 - Latin American, Hispanic, Latino or Spanish Origin (6)
 - African American, Black or African Origin (20)
 - White (22)
 - Other (23) _____
4. What is the number of people who live in your household (including self)?
- 1 (12)
 - 2 (1)
 - 3 (2)
 - 4 or more (3)
5. Eating healthy is _____ to me
- Not important (1)
 - Somewhat important (2)
 - Moderately important (3)
 - Important (4)
 - Very important (5)
6. I look at the Nutrition Facts panels when buying a new product.
- Never (1)
 - Rarely (2)
 - Sometimes (3)
 - Always (4)

7. I can _____ understand Nutrition Facts panels:
- Not easily (1)
 - Moderately easily (2)
 - Easily (3)
 - Very easily (10)
8. I look at the ingredients labels when buying a new product:
- Never (1)
 - Rarely (2)
 - Sometimes (3)
 - Always (4)
9. I can _____ understand ingredients labels:
- Not easily (2)
 - Moderately easily (3)
 - Easily (10)
 - Very easily (4)
10. Which of the following statements apply to you? (check all that apply)
- I consume at least 1 serving of protein each day (1 svg = 3 oz lean meat, 1 TBS peanut butter, 1/4 cooked beans, etc.) (1)
 - I consume at least 2 servings of fruits each day (1 svg = 1 cup fruit, 1/2 cup fruit juice, etc.) (2)
 - I consume at least 2 1/2 servings of vegetables each day (1 svg = 1 cup raw vegetable, 2 cups leafy greens, etc.) (3)
 - I consume at least 3 servings of dairy each day (1 svg = 1 cup milk or yogurt, 1.5 oz cheese, 2/3 cup of ice cream, etc.) (4)
 - At least half of the grains that I consume are whole grains (5)
 - I limit my consumption of added sugars, solid fats and salt (6)
 - I drink more water than sugary drinks (7)
11. To what extent do you make an effort to limit lactose consumption?
- Not at all (4)
 - Sometimes (2)
 - Always (5)

The following questions are asked to establish your understanding of select concepts BEFORE the focus group. (Note: some of these concepts may be brand new and it is entirely OK if you do not know the answer. You will learn about some (but not all) of the concepts in your focus group.)

12. A Daily Value (%DV) of 5% or less of a nutrient per serving is low, and 20% DV or more of a nutrient per serving is high.

- false (1)
- true (2)

13. Which of these ingredients are considered added sugars? (check any and all that apply)

- Corn syrup (1)
- Milk (2)
- 100% Fruit juice (3)
- Table sugar (4)
- Honey (5)
- Whey (6)

14. How many essential nutrients are naturally found in dairy products (milk, yogurt, cheese, ice cream)?

- I don't know (1)
- none (2)
- 1 (3)
- 3 (4)
- 5 (5)
- 7 (6)
- 9 (7)

15. I know _____ about lactose maldigestion.

- nothing (1)
- a little (2)
- a moderate amount (3)
- a lot (4)

16. I know _____ about probiotics.

- nothing (1)
- a little (2)
- a moderate amount (3)
- a lot (4)

17. I know _____ about prebiotics.

- nothing (1)
- a little (2)
- a moderate amount (3)
- a lot (4)

The final questions relate to your dairy products (milk, yogurt, cheese and ice cream) purchasing and consumption within the past month. (Note: do not include purchasing and consumption of plant-based milk alternatives.)

18. Do you consider yourself the primary food purchaser in your household?
- no, someone else is (1)
 - no, shopping is shared equally with another (2)
 - yes, I am the primary purchaser (4)
19. How much milk did you purchase for home use this month?
- none (1)
 - <1 gallon (2)
 - 1 gallon (3)
 - > 1 gallon (5)
20. How much milk did you (personally) consume at home this month?
- none (1)
 - < 1 gallon (2)
 - 1 gallon (3)
 - > 1 gallon (4)
21. Which of the following MOST influences the milk you buy for your home?
- family member's brand or flavor preference (1)
 - my personal brand or flavor preference (2)
 - product's ingredients or nutrition (3)
 - price (5)
 - other not listed: (4) _____
22. How much yogurt did you purchase for home use this month?
- none (1)
 - up to 3 servings (2)
 - 3 - 5 servings (3)
 - more than 5 servings (4)
23. How much yogurt did you (personally) consume at home this month?
- none (1)
 - up to 3 servings (2)
 - 3 - 5 servings (3)
 - more than 5 servings (4)
24. Which of the following MOST influences the yogurt you buy for your home?
- family member's brand or flavor preference (1)
 - my personal brand or flavor preference (2)
 - product's ingredients or nutrition (3)
 - other not listed: (4) _____
 - price (5)
25. How much cheese did you purchase for home use this month?
- none (1)

- up to 1 package (8 oz) (2)
- 1 - 2 packages (1 lb) (3)
- more than 1 lb (4)

26. How much cheese did you (personally) consume at home this month?

- none (1)
- up to 1 package (8 oz) (2)
- 1 - 2 packages (1 lb) (3)
- more than 1 lb (4)

27. Which of the following MOST influences the cheese you buy for your home?

- family member's brand or flavor preference (1)
- my personal brand or flavor preference (2)
- product's ingredients or nutrition (3)
- other not listed: (4) _____
- price (5)

28. How much ice cream did you purchase for home use this month?

- none (1)
- 1 - 3 scoops (2)
- about 16 ounces (1 pint) (3)
- about 32 ounces (1 quart) (4)
- more than 1 quart (5)

29. How much ice cream did you (personally) consume at home this month?

- none (1)
- 1 - 3 scoops (2)
- about 16 ounces (1 pint) (3)
- about 32 ounces (1 quart) (4)
- more than 1 quart (5)

30. Which of the following MOST influences the ice cream you buy for your home?

- family member's brand or flavor preference (1)
- my personal brand or flavor preference (2)
- product's ingredients or nutrition (3)
- other not listed: (4) _____
- price (5)

31. How often do you try something different in the dairy category? (brand, packaging, product, flavor, etc.)?

- never (1)
- maybe every 3-4 months (2)
- maybe every 1-2 months (3)
- at least once a month (4)

32. What may most likely increase your willingness to try something different in the dairy category? (check all responses that are true for you at this time).

- higher protein (1)
- lower sugar (2)
- lower added sugars (3)
- lower lactose (4)
- higher lactose (5)
- plant-based ingredients (6)
- prebiotic ingredients (7)
- probiotic bacteria (8)
- more information about the product (11)
- other (12) _____

33. If more information was available about a dairy product, which of the following would you read more about? (check all responses that are true for you at this time).

- I would not read more about any of these things (1)
- sustainability about the product, ingredients or packaging (2)
- the purpose of ingredients with unfamiliar names (e.g., annatto, carrageenan) (3)
- the natural and added sources of sugar in the product (4)
- animal welfare conditions surrounding the product (5)
- a summary of scientific research demonstrating benefits or risks from consuming the type of product (6)
- information about the animals, farm, farmer or manufacturer who handled the product (8)
- the natural and synthetic sources of ingredients in the product (9)

Appendix F - NFG Post Survey

0. Please enter the 3-digit code written on your folder:

1. How much did you learn about how to read and use food ingredients labels today?

- Nothing new (1)
- Very little (2)
- A moderate amount (3)
- A lot (4)

2. I plan to look at food ingredient labels when buying new products in the future.

- Never (1)
- Sometimes (2)
- Frequently (3)
- Every time (4)

3. Which of these ingredients are considered added sugars? (check all that apply)

- Honey (1)
- Table sugar (2)
- Milk (3)
- Corn syrup (4)
- 100% fruit juice (5)
- Whey (6)

4. 5% Daily Value or less of a nutrient per serving is low and 20% Daily Value or more of a nutrient per serving is high.

- False (1)
- True (2)

5. How much did you learn about how to read and use Nutrition Facts panels today?

- Nothing new (1)
- Very little (2)
- A moderate amount (3)
- A lot (4)

6. I plan to look at Nutrition Facts panels when buying new products in the future.

- Never (1)
- Sometimes (2)
- Frequently (3)
- Every time (4)

7. Using the Nutrition Facts label of this low-fat vanilla yogurt, how much lactose is in a serving?

- I don't know (2)
- 6 grams (3)
- 8 grams (4)

- 14 grams (5)

8. How much did you learn about essential nutrients in dairy products today?

- I was not in that focus group (1)
- nothing new (2)
- very little (3)
- a moderate amount (4)
- a lot (5)

(Skip to: 11 If 8. How much did you learn about essential nutrients in dairy products today? = I was not in that focus group)

9. How many essential nutrients are naturally found in dairy products (milk, yogurt, cheese, ice cream)?

- I don't know (1)
- none (2)
- 1 (3)
- 3 (4)
- 5 (5)
- 7 (6)
- 9 (9)

10. Based on what you learned about essential nutrients in dairy today, how will it change what dairy products you purchase and consume in the future?

- I will decrease my dairy purchases/consumption (2)
- I will not change my behavior (3)
- I will increase my dairy purchases/consumption (4)

11. How much did you learn about lactose maldigestion today?

- I was not in that focus group (1)
- Nothing new (2)
- Very little (3)
- A moderate amount (4)
- A lot (5)

(Skip To: 13 If 11. How much did you learn about lactose maldigestion today? = I was not in that focus group.)

12. Based on what you learned about lactose maldigestion today, how will it change your dairy products purchasing and consumption in the future?

- I will decrease my dairy purchases/consumption (2)
- I will not change my behavior (3)
- I will increase my dairy purchases/consumption (4)

13. How much did you learn about probiotics and prebiotics today?

- I was not in that focus group (1)
- Nothing new (2)
- Very little (3)
- A moderate amount (4)
- A lot (5)

(Skip To: 0000 If 13. How much did you learn about probiotics and prebiotics today? = I was not in that focus group)

14. Based on what you learned about probiotics and prebiotics today, how will it change dairy products purchasing and consumption in the future?

- I will decrease my dairy purchases/consumption (2)
- I will not change my behavior (3)
- I will increase my dairy purchases/consumption (4)

Please answer the following questions regarding possible new dairy products in the market.

15. How much less or more likely would you purchase a dairy product labelled with "Naturally contains nine essential nutrients" than the same product without the statement?

- Much less likely (1)
- Somewhat less likely
- Equally likely (4)
- Slightly more likely (5)
- Much more likely (6)

16. How much less or more likely are you to purchase milk with extra lactose if it would cost less than regular milk?

- Much less likely (1)
- Somewhat less likely (2)
- Equally likely (3)
- Somewhat more likely (4)
- Much more likely (5)

17. How much less or more likely would you purchase cheese with extra lactose if it would cost less than regular cheese?

- Much less likely (1)
- Somewhat less likely (2)
- Equally likely (5)
- Somewhat more likely (4)
- Much more likely (6)

18. How much less or more likely are you to purchase ice cream with extra lactose if it would cost less than regular ice cream?

- Much less likely (1)
- Somewhat less likely (2)

- Equally likely (3)
- Somewhat more likely (4)
- Much more likely (5)

19. How much less or more likely might you be to purchase “probiotic” or “prebiotic” milk than regular milk?

- Much less likely (1)
- Somewhat less likely (2)
- Equally likely (3)
- Somewhat more likely (4)
- Much more likely (5)

20. How much less or more likely might you be to purchase cheese labelled with "probiotic" or "prebiotic" compared to cheese without the statement?

- Much less likely (1)
- Somewhat less likely (2)
- Equally likely (3)
- Somewhat more likely (4)
- Much more likely (5)

21. If “probiotic” or “prebiotic” ice cream were available in stores, how much less or more likely might you be to purchase it than regular ice cream?

- Much less likely (1)
- Somewhat less likely (2)
- Equally likely (3)
- Somewhat more likely (4)
- Much more likely (5)

22. Additional comments are welcome below.

Appendix G - One-Month Follow-Up Survey

1. If you agree to the terms, please type your e-mail address and continue to the survey. This will qualify you for entry into the drawing for a \$25 Amazon gift card. (note: Your name and address will not be directly associated with the data collected.)
2. How often have you looked at food ingredient labels in the past 3 weeks?
 - Never (1)
 - A few times (fewer than 3 food products I have considered purchasing) (2)
 - Frequently (at least 3 food products I have considered purchasing) (3)
 - Every time (4)
3. How often have you looked at Nutrition Facts panels in the past 3 weeks?
 - Never (1)
 - A few times (fewer than 3 food products I have considered purchasing) (2)
 - Frequently (at least 3 food products I have considered purchasing) (3)
 - Every time (4)
4. Which of these ingredients are considered added sugars? (check all that apply)
 - Honey (1)
 - Table sugar (2)
 - Milk (3)
 - Corn syrup (4)
 - 100% fruit juice (5)
 - Whey (6)
5. 5% Daily Value or less of a nutrient per serving is low and 20% Daily Value or more of a nutrient per serving is high.
 - False (1)
 - True (2)
6. Using the Nutrition Facts label of this low-fat vanilla yogurt, how much lactose is in a serving?
 - I don't know (1)
 - 6 grams (2)
 - 8 grams (3)
 - 14 grams (4)
7. How many essential nutrients are naturally in dairy products?
 - I don't know (1)
 - none (2)
 - 1 (3)
 - 3 (4)
 - 5 (5)
 - 7 (6)

- 9 (9)
8. How often have you modified a purchase based on amount of lactose in a product in the past 3 weeks?
- Never (1)
 - A few times (fewer than 3 food products I have considered purchasing) (2)
 - Frequently (at least 3 food products I have considered purchasing) (3)
 - Every time (4)
9. How often have you modified a purchase based on added sugars in a product in the past 3 weeks?
- Never (1)
 - A few times (fewer than 3 food products I have considered purchasing) (2)
 - Frequently (at least 3 food products I have considered purchasing) (3)
 - Every time (4)
10. How often have you modified a purchase based on probiotics or prebiotics in a product in the past 3 weeks?
- Never (1)
 - A few times (fewer than 3 food products I have considered purchasing) (2)
 - Frequently (at least 3 food products I have considered purchasing) (3)
 - Every time (4)
11. How much milk did you purchase in the past 3 weeks?
- None (1)
 - Less than one gallon (2)
 - A gallon (3)
 - More than one gallon (4)
12. How much milk did you (personally) drink in the past 3 weeks?
- None (1)
 - Less than one gallon (2)
 - A gallon (3)
 - More than one gallon (4)
13. How much yogurt did you purchase in the past 3 weeks?
- None (1)
 - Up to 3 servings (2)
 - 3-5 servings (3)
 - More than 5 servings (4)
14. How much yogurt did you (personally) consume in the past 3 weeks?
- None (1)
 - Up to 3 servings (2)
 - 3-5 servings (3)
 - More than 5 servings (4)

15. How much cheese did you purchase in the past 3 weeks? (consider a serving 1.5 ounces)
- None (1)
 - One package (8 oz) (2)
 - Two packages (1 lb) (3)
 - More than 1 lb (4)
16. How much cheese did you (personally) eat in the past 3 weeks? (consider a serving 1.5 ounces)
- None (1)
 - One package (8 oz) (2)
 - Two packages (1 lb) (3)
 - More than 1 lb (4)
17. How much ice cream did you purchase in the past 3 weeks?
- None (1)
 - 1-3 scoops (2)
 - About 16 oz (1 pint) (3)
 - About 32 oz (quart) (4)
 - More than 32 oz (5)
18. How much ice cream did you (personally) eat in the past 3 weeks?
- None (1)
 - 1-3 scoops (2)
 - About 16 oz (1 pint) (3)
 - About 32 oz (1 quart) (4)
 - More than 32 fl oz (5)
19. How much less or more likely will you be to purchase a dairy product labelled with "Naturally contains Nine Essential Nutrients" than the same product without the statement?
- Much less likely (1)
 - Somewhat less likely (2)
 - Equally likely (3)
 - Somewhat more likely (4)
 - Much more likely (5)
20. How much less or more likely will you be to purchase milk with extra lactose if it costs less than regular milk?
- Much less likely (1)
 - Somewhat less likely (2)
 - Equally likely (3)
 - Somewhat more likely (5)
 - Much more likely (4)

21. How much less or more likely will you be to purchase ice cream with extra lactose if it costs less than regular ice cream?

- Much less likely (1)
- Somewhat less likely (2)
- Equally likely (3)
- Somewhat more likely (5)
- Much more likely (4)

22. If “probiotic” or “prebiotic” ice cream available in stores, how much less or more likely will you be to purchase it?

- Much less likely (1)
- Somewhat less likely (2)
- Equally likely (3)
- Somewhat more likely (4)
- Much more likely (5)

23. Additional comments related to last month's focus group or your dairy products purchases and consumption are welcome below

Appendix H - NFG Pre-Survey QR Code

Please hold your telephone camera over this QR code, then click on the link to take the Qualtrics Focus Group Pre-Survey:



Appendix I - NFG Post Survey QR Code

Please hold your telephone camera over this QR code, then click on the link to take the Qualtrics Focus Group Post-Survey:



Appendix J - COVID-19 Screening Questions

1. Have you been tested for COVID-19 in the past 14 days?
2. Are you currently awaiting results from a COVID-19 test?
3. Are you currently experiencing any of the following symptoms?
 - a. Temperature over 100.4°F
 - b. Cough
 - c. Shortness of breath or difficulty breathing
 - d. Fatigue
 - e. Muscle or body aches
 - f. Headache
 - g. Congestion, runny nose, or sore throat
 - h. Nausea or vomiting
 - i. New loss of taste or smell
 - j. Diarrhea

If any panelists responds yes to any of the following questions, they were asked to reschedule

Appendix K - Consent Form

Consent form for participation in ice cream consumption study

Thank you for your willingness to participate in this research, being carried out by the team of Dr. Stephanie Clark, department of Food Science and Human Nutrition at Iowa State University and Dr. Karen Schmidt, department of Animal Sciences and Industry at Kansas State University. This form explains the study and your part in it if you decide to join the study. This research study is being done to understand consumer dairy product purchasing and consumption behavior, liking of three samples of ice cream, and response to an educational message, as part of our ongoing effort to learn how to provide information to consumers that helps them to make informed purchasing decisions.

This study has been approved for human subjects participation by the Iowa State University Institutional Review Board (ISU IRB). Your participation is voluntary and you may decide not to participate for any reason. If you do join the study, you can change your mind later or quit at any time. There will be no penalty or loss of services or benefits if you decide to not take part in the study. If you are an employee or student of the researchers, your decision to participate or not will have no bearing on your status or your relationship with the researchers. You may also skip responding to questions, or quit later. However, you must remain in the room during the focus group in order to earn the \$15. The entire process is expected to take 60 minutes and will not exceed 75 minutes.

As part of this study, you will be asked to taste three samples of ice cream (approximately a $\frac{3}{4}$ -cup in total). If you have been diagnosed with a dairy allergy or lactose intolerance, you are discouraged from participating because you will likely feel discomfort (e.g., gas, bloating) after eating the ice cream. Similarly, you should not participate if you are not a dairy consumer.

You will first be handed a packet with several pieces of paper. All of the paperwork is labeled with a unique 3-digit number, which will be your unique identifier throughout this study; your

name will not be directly associated with any data. All of the pages in the packet will be explained to you as part of the study, and you may ask questions of the researchers at any time.

As part of today's study, you will be guided through a process involving five steps:

1. Demographic, purchasing and consumption behavior questionnaire
2. Ice cream tasting and an acceptability survey
3. Educational message
4. Post-consumption survey
5. Invitation to participate in a follow-up survey one month later

For your time needed to participate in the study, and willingness to provide sensory evaluation of the ice cream and information about your purchasing behavior, you will earn \$15. You may elect to drop out of the study at any time, without any negative feelings, but must participate in the sensory evaluation part of the study in order to earn the \$15. The compensation will be paid to you at the end of the study. If you participate in the follow-up survey, you will have another chance at a randomly-selected \$25 Amazon gift certificate.

There is no direct benefit to you from being in this study except the financial compensation you will earn for your time and sensory evaluation. The potential risks from taking part in this study are potential stress in filling out the survey, distaste for the ice cream, or stress or discomfort if you are uncomfortable in the room we are in. To minimize these issues, you do not have to complete the survey within the session period and you may discontinue eating the ice cream at any time. The researchers may be able to assist you with locating emergency treatment, if appropriate, but you or your insurance company will be responsible for the cost. By agreeing to participate in the study, you do not give up your right to seek payment if you are harmed as a result of being in this study. However, claims for payment sought from the University will only be paid to the extent permitted by Iowa law, including the Iowa Tort Claims Act (Iowa Code Chapter 669).

It is hoped that the information gained in this study will help food producers communicate more effectively with consumers.

Research records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available without your permission. However, it is possible that other people and offices responsible for making sure research is done safely and responsibly will see your information. Agencies like the Midwest Dairy Foods Research Center, auditing departments of ISU, and the IRB (a committee that reviews and approves human subject research studies). They may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information. However, no published results will identify you, and your name and e-mail address will not be directly associated with the data. Information about you, collected for this study may be shared with other researchers. It may also be used for other research studies. These studies may be similar to this study or completely different. We will make sure that your identity cannot be linked to the information we share. We will not ask you for additional permission before sharing the information.

If you have questions about this study or the information in this form, please contact the principal investigator of the project, Dr. Stephanie Clark, at 515-294-7346 or milkmade@iastate.edu. If you have questions about your rights related to research participation, please contact the ISU IRB, at 515-294-4215 or IRB@iastate.edu.

Signing this form means that:

- You understand the information given to you in this form
- You have been able to ask the researcher questions and state any concerns
- The researcher has responded to your questions and concerns
- You believe you understand the research study and the potential benefits and risks

involved

If you agree to the terms of this form, please sign this form. Upon request, you will be given a copy of this consent document for your records.

We sincerely thank you for your time.

Stephanie Clark (ISU)

Karen Schmidt (KSU)

Statement of Consent

I give my voluntary consent to take part in this study. Upon request, I will be given a copy of this consent document for my records.

_____ Signature of Participant

_____ Date

_____ Printed Name of Participant

Appendix L - Primary Educational Message

Now we would like to walk you through an infographic that has been prepared for you about reading Nutrition Facts Panels on food packaging. Please turn the STOP sign over to the left side and take the infographic out of your packet as we walk you through it. You can keep it out, and later, take it home with you.

The information provided on ANY food and beverage package is meant to help you make informed decisions about purchases. In addition to the product name, company and container contents, all packaged foods are legally required to display a list of ingredients, an allergen statement, and a Nutrition Facts Panel on any food package.

This specific Nutrition Facts panel and list of ingredients is from Blue Bunny vanilla flavored ice cream.

The first thing I want to point out is the list of ingredients. You can find this UNDER or to the RIGHT of what is called the Nutrition Facts panel.

Ingredients must be listed in order from highest to lowest amount in the food. So, for this particular product, milk is the main ingredient, followed by cream. Many times, a company will write “contains less than 2% of” for ingredients that are used sparingly. Note that there are several of those ingredients in this ice cream. Most of the ingredients found at less than 2% in ice cream are emulsifiers (like mono and diglycerides) and stabilizers (the gums). These ingredients (most of which are from plants) help ice cream last longer in your freezer, feel smooth, and melt more slowly in your mouth so it does not feel so cold. In this case, natural color is also added. Annatto is from tree bark, and it is also what they use to make Cheddar cheese orange.

Do you have any questions about anything I have said so far?

The next thing to point out is the allergen statement. Even though less than 4% of the population is allergic to milk protein, milk is one of 8 major food allergens, so it is required to be listed. Tree nuts, peanuts, fish, shellfish, soy, egg, and wheat are also major food allergens.

Do you have any questions about that?

The last thing I want to tell you about is the Nutrition Facts panel. That panel is there to help consumers make good nutritional choices. At the top, it tells you a serving size and how many servings there are in the package. Serving size is based on a “reference amount customarily consumed”. For ice cream, that is 2/3 cup. Even though you might want to eat more than 2/3 cup, that is what a serving size is based on. For this example, 2/3 cup weighs 87 grams.

Legally, ice cream may contain up to 50% air. An ice cream that contains 50% air, like this one, will weigh less than an ice cream with about 25% air, like the products you will taste later in this focus group.

The next thing listed on the Nutrition Facts panel is the number of calories per serving. Because a serving is $\frac{2}{3}$ cup, and there are 9 servings in this container, if you were to eat half of the container, you would have to multiply the number of calories times 4.5 (that's 756 calories)!

In the Nutrition Facts panel, you will see individual nutrients, like fats, sodium, carbohydrates, protein, vitamins and minerals listed along the left. Next to the nutrient is the number of grams of each nutrient in each serving. Now, look in the right-hand column. That is NOT the percent of each nutrient in the serving. It is the percent Daily Value you get from eating a serving of the food.

Let me explain. If you eat 2,000 calories in the entire day, and you eat one serving of the Blue Bunny vanilla flavored ice cream shown here, you will have consumed 7% of the total carbohydrates, and 26% of the total added sugars that you should have for the entire day. If you are trying to limit how much added sugars you are eating, you can look for other products that have a lower % Daily Value of added sugars in that column.

We like to pause for a moment here to allow more time to think about what was just said in case questions come to mind. Do you have any questions?

There is one more thing I want to point out here. Since lactose is a natural component of milk, it is not added sugar. So when we take the total sugar (in this case, 18 g) minus the added sugars (in this case, 13 g), we get 5 grams of lactose per serving of this ice cream. You can do this with just about any dairy product to determine how much lactose is in the product.

Appendix M - K-State Cash Receipt Form

CONFIDENTIAL

Kansas State University
Research Participant Receipt Form

Kansas State University (KSU) is required to maintain confidentiality of information about research study participants while still complying with record keeping requirements of the State of Kansas, the Internal Revenue Service and funding agencies. The purpose of this form is to serve as documentation of the receipt of compensation associated with participation in a research study conducted by K-State personnel.

I, _____ have received compensation in the form of \$15 cash.

(Print Research Participant Name)

Research Participant Signature

Date

Research Participant's Address

City, State, Zip

Appendix N - Nine Essential Nutrients EM

One of the reasons we brought you here today is to teach you more about dairy products nutrition. To help, we have put another infographic in your folder. You may take that out now.

Dairy products are an important food group that should remain a part of our diet. Dairy products naturally provide us with 9 essential nutrients, nutrients we must get from foods because our bodies cannot produce them. These nine essential nutrients are: Protein, Calcium, Vitamin D, Phosphorus, Riboflavin, Niacin, Pantothenic Acid, Vitamin B-12, and Vitamin A. Each one of these nutrients contributes to our health, including red blood cell production, building and maintaining strong bones and teeth, and aiding in nutrient metabolism.

Cutting out dairy can result in various nutrient deficiencies if they are not adequately provided in the diet. Ice cream has the same 9 essential nutrients as found in milk, cheese and yogurt.

Do you have any questions?

Appendix O - Lactose Maldigestion Educational Message

One of the reasons we brought you here today is to teach you more about lactose. To help, we have put another infographic in your folder. You may take that out now.

Lactose, the sugar that is naturally found in milk, is a disaccharide, which means it is two sugar molecules bound together. During normal digestion, an enzyme produced in our small intestine, called lactase, breaks lactose into glucose and galactose. Our bodies use glucose as a source of energy, and galactose for other processes.

Lactose maldigestion is the insufficient breakdown of lactose in the small intestine. It is caused by consuming more lactose than the lactase enzyme can keep up with, so some of the lactose reaches the large intestine without being broken down.

A lot of our normal microflora is located in our large intestine. When lactose is not digested, these bacteria get too much lactose and ferment it. Although gut bacteria are normal and important for our health, when they get too much lactose they create gas, which causes discomfort. There are varying degrees of lactose maldigestion, ranging from no symptoms to diarrhea, nausea and abdominal cramps. Lactose intolerance is a term that should only be used for extreme cases, where people get discomfort from even a little lactose. About 25% of the population in the United States and 75% of the world have some form of lactose maldigestion so it is actually very common.

Do you have any questions?

Appendix P - Prebiotic and Probiotic Educational Message

Some people avoid ice cream and other dairy products because they suffer from LACTOSE INTOLERANCE or Lactose maldigestion. BUT THIS does not mean they should stop eating dairy products.

The next infographic in your folder is meant to help explain why. Please take it out of your folder as we explain. You may also take it with you when you leave.

During normal digestion, an enzyme produced in our small intestine, called lactase helps us digest lactose. Lactose maldigestion is the insufficient breakdown of lactose in the small intestine caused by consuming more lactose than the lactase enzyme can keep up with. When the lactose is not digested, bacteria in the large intestine get too much lactose and ferment it into gas, which causes discomfort.

Now, we would like to introduce you to two terms: “probiotic” and “prebiotic”. Probiotics are live bacteria that are beneficial to human health.

Prebiotic means food for bacteria. Lactose is actually a prebiotic because it feeds beneficial probiotic bacteria in your gut. Lactose allows an increase of “good” bacteria, as well as suppression of “bad” bacteria, promoting an environment for digestive health. Even lactose maldigesters may benefit from small doses of lactose.

Do you have any questions?

Appendix Q - Modified Focus Group Script

Control groups SCRIPT

Jack welcome panelists, hand them specific folder (3-digit number based on e-mail only), and direct them to their seats.

SPEAKER: JACK

Hello, my name is Jack Myers, and I welcome you to this research panel. Thank you for agreeing to participate in today's session. The researchers in charge of this study include Dr. Karen Schmidt (point), and Dr. Stephanie Clark and Derek Schweiger who are up in Ames, IA.

You have been given a packet with your unique 3-digit identifier number. We will use this ID number, and only this number to identify you throughout today's study.

Please open your packets. Everything in the packet is in a specific order. We ask that you not mix up the pages or read ahead. When you come to a STOP sign on a page, that means we need you to wait until we tell you to proceed. It is very important that you not read ahead.

First, you will find the consent form, which [Dr. Schmidt] will read out loud. After Dr. Schmidt reads the full text, you will have a chance to ask us questions and state any concerns. Feel free to ask any of us in the room any question at any time. If you would like to drop out at this time, before proceeding, you are welcome to do so, with absolutely no hard feelings.

SPEAKER: Dr. Schmidt [Read the consent form; answer questions without divulging information about stages of the experiment beyond what has been revealed in the consent form]

(Begin consent form) Thank you for your willingness to participate in this research, being carried out by the team of Dr. Stephanie Clark, department of Food Science and Human Nutrition at Iowa State University and Dr. Karen Schmidt, department of Animal Sciences and Industry at Kansas State University. This form explains the study and your part in it if you decide to join the study. This research study is being done to understand consumer dairy product purchasing and consumption behavior, liking of three samples of ice cream, and response to an educational message, as part of our ongoing effort to learn how to provide information to consumers that helps them to make informed purchasing decisions.

This study has been approved for human subjects participation by the Iowa State University Institutional Review Board (ISU IRB). Your participation is voluntary and you may decide not to participate for any reason. If you do join the study, you can change your mind later or quit at any time. There will be no penalty or loss of services or benefits if you decide to not take part in the study. If you are an employee or student of the researchers, your decision to participate or not will have no bearing on your status or your relationship with the researchers. You may also skip responding to questions, or quit later. However, you must remain in the room during the focus group in order to earn the \$15. The entire process is expected to take 60 minutes and will not exceed 75 minutes.

As part of this study, you will be asked to taste three samples of ice cream (approximately a ¾-cup in total). If you have been diagnosed with a dairy allergy or lactose intolerance, you are discouraged from participating because you will likely feel discomfort (e.g., gas, bloating) after eating the ice cream. Similarly, you should not participate if you are not a dairy consumer.

You will first be handed a packet with several pieces of paper. All of the paperwork is labeled with a unique 3-digit number, which will be your unique identifier throughout this study; your name will not be directly associated with any data. All of the pages in the packet will be explained to you as part of the study, and you may ask questions of the researchers at any time.

As part of today's study, you will be guided through a process involving five steps:

1. Demographic, purchasing and consumption behavior questionnaire
2. Ice cream tasting and an acceptability survey
3. Educational message
4. Post-consumption survey
5. Invitation to participate in a follow-up survey one month later

For your time needed to participate in the study, and willingness to provide sensory evaluation of the ice cream and information about your purchasing behavior, you will earn \$15. You may elect to drop out of the study at any time, without any negative feelings, but must participate in the sensory evaluation part of the study in order to earn the \$15. The compensation will be paid to you at the end of the study. If you participate in the follow-up survey, you will have another chance at a randomly-selected \$25 Amazon gift certificate.

There is no direct benefit to you from being in this study except the financial compensation you will earn for your time and sensory evaluation. The potential risks from taking part in this study are potential stress in filling out the survey, distaste for the ice cream, or stress or discomfort if you are uncomfortable in the room we are in. To minimize these issues, you do not have to complete the survey within the session period and you may discontinue eating the ice cream at any time. The researchers may be able to assist you with locating emergency treatment, if appropriate, but you or your insurance company will be responsible for the cost. By agreeing to participate in the study, you do not give up your right to seek payment if you are harmed as a result of being in this study. However, claims for payment sought from the University will only be paid to the extent permitted by Iowa law, including the Iowa Tort Claims Act (Iowa Code Chapter 669).

It is hoped that the information gained in this study will help food producers communicate more effectively with consumers.

Research records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available without your permission. However, it is possible that other people and offices responsible for making sure research is done safely and responsibly will see your information. Agencies like the Midwest Dairy Foods Research Center, auditing departments of ISU, and the IRB (a committee that reviews and approves human subject research studies). They may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information. However,

no published results will identify you, and your name and e-mail address will not be directly associated with the data. Information about you, collected for this study may be shared with other researchers. It may also be used for other research studies. These studies may be similar to this study or completely different. We will make sure that your identity cannot be linked to the information we share. We will not ask you for additional permission before sharing the information.

If you have questions about this study or the information in this form, please contact the principal investigator of the project, Dr. Stephanie Clark, at 515-294-7346 or milkmade@iastate.edu. If you have questions about your rights related to research participation, please contact the ISU IRB, at 515-294-4215 or IRB@iastate.edu.

Signing this form means that:

- You understand the information given to you in this form
- You have been able to ask the researcher questions and state any concerns
- The researcher has responded to your questions and concerns
- You believe you understand the research study and the potential benefits and risks

involved

If you agree to the terms of this form, please sign this form. Upon request, you will be given a copy of this consent document for your records.

We sincerely thank you for your time.

Stephanie Clark (ISU)

Karen Schmidt (KSU)

Are there any questions? If not, please sign the form.

SPEAKER: JACK

Now that you have agreed to participate, we would like you to fill out a survey in order for us to understand your past purchasing behaviors. Please turn to the next item in your packet, which has a QR CODE for a Qualtrics survey. It will take about 7 – 10 minutes to complete the survey. You will be given plenty of time to finish the survey without pressure. When you have completed the survey, we ask that you turn the QR CODE over to the left side of your folder and exhibit the STOP sign on the right side of your folder. Please stop when you get to the STOP page, and do not read further.

If you need help accessing the survey, please raise your hand. One of us can sanitize and loan you our phone if yours does not work.

(Allow 10 minutes for survey; gently ask who is not done if not all STOP signs are not turned by 10 m)

We will now begin going through a set of instructions so that we are able to clearly convey the procedures for today. From this point forward, we ask that there be no talking among participants, but you may ask questions at any time.

Are there any questions?

Now we would like to walk you through an infographic that has been prepared for you about reading Nutrition Facts Panels on food packaging. Please turn the STOP sign over to the left side and take the infographic out of your packet as we walk you through it. You can keep it out, and later, take it home with you.

The information provided on ANY food and beverage package is meant to help you make informed decisions about purchases. In addition to the product name, company and container contents, all packaged foods are legally required to display a list of ingredients, an allergen statement, and a Nutrition Facts Panel on any food package.

This specific Nutrition Facts panel and list of ingredients is from Blue Bunny vanilla flavored ice cream.

The first thing I want to point out is the list of ingredients. You can find this UNDER or to the RIGHT of what is called the Nutrition Facts panel.

Ingredients must be listed in order from highest to lowest amount in the food. So, for this particular product, milk is the main ingredient, followed by cream. Many times, a company will write “contains less than 2% of” for ingredients that are used sparingly. Note that there are several of those ingredients in this ice cream. Most of the ingredients found at less than 2% in ice cream are emulsifiers (like mono and diglycerides) and stabilizers (the gums). These ingredients (most of which are from plants) help ice cream last longer in your freezer, feel smooth, and melt more slowly in your mouth so it does not feel so cold. In this case, natural color is also added. Annatto is from tree bark, and it is also what they use to make Cheddar cheese orange.

Do you have any questions about anything I have said so far?

The next thing to point out is the allergen statement. Even though less than 4% of the population is allergic to milk protein, milk is one of 8 major food allergens, so it is required to be listed. Tree nuts, peanuts, fish, shellfish, soy, egg, and wheat are also major food allergens.

Do you have any questions about that?

The last thing I want to tell you about is the Nutrition Facts panel. That panel is there to help consumers make good nutritional choices. At the top, it tells you a serving size and how many servings there are in the package. Serving size is based on a “reference amount customarily consumed”. For ice cream, that is 2/3 cup. Even though you might want to eat more than 2/3 cup, that is what a serving size is based on. For this example, 2/3 cup weighs 87 grams.

Legally, ice cream may contain up to 50% air. An ice cream that contains 50% air, like this one, will weigh less than an ice cream with about 25% air, like the products you will taste later in this focus group.

The next thing listed on the Nutrition Facts panel is the number of calories per serving. Because a serving is $\frac{2}{3}$ cup, and there are 9 servings in this container, if you were to eat half of the container, you would have to multiply the number of calories times 4.5 (that's 756 calories)!

In the Nutrition Facts panel, you will see individual nutrients, like fats, sodium, carbohydrates, protein, vitamins and minerals listed along the left. Next to the nutrient is the number of grams of each nutrient in each serving. Now, look in the right-hand column. That is NOT the percent of each nutrient in the serving. It is the percent Daily Value you get from eating a serving of the food.

Let me explain. If you eat 2,000 calories in the entire day, and you eat one serving of the Blue Bunny vanilla flavored ice cream shown here, you will have consumed 7% of the total carbohydrates, and 26% of the total added sugars that you should have for the entire day. If you are trying to limit how much added sugars you are eating, you can look for other products that have a lower % Daily Value of added sugars in that column.

We like to pause for a moment here to allow more time to think about what was just said in case questions come to mind. Do you have any questions?

There is one more thing I want to point out here. Since lactose is a natural component of milk, it is not added sugar. So when we take the total sugar (in this case, 18 g) minus the added sugars (in this case, 13 g), we get 5 grams of lactose per serving of this ice cream. You can do this with just about any dairy product to determine how much lactose is in the product.

SPEAKER: Jack

In the next part of the study, we will ask you to taste three samples of vanilla ice cream, ONE AT A TIME. Please, wait to remove your masks until all the samples have been distributed.

You may now turn the page. An acceptability ballot will appear with a number associated with an ice cream sample. In a moment, we will bring you the three samples of ice cream. We ask you to taste the product, but you do not have to eat the entire scoop of ice cream. Please taste the ice cream in the order that they appear on your ballots. It is very important that you do not go back and forth between samples, please only taste one sample at a time. Additionally, please do not change your answers after tasting the other samples. The upside-down cup may be used to spit it out if you do not like a sample. The water is there for you to have a drink between samples.

On the acceptability ballot, we ask that you indicate how much you like or dislike different aspects of the samples. You may write down additional remarks that will help you remember what you think about each sample. When done, move the ballot over to the left side of the folder. Try not go back to it when you get your 2nd or 3rd sample.

Are there any questions?

Bring out ice cream freezers and distribute sample(s).

Take your time writing down your feelings about the ice cream. There is no hurry here, furthermore please refrain from laying your spoons on the Styrofoam trays. When done with the 3 samples, please turn your sensory sheets over and exhibit the STOP sign, and please place your masks back on.

[Wait until all ice cream is distributed] You can now remove your masks.

[ALLOW 10 MIN. Sensory takes place... ONE AT A TIME BASED UPON BALLOT]

[Wait until everyone is done tasting] If you have not already done so, please place your masks back on.

Now that you have shared your opinion on the samples you tasted, we will provide you with some information. We want to tell you a little more about the ice creams you just tasted. We didn't tell you these details before because we wanted your opinions about the ice cream without knowing what differed among them. It is VERY IMPORTANT that you NOT change anything that you wrote on the three ballots now but you may take them out to look at them.

All three products were made by our research team, with a relatively inexpensive ingredient that is a by-product of cheesemaking. Perhaps you have heard of whey?

Whey, a natural by-product of cheesemaking, can have different amounts of lactose, depending on the concentration method used. We used different types and amounts of whey in each of the 3 products to control the amount of lactose in the ice cream. We wanted to see if that influenced how much you liked the products.

The Nutrition Facts for each of these products is included on the next page in your folder. We encourage you to take a look at that page and you are welcome to take it with you.

We want to point out that sample #976 contained about 3.8% lactose. Sample #434 contained 5.8% lactose, which is about the same amount found in the Blue Bunny vanilla ice cream we looked at. Sample #236 contained 7.8% lactose (about double the amount found in sample #976). We also want to point out that because lactose is a natural component of milk and whey, the added sugar in each ice cream declined as the amount of lactose increased. That was directly related to the whey ingredient that we used in the product.

Again, we want to know how much you liked each of them before learning this information, so please do NOT change anything that you wrote on the three ballots.

Do you have any questions at this time?

EDUCATION MESSAGE PART depends on RANDOMIZATION SCHEME (place message after this page, as appropriate).

FOR CONTROL, continue with next page.

INSERT page here, AS APPROPRIATE, DEPENDING on RANDOMIZATION SCHEME.

SPEAKER: JACK

With this information in mind, we ask you NOW turn the page to reveal the SECOND QR code. Please follow the link and FILL OUT the post-survey in Qualtrics. The post-survey asks you about how what you learned today may impact your future purchasing and consumption of dairy products. It should take 5 – 7 minutes. When done, please turn your QR code over to the left side of your packet. You may begin.

[Allow 10 minutes. In the meantime, get \$ ready]

Thank you for filling that out.

Today, you may have received a different educational message than what others who participate in this study. That was by design, as we are trying to understand the influence of different educational messages on dairy products purchasing behavior. If any of your acquaintances are participating in this study in later sessions, it is essential that you do not share any of the details of the study with them. Thank you for respecting the integrity of this research.

We are nearly done, but want to invite you to participate in one more stage of this research study. One month from now, you will receive an invitation to participate in ONE MORE Qualtrics survey. The survey will ask you about purchasing and consumption behaviors AFTER today, and should take no longer than 10 minutes. If you participate, you will be entered into ANOTHER drawing for a \$25 Amazon gift certificate. We hope you will participate!

We have reached the end of our study. Thank you, once again, for participating. To receive your cash, please sign the receipt form in your folder. Please hand Dr. Schmidt, the signed receipt form and she will exchange it with your cash.

Please leave the signed consent form, and all other white pages in the folder BUT we welcome you to take any of the colored pages with you. Additionally, you can leave all of your empty containers at your station, and we will discard them for you.

Do you have any final questions?

Thank you once again for participating in this study—enjoy your day!

Appendix R - Ice Cream Nutrition Facts Panels

Sample # 976: 3.8% lactose

Sample # 434: 5.8% lactose

Sample # 236: 7.8% lactose

| Nutrition Facts | |
|---|-----------------------|
| 6 servings per container | |
| Serving size | 2/3 cup (133g) |
| <hr/> | |
| Amount per serving | |
| Calories | 270 |
| | % Daily Value* |
| Total Fat 15g | 19% |
| Saturated Fat 10g | 50% |
| <i>Trans</i> Fat 0g | |
| Cholesterol 60mg | 20% |
| Sodium 60mg | 3% |
| Total Carbohydrate 31g | 11% |
| Dietary Fiber 0g | 0% |
| Total Sugars 28g | |
| Includes 23g Added Sugars | 46% |
| Protein 4g | |
| <hr/> | |
| Vitamin D 2mcg | 10% |
| Calcium 132mg | 10% |
| Iron 2mg | 10% |
| Potassium 138mg | 2% |
| <hr/> | |
| *The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice. | |

| Nutrition Facts | |
|---|-----------------------|
| 6 servings per container | |
| Serving size | 2/3 cup (133g) |
| <hr/> | |
| Amount per serving | |
| Calories | 270 |
| | % Daily Value* |
| Total Fat 15g | 19% |
| Saturated Fat 10g | 50% |
| <i>Trans</i> Fat 0g | |
| Cholesterol 60mg | 20% |
| Sodium 85mg | 4% |
| Total Carbohydrate 31g | 11% |
| Dietary Fiber 0g | 0% |
| Total Sugars 26g | |
| Includes 20g Added Sugars | 40% |
| Protein 5g | |
| <hr/> | |
| Vitamin D 2mcg | 10% |
| Calcium 165mg | 15% |
| Iron 2mg | 10% |
| Potassium 185mg | 4% |
| <hr/> | |
| *The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice. | |

| Nutrition Facts | |
|---|-----------------------|
| 6 servings per container | |
| Serving size | 2/3 cup (133g) |
| <hr/> | |
| Amount per serving | |
| Calories | 270 |
| | % Daily Value* |
| Total Fat 15g | 19% |
| Saturated Fat 10g | 50% |
| <i>Trans</i> Fat 0g | |
| Cholesterol 55mg | 18% |
| Sodium 105mg | 5% |
| Total Carbohydrate 31g | 11% |
| Dietary Fiber 0g | 0% |
| Total Sugars 24g | |
| Includes 18g Added Sugars | 36% |
| Protein 5g | |
| <hr/> | |
| Vitamin D 3mcg | 15% |
| Calcium 199mg | 15% |
| Iron 2mg | 10% |
| Potassium 235mg | 6% |
| <hr/> | |
| *The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice. | |

INGREDIENTS: Milk, Cream, Sugar, Contains 2% or less of: Whey, Water, Locust bean gum, Guar gum, Carrageenan, Dextrose, Natural and artificial flavors

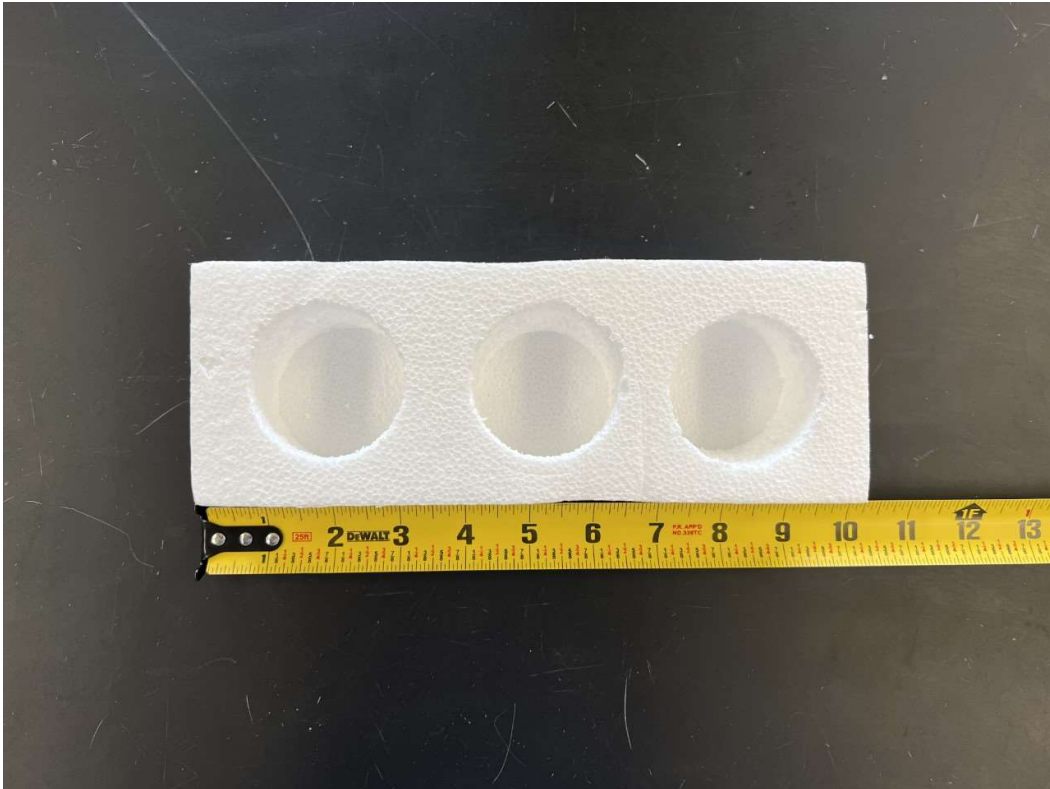
INGREDIENTS: Milk, Cream, Sugar, Whey, Contains 2% or less of: Water, Locust bean gum, Guar gum, Carrageenan, Dextrose, Natural and artificial flavors

INGREDIENTS: Milk, Cream, Sugar, Whey, Contains 2% or less of: Water, Locust bean gum, Guar gum, Carrageenan, Dextrose, Natural and artificial flavors

Appendix S - Insulated Cold Packs



Appendix T - Ice Cream Tray



Appendix U - Ice Cream Sensory Ballot

Sample #: 236, 434, and 976

Panelist # _____

Sensory Evaluation of Vanilla Ice Cream

Please taste the ice cream sample #976, then circle the NUMBER that best fits your opinion of the sample.

Appearance/Color

| | | | | |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|
| 1 dislike very much much | 2 dislike slightly | 3 neither dislike nor like | 4 like slightly | 5 like very |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|

Sweetness

| | | | | |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|
| 1 dislike very much much | 2 dislike slightly | 3 neither dislike nor like | 4 like slightly | 5 like very |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|

Flavor

| | | | | |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|
| 1 dislike very much much | 2 dislike slightly | 3 neither dislike nor like | 4 like slightly | 5 like very |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|

Texture/Mouthfeel

| | | | | |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|
| 1 dislike very much much | 2 dislike slightly | 3 neither dislike nor like | 4 like slightly | 5 like very |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|

Overall Liking

| | | | | |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|
| 1 dislike very much much | 2 dislike slightly | 3 neither dislike nor like | 4 like slightly | 5 like very |
|--------------------------------|-----------------------|-------------------------------|--------------------|----------------|

Comments are welcome:

Appendix V - SAS Code for the Logistic Regression

```
PROC IMPORT DATAFILE=REFFILE
  DBMS=XLSX
  OUT=WORK.IMPORT;
  GETNAMES=YES;
RUN;

PROC CONTENTS DATA=WORK.IMPORT; RUN;

%web_open_table(WORK.IMPORT);
PROC LOGISTIC DATA=WORK.IMPORT;
  class Education Gender Household Purchaser Age / param=glm;
  model Response (event='1')= Education Gender Household
  Purchaser Age/ clodds=wald orpvalue;
  oddsratio Education;
run;
```

| Effect | Degrees of Freedom | Wald Chi-Square | Pr > Chi Sq |
|-----------|--------------------|-----------------|-------------|
| Education | 3 | 1.1534 | 0.7642 |
| Gender | 1 | 0.5305 | 0.4664 |
| Household | 3 | 3.7467 | 0.2901 |
| Purchaser | 2 | 4.5290 | 0.1039 |
| Age | 4 | 4.4469 | 0.3465 |

Appendix W - SAS Ice Cream Sensory Code

```
PROC GLIMMIX data=WORK.IMPORT1 plots=studentpanel; *alpha=0.05;
  *class Sample Panelists;
  class Sample;
  model Texture=Sample;
  *random Panelists/solution g gcorr;

lsmeans Sample / bon ALPHA=0.05;
lsmeans Sample / adjust=tukey lines;

run;

proc anova DATA=WORK.IMPORT1;

  Class Sample;

  model Texture=Sample ;

run;
```

Appendix X - SAS Code for the Wilcoxon Signed Rank Test

```
PROC IMPORT DATAFILE=REFFILE
  DBMS=XLSX
  OUT=WORK.IMPORT2;
  GETNAMES=YES;
RUN;

PROC CONTENTS DATA=WORK.IMPORT2; RUN;

%web_open_table(WORK.IMPORT2);
Proc GLIMMIX data=WORK.IMPORT2 plots=studentpanel;
  class Education;
  model Change=Education;
  run;

PROC UNIVARIATE DATA=WORK.IMPORT2 normal;
  class Message;
  Var Change;
run;

PROC LOGISTIC DATA=WORK.IMPORT2;
  class Education (ref='Control');
  model Change=Education;
run;
```

Appendix Y - SAS Code the Paired T- Tests

```
PROC TTEST data=WORK.IMPORT1 alpha=0.05;  
paired premilk*postmilk;  
run;
```

```
PROC TTEST data=WORK.IMPORT1 alpha=0.05;  
paired preyogurt*postyogurt;  
run;
```

```
PROC TTEST data=WORK.IMPORT1 alpha=0.05;  
paired precheese*postcheese;  
run;
```

```
PROC TTEST data=WORK.IMPORT1 alpha=0.05;  
paired preicecream*posticecream;  
run;
```

Appendix Z - Stop Sign



Appendix AA - Food Choices and Intolerances Survey Raw Data

Results from the Food Choices and Intolerances Survey

| Please Indicate the nearest city you are located | Number of Responses |
|---|----------------------------|
| Ames, IA | 1 |
| Ankeny, IA | 1 |
| Nevada, IA | 0 |
| Des Moines, IA | 1 |
| Iowa City, IA | 5 |
| Manhattan, KS | 1906 |
| Junction City, KS | 26 |
| Topeka, KS | 168 |
| Salina, KS | 125 |
| Outside Iowa and Kansas | 230 |

| Eating healthy is _____ to me. | Number of Responses |
|---------------------------------------|----------------------------|
| Not Important | 15 |
| Somewhat Important | 329 |
| Moderately Important | 633 |
| Important | 1002 |
| Very Important | 468 |

| I go out of my way to consume foods containing (check any and all responses that are true for your at this time). | Number of Responses |
|--|----------------------------|
| Cereal grains (e.g. oat, rice, wheat) | 801 |
| Dairy (e.g., milk, yogurt, ice cream, etc.) | 891 |
| Eggs | 886 |
| Meat (e.g., beef, pork, poultry) | 1417 |
| Peanuts | 333 |
| Pulses (e.g. beans, peas, lentils, etc.) | 471 |
| Seafood (including shellfish) | 545 |
| Soy (including Tofu) | 228 |
| Tree nuts (e.g. almonds, pecans) | 483 |
| Vegetables (e.g. zucchini, broccoli, etc.) | 167 |
| Others not listed | 78 |
| I don't go out of my way to consume any of the listed options. | 378 |
| Fruits (e.g. kiwi, banana, avocado) | 1682 |

| I go out of my way to avoid foods containing (check any and all responses that are true for your at this point). | Number of Responses |
|---|----------------------------|
| Cereal grains (e.g. oat, rice, wheat) | 230 |

| | |
|--|-----|
| Dairy (e.g., milk, yogurt, ice cream, etc.) | 535 |
| Eggs | 172 |
| Meat (e.g., beef, pork, poultry) | 263 |
| Peanuts | 181 |
| Pulses (e.g. beans, peas, lentils, etc.) | 197 |
| Seafood (including shellfish) | 525 |
| Soy (including Tofu) | 493 |
| Tree nuts (e.g. almonds, pecans) | 202 |
| Vegetables (e.g. zucchini, broccoli, etc.) | 62 |
| Others not listed | 248 |
| I don't go out of my way to consume any of the listed options. | 848 |
| Fruits (e.g. kiwi, banana, avocado) | 48 |

| | |
|--|----------------------------|
| I have been medically diagnosed with an allergy/intolerance to (check any and all responses that are true for your at this time). | Number of Responses |
|--|----------------------------|

| | |
|--|------|
| Cereal grains (e.g. oat, rice, wheat) | 95 |
| Dairy (e.g., milk, yogurt, ice cream, etc.) | 256 |
| Eggs | 50 |
| Meat (e.g., beef, pork, poultry) | 25 |
| Peanuts | 58 |
| Pulses (e.g. beans, peas, lentils, etc.) | 14 |
| Seafood (including shellfish) | 48 |
| Soy (including Tofu) | 29 |
| Tree nuts (e.g. almonds, pecans) | 68 |
| Vegetables (e.g. zucchini, broccoli, etc.) | 13 |
| Others not listed | 100 |
| I don't go out of my way to consume any of the listed options. | 1916 |
| Fruits (e.g. kiwi, banana, avocado) | 33 |

| | |
|---|----------------------------|
| I avoid these foods because I experience digestive discomfort, not from medically diagnosed condition, after consuming (check and all responses that are true for you at this time). | Number of Responses |
|---|----------------------------|

| | |
|--|-----|
| Cereal grains (e.g. oat, rice, wheat) | 177 |
| Dairy (e.g. milk, yogurt, ice cream, etc.) | 783 |
| Eggs | 123 |
| Meat (e.g. beef, pork, poultry) | 129 |
| Peanuts | 57 |
| Pulses (e.g., beans, peas, lentils, etc.) | 87 |
| Seafood (including shellfish) | 90 |
| Soy (including Tofu) | 106 |

| | |
|---|------|
| Tree nuts (e.g. almonds, pecans) | 52 |
| Vegetables (e.g. zucchini, broccoli, etc.) | 50 |
| Others not listed | 206 |
| I experience no digestive discomfort or issues from any of these foods. | 1222 |

| In the past week, I have experienced (check any and all responses that are true for you at this time). | Number of Responses |
|---|----------------------------|
| I experienced none of these symptoms | 776 |
| Bloating | 1089 |
| Constipation | 489 |
| Cramping | 557 |
| Diarrhea | 588 |
| Flatulence | 693 |
| Other digestive discomfort or issue not listed | 252 |
| Prefer not to answer | 53 |

| Other reasons for avoiding foods are listed below. Which of the following reasons explain why you avoid ANY of the food products selected in question 4. | Number of Responses |
|---|----------------------------|
| I generally do not like the taste of it/them | 485 |
| I do not like the texture of it/them | 595 |
| I had a bad experience with it and won't eat it anymore | 354 |
| I am a vegetarian | 113 |
| I am a vegan | 34 |
| Follow a diet that excludes one or more foods category (e.g. Keto, Paleo, Whole 30) | 80 |
| Doctor Recommendation | 215 |
| Registered Dietitian / Nutritionist Recommendation | 69 |
| Friend Recommendation | 47 |
| Website Recommendation | 43 |
| Cost is prohibitory | 133 |
| Religious reason | 32 |
| Concern for environment | 198 |
| Concern for animal welfare | 154 |
| Weight control | 429 |
| Nutrition Concern | 380 |
| Other not listed | 176 |
| I do not avoid any of these foods | 697 |
| Culture/ethnicity reasons | 26 |

| I go out of my way to eat, drink or consume (check any and all responses that are true for your at this point in time): | Number of Responses |
|--|----------------------------|
| More calcium | 480 |
| More protein | 1167 |
| More vitamin D | 557 |
| Less added sugar | 1154 |
| Less carbohydrates | 491 |
| Less fat | 459 |
| Less sodium | 531 |
| Less sugar | 927 |
| More probiotics | 512 |
| More prebiotics | 131 |
| Not applicable | 388 |

| I go out of my way to (check any and all responses that are true for your at this point in time): | Number of Responses |
|--|----------------------------|
| Buy local | 815 |
| Buy lactose-free | 385 |
| Buy probiotic foods | 244 |
| Buy organic foods | 350 |
| Buy more plant-based foods | 531 |
| Cook for myself | 1610 |
| Move regularly | 1282 |
| Learn about what I put in my body | 985 |
| Reduce my carbon footprint | 580 |
| Buy prebiotic foods | 74 |
| Buy more nutrient-dense foods | 682 |
| I don't pay attention to any of these things | 224 |

| I look at the nutrition facts panels when buying a new product. | Number of Responses |
|--|----------------------------|
| Never | 107 |
| Rarely | 359 |
| Sometimes | 1108 |
| Always | 790 |

| I can read and easily understand nutrition facts panels. | Number of Responses |
|---|----------------------------|
| Cannot | 14 |
| Not Easily | 8 |
| Moderately Easily | 595 |
| Easily | 856 |
| Very Easily | 831 |

| I look at the ingredients label when buying a new products. | Number of Responses |
|--|----------------------------|
| Never | 122 |
| Rarely | 429 |
| Sometimes | 1053 |
| Always | 774 |

| I can read and easily understand ingredients labels. | Number of Responses |
|---|----------------------------|
| Cannot | 20 |
| Not easily | 163 |
| Moderately Easily | 638 |
| Easily | 855 |
| Very Easily | 708 |

| Which of the following statements apply to you (check all that apply)? | Number of Responses |
|--|----------------------------|
| I consume at least 5.5 ounces of protein each day | 1503 |
| I consume at least 2 cups (2 servings) of fruits each day. | 891 |
| I consume at least 2.5 cups (2 ½ servings) of vegetables each day | 850 |
| I consume at least 3 cups (3 servings) of dairy each day (NOT including plant-based milk alternatives) | 537 |
| At least half of the grains that I consume are whole grains | 875 |
| I limit by consumption of added sugars, solid fats, and salts | 1089 |
| I drink more water than sugary drinks. | 1944 |

| Would you like to be invited to participate in an in-person follow-up study that involves ice cream? | Number of Responses |
|---|----------------------------|
| No | 1292 |
| Yes | 1100 |

Appendix BB - Results from Summer and Fall Distribution of the Food Choices and Intolerances Survey

| Research Step | Summer | | Fall | | |
|---|---------------------------|-------|---------|-------|---------|
| Gross number research participants that responded to FCI | 662 | | 1,833 | | |
| | Educational Message | Males | Females | Males | Females |
| Number of panelists meeting the selection criteria and invited to attend an NFG | | 40 | 124 | 24 | 79 |
| Number responding to NFG email invitation | | 17 | 39 | 11 | 52 |
| Number of research participants at NFG | | 11 | 33 | 17 | 41 |
| | Primary | 1 | 11 | 4 | 6 |
| | Lactose maldigestion | 4 | 3 | 6 | 10 |
| | 9 essential nutrients | 3 | 4 | 1 | 14 |
| | Prebiotics and probiotics | 3 | 15 | 6 | 11 |
| Number of research participants who completed the one-month follow-up survey | | 8 | 27 | 14 | 33 |
| | Primary | 0 | 9 | 4 | 3 |
| | Lactose maldigestion | 2 | 2 | 5 | 8 |
| | 9 essential nutrients | 3 | 3 | 1 | 12 |
| | Prebiotics and probiotics | 3 | 13 | 4 | 10 |

Appendix CC - Results from the NFG Pre-Survey

| What best described your gender? | Number of Responses |
|--|----------------------------|
| Male | 28 |
| Female | 74 |
| Within what range does your age fall? | Number of Responses |
| 18-24 | 50 |
| 25-34 | 21 |
| 35-44 | 11 |
| 45-54 | 11 |
| 55 and above | 9 |
| Which of the following best describe(s) your race and ethnicity? | Number of Responses |
| American Indian, Alaskan Native, Indigenous Person of Americas | 2 |
| Native Hawaiian or Other Pacific Islander | 1 |
| Asian American or Asian Origin | 6 |
| Latin American, Hispanic, Latino, or Spanish Origin | 12 |
| Prefer not to answer | 0 |
| African American, Black, or African Origin | 3 |
| White | 84 |
| Other | 2 |
| What is the number of people who live in your household (including self)? | Number of Responses |
| 1 | 15 |
| 2 | 38 |
| 3 | 19 |
| 4 or more | 30 |
| Eating healthy is _____ to me | Number of Responses |
| Not Important | 0 |
| Somewhat Important | 12 |
| Moderately Important | 30 |
| Important | 46 |
| Very Important | 13 |
| I look at the Nutrition Facts panels when buying a new product: | Number of Responses |
| Never | 3 |
| Rarely | 18 |
| Sometimes | 53 |
| Always | 28 |
| I can _____ understand Nutrition Facts panels: | Number of Responses |

| | |
|--|----------------------------|
| Not Easily | 4 |
| Moderately Easily | 34 |
| Easily | 41 |
| Very Easily | 23 |
| I look at the Ingredients labels when buying a new product: | Number of Responses |
| Never | 1 |
| Rarely | 27 |
| Sometimes | 43 |
| Always | 31 |
| I can _____ understand ingredients labels: | Number of Responses |
| Not Easily | 5 |
| Moderately Easily | 41 |
| Very Easily | 15 |
| Easily | 40 |
| Which of the following statement apply to you? | Number of Responses |
| I consume at least 1 serving of protein each day (1 svg = 3 oz lean meat, 1 TBS peanut butter, 1/4 cooked beans, etc.) | 94 |
| I consume at least 2 servings of fruits each day (1 svg = 1 cup fruit, 1/2 cup fruit juice, etc.) | 47 |
| I consume at least 2 1/2 servings of vegetables each day (1 svg = 1 cup raw vegetable, 2 cups leafy greens, etc.) | 40 |
| I consume at least 3 servings of dairy each day (1 svg = 1 cup milk or yogurt, 1.5 oz cheese, 2/3 cup of ice cream, etc.) | 41 |
| At least half of the grains that I consume are whole grains | 45 |
| I limit my consumption of added sugars, solid fats and salt | 50 |
| I drink more water than sugary drinks | 86 |
| To what extent do you make an effort to limit lactose consumption? | Number of Responses |
| Sometimes | 41 |
| Not At All | 58 |
| Always | 3 |
| A Daily Value (%DV) of 5% or less of a nutrient per serving is low, and 20% DV or more of a nutrient per serving is high. | Number of Responses |
| True | 82 |
| False | 18 |

| Which of these ingredients are considered added sugars? (check any and all that apply) | Number of Responses |
|--|----------------------------|
| Corn Syrup | 101 |
| Milk | 6 |
| 100% Fruit Juice | 18 |
| Table Sugar | 96 |
| Honey | 51 |
| Whey | 9 |
| How many essential nutrients are naturally found in dairy products (milk, yogurt, cheese, ice cream)? | Number of Responses |
| None | 0 |
| 1 | 4 |
| 3 | 22 |
| 5 | 21 |
| 7 | 7 |
| 9 | 3 |
| I know _____ about lactose maldigestion. | Number of Responses |
| Nothing | 34 |
| A Little | 52 |
| A Moderate Amount | 15 |
| A Lot | 0 |
| I know _____ about probiotics. | Number of Responses |
| Nothing | 8 |
| A Little | 65 |
| A Moderate Amount | 26 |
| A Lot | 2 |
| I know _____ about prebiotics. | Number of Responses |
| Nothing | 49 |
| A Little | 40 |
| A Moderate Amount | 10 |
| A Lot | 3 |
| Do you consider yourself the primary food purchaser in your household? | Number of Responses |
| No, someone else is. | 12 |
| No, shopping is shared equally with another | 31 |
| Yes, I am the primary purchaser | 58 |
| How much milk did you purchase for home use this month. | Number of Responses |
| None | 14 |
| <1 Gallon | 18 |
| 1 Gallon | 22 |
| >1 Gallon | 47 |

| How much milk did you (personally) consumer at home this month? | Number of Responses |
|---|----------------------------|
| None | 17 |
| <1 Gallon | 54 |
| 1 Gallon | 20 |
| >1 gallon | 11 |
| Which of the following MOST influences the milk you buy for your home? | Number of Responses |
| Family member's brand or flavor preference | 21 |
| My personal brand or flavor preference | 30 |
| Product's ingredients or nutrition | 19 |
| Other not listed | 4 |
| Price | 28 |
| How much yogurt did you purchase of your home this month? | Number of Responses |
| None | 38 |
| Up to 3 servings | 18 |
| 3-5 Servings | 14 |
| More than 5 servings | 32 |
| How much yogurt did you (personally) consume at home this month? | Number of Responses |
| None | 31 |
| Up to 3 servings | 29 |
| 3-5 Servings | 18 |
| More than 5 servings | 24 |
| Which of the following MOST influences the yogurt you buy for your home? | Number of Responses |
| Family member's brand or flavor preference | 10 |
| My personal brand or flavor preference | 48 |
| Product's ingredients or nutrition | 23 |
| Other not listed | 7 |
| Price | 12 |
| How much cheese did you purchase of home use this month? | Number of Responses |
| None | 12 |
| Up to 1 package (8 oz.) | 24 |
| 1 – 2 Packages (1 lb.) | 35 |
| More than 1 lb. | 31 |
| How much cheese did you personally consumer at home this moth? | Number of Responses |
| None | 6 |
| Up to 1 package (8 oz.) | 54 |
| 1 – 2 Packages (1 lb.) | 30 |
| More than 1 lb. | 12 |
| Which of the following MOST influences the cheese you buy for your home? | Number of Responses |

| | |
|--|-----------------------------|
| Family member's brand or flavor preference | 13 |
| My personal brand or flavor preference | 60 |
| Product's ingredients or nutrition | 7 |
| Other Not Listed | 1 |
| Price | 20 |
| How much ice cream did you purchase for home use this month? | Number of Responses |
| None | 17 |
| 1-3 scoops | 12 |
| About 16 ounces (1 pint) | 20 |
| About 32 ounces (1 quart) | 19 |
| More than 1 quart | 34 |
| How much ice cream did you (personally) consume at home this month? | Number of Responses |
| None | 11 |
| 1-3 scoops | 35 |
| About 16 ounces (1 pint) | 31 |
| About 32 ounces (1 quart) | 14 |
| More than 1 quart | 11 |
| Which if the following most influences the ice cream you buy for your home? | Number of Responses |
| Family member's brand or flavor preference | 20 |
| My personal brand or flavor preference | 65 |
| Product's ingredients or nutrition | 9 |
| Other Not Listed | 1 |
| Price | 7 |
| How often do you try something new in the dairy category? | Numbers of Responses |
| Never | 12 |
| Maybe Every 3-4 Months | 54 |
| Maybe Every 1-2 Months | 27 |
| At least once a month | 8 |
| What may most likely increase your willingness to try something different in the dairy category? (check all responses that are true for you at this time) | Number of Responses |
| Higher protein | 47 |
| Lower Sugar | 36 |
| Lower Added Sugars | 49 |
| Lower Lactose | 26 |
| Higher Lactose | 1 |
| Plant-based ingredients | 31 |
| Prebiotic Ingredients | 26 |
| Probiotic Bacteria | 40 |
| More Information About the Product | 42 |
| Other | 20 |

| If more information was available about a dairy product, which of the following would you read more about? (check all responses that are true for you at this time) | Number of Responses |
|---|---------------------|
| I would not read more about any of these things | 8 |
| Sustainability about the product, ingredients or packaging | 57 |
| The purpose of ingredients with unfamiliar names (e.g., annatto, carrageenan) | 70 |
| The natural and added sources of sugar in the product | 52 |
| animal welfare conditions surrounding the product | 43 |
| A summary of scientific research demonstrating benefits or risks from consuming the type of product | 36 |
| Information about the animals, farm, farmer or manufacturer who handled the product | 44 |
| The natural and synthetic sources of ingredients in the product | 50 |

Appendix DD - NFG Post Survey Raw Data

| | |
|---|----------------------------|
| How much did you learn about how to read and use food ingredients labels today? | Number of Reponses |
| Nothing New | 14 |
| Very Little | 22 |
| A Moderate Amount | 52 |
| A Lot | 12 |
| I plan to look at food ingredient labels when buying new products in the future. | Number of Responses |
| Never | 2 |
| Sometimes | 30 |
| Frequently | 43 |
| Every time | 26 |
| Which of these ingredients are considered added sugars? (check all that apply) | Number of Responses |
| Honey | 67 |
| Table Sugar | 94 |
| Milk | 5 |
| Corn Syrup | 95 |
| 100% Fruit Juice | 35 |
| Whey | 26 |
| 5% Daily Value or less of a nutrient per serving is low and 20% Daily Value or more of a nutrient per serving is high. | Number of Responses |
| True | 92 |
| False | 7 |
| How much did you learn about how to read and use Nutrition Facts panels today? | Number of Responses |
| Nothing New | 13 |
| Very Little | 27 |
| A moderate amount | 49 |
| A Lot | 12 |
| I plan to look at Nutrition Facts panels when buying new products in the future. | Number of Responses |
| Never | 1 |
| Sometimes | 31 |
| Frequently | 42 |
| Every time | 27 |
| Using the Nutrition Facts label of this low-fat vanilla yogurt, how much lactose is in a serving? | Number of Responses |
| I don't know | 3 |

| | |
|---|----------------------------|
| 6 grams | 83 |
| 8 grams | 13 |
| 14 grams | 2 |
| How much did you learn about essential nutrients in dairy today? | Number of Responses |
| I was not in that focus group | 20 |
| Nothing New | 8 |
| Very Little | 25 |
| A moderate Amount | 43 |
| A Lot | 5 |
| How many essential nutrients are naturally found in dairy products (milk, yogurt, cheese, ice cream)? | Number of Responses |
| I don't know | 24 |
| None | 0 |
| 1 | 4 |
| 3 | 16 |
| 5 | 10 |
| 7 | 4 |
| 9 | 20 |
| Based on what you learned about essential nutrients in dairy today, how will it change what dairy products you purchase and consume in the future? | Number of Responses |
| I will decrease my dairy purchases/consumption | 2 |
| I will not change my behavior | 63 |
| I will increase my dairy purchases/consumption | 12 |
| How much did you learn about lactose maldigestion today? | Number of Responses |
| I was not in that focus group | 23 |
| Nothing New | 13 |
| Very Little | 22 |
| A moderate Amount | 34 |
| A Lot | 8 |
| Based on what you learned about lactose maldigestion today, how will it change your dairy products purchasing and consumption in the future? | Number of Responses |
| I will decrease my dairy purchases/consumption | 2 |
| I will not change my behavior | 63 |
| I will increase my dairy purchases/consumption | 8 |

| How much did you learn about probiotics and prebiotics today? | Number of Responses |
|---|----------------------------|
| I was not in that focus group | 39 |
| Nothing New | 19 |
| Very Little | 18 |
| A moderate Amount | 17 |
| A Lot | 7 |
| Based on what you learned about probiotics and prebiotics today, how will it change dairy products purchasing and consumption in the future? | Number of Responses |
| I will decrease my dairy purchases/consumption | 1 |
| I will not change my behavior | 44 |
| I will increase my dairy purchases/consumption | 15 |
| How much less or more likely would you purchase a dairy product labelled with "Naturally contains nine essential nutrients" than the same product without the statement? | Number of Responses |
| Much less likely | 1 |
| Somewhat less likely | 2 |
| Equally Likely | 33 |
| Slightly more likely | 42 |
| Much more likely | 12 |
| How much less or more likely are you to purchase milk with extra lactose if it would cost less than regular milk? | Number of Responses |
| Much less likely | 10 |
| Somewhat less likely | 21 |
| Equally Likely | 23 |
| Slightly more likely | 29 |
| Much more likely | 7 |
| How much less or more likely would you purchase cheese with extra lactose if it would cost less than regular cheese? | Number of Responses |
| Much less likely | 6 |
| Somewhat less likely | 18 |
| Equally Likely | 31 |
| Slightly more likely | 26 |
| Much more likely | 9 |
| How much less or more likely are you to purchase ice cream with extra lactose if it would cost less than regular ice cream? | Number of Responses |
| Much less likely | 7 |

| | |
|----------------------|----|
| Somewhat less likely | 18 |
| Equally Likely | 22 |
| Slightly more likely | 29 |
| Much more likely | 13 |

| | |
|---|----------------------------|
| How much less or more likely might you be to purchase prebiotic or probiotic milk than regular milk? | Number of Responses |
|---|----------------------------|

| | |
|----------------------|----|
| Much less likely | 4 |
| Somewhat less likely | 6 |
| Equally Likely | 35 |
| Slightly more likely | 37 |
| Much more likely | 8 |

| | |
|--|----------------------------|
| How much less or more likely might you be to purchase cheese labelled with "probiotic" or "prebiotic" compared to cheese without the statement? | Number of Responses |
|--|----------------------------|

| | |
|----------------------|----|
| Much less likely | 3 |
| Somewhat less likely | 4 |
| Equally Likely | 35 |
| Slightly more likely | 40 |
| Much more likely | 8 |

| | |
|--|----------------------------|
| If prebiotic or probiotic ice cream were available in stores, how much less or more likely might you bet to purchase it than regular ice cream? | Number of Responses |
|--|----------------------------|

| | |
|----------------------|----|
| Much less likely | 7 |
| Somewhat less likely | 6 |
| Equally Likely | 31 |
| Slightly more likely | 43 |
| Much more likely | 8 |

Appendix EE - One-month follow-up survey raw data

| How often have you looked at food ingredient labels in the past 3 weeks? | Number of Responses |
|---|----------------------------|
| Never | 5 |
| A few times (fewer than 3 food products that I have considered purchasing) | 34 |
| Frequently (at least 3 food products that I have considered purchasing) | 35 |
| Every time | 10 |
| How often have you looked at Nutrition Facts panels in the past 3 weeks? | Number of Responses |
| Never | 5 |
| A few times | 31 |
| Frequently | 41 |
| Every time | 8 |
| Which of these ingredients are considered added sugars? (check all that apply) | Number of Responses |
| Honey | 48 |
| Table sugar | 81 |
| Milk | 8 |
| Corn syrup | 85 |
| 100% fruit juice | 23 |
| Whey | 28 |
| 5% Daily Value or less of a nutrient per serving is low and 20% Daily Value or more of a nutrient per serving is high. | Number of Responses |
| True | 72 |
| False | 10 |
| Using the Nutrition Facts label of this low-fat vanilla yogurt, how much lactose is in a serving? | Number of Responses |
| I don't know | 9 |
| 6 grams | 59 |
| 8 grams | 9 |
| 14 grams | 8 |
| How many essential nutrients are naturally in dairy products? | Number of Responses |
| I don't know | 23 |
| None | 0 |
| 1 | 0 |
| 3 | 12 |
| 4 | 8 |
| 7 | 19 |

| How often have you modified a purchase based on amount of lactose in a product in the past 3 weeks? | Number of Responses |
|---|----------------------------|
| Never | 56 |
| A few times | 20 |
| Frequently | 3 |
| Every time | 1 |
| How often have you modified a purchase based on added sugars in a product in the past 3 weeks? | Number of Responses |
| Never | 23 |
| A few times | 43 |
| Frequently | 14 |
| Every time | 2 |
| How often have you modified a purchase based on probiotics or prebiotics in a product in the past 3 weeks? | Number of Responses |
| Never | 57 |
| A few times | 19 |
| Frequently | 6 |
| Every time | 0 |
| How much milk did you purchase in the last three weeks? | Number of Responses |
| None | 11 |
| Less than a gallon | 20 |
| A gallon | 25 |
| More than a gallon | 26 |
| How much milk did you (personally) drink in the past 3 weeks? | Number of Responses |
| None | 16 |
| Less than a gallon | 51 |
| A gallon | 8 |
| More than a gallon | 7 |
| How much yogurt did you purchase in the past 3 weeks? | Number of Responses |
| None | 38 |
| Up to 3 servings | 14 |
| 3-5 Servings | 15 |
| More than 5 servings | 15 |
| How much yogurt did you (personally) consume in the last 3 weeks? | Number of Responses |
| None | 35 |
| Up to 3 servings | 23 |
| 3-5 Servings | 12 |
| More than 5 servings | 12 |

| How much cheese did you purchase in the past 3 weeks? (consider a serving 1.5 ounces) | Number of Responses |
|--|----------------------------|
| None | 15 |
| One package (8 oz.) | 25 |
| Two packages (1 lb.) | 25 |
| More than 1 lb. | 16 |
| How much cheese did you (personally) eat in the past 3 weeks? (Consider a serving 1.5 ounces) | Number of Responses |
| None | 7 |
| One package (8 oz.) | 52 |
| Two packages (1 lb.) | 13 |
| More than 1 lb. | 10 |
| How much ice cream did your purchase in the past 3 weeks? | Number of Responses |
| None | 18 |
| 1-3 scoops | 21 |
| About 16 oz. (1 pint) | 6 |
| About 32 oz. (1 quart) | 24 |
| More than 32 oz. | 13 |
| How much ice cream did you (personally) eat in the past 3 weeks? | Number of Responses |
| None | 14 |
| 1-3 scoops | 30 |
| About 16 oz. (1 pint) | 24 |
| About 32 oz. (1 quart) | 12 |
| More than 32 oz. | 4 |
| How much less or more likely will you be to purchase a dairy product labelled with "Naturally contains Nine Essential Nutrients" than the same product without the statement? | Number of Responses |
| Much less likely | 1 |
| Somewhat less likely | 0 |
| Equally Likely | 47 |
| Somewhat more likely | 33 |
| Much more likely | 3 |
| How much less or more likely will you be to purchase milk with extra lactose if it costs less than regular milk? | Number of Responses |
| Much less likely | 11 |
| Somewhat less likely | 19 |
| Equally Likely | 22 |
| Somewhat more likely | 9 |
| Much more likely | 23 |

| How much less or more likely will you be to purchase ice cream with extra lactose if it costs less than regular ice cream? | Number of Responses |
|---|----------------------------|
| Much less likely | 9 |
| Somewhat less likely | 20 |
| Equally Likely | 13 |
| Somewhat more likely | 10 |
| Much more likely | 32 |
| If prebiotic and probiotic ice cream available in stores, how much less or more likely will you be to purchase it? | Number of Responses |
| Much less likely | 2 |
| Somewhat less likely | 8 |
| Equally Likely | 28 |
| Somewhat more likely | 42 |
| Much more likely | 4 |