Dairy nutrition education: Potential to motivate behavior change towards food labelling and actions towards dairy products

by

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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>v</td>
</tr>
<tr>
<td>NOMENCLATURE</td>
<td>vi</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>vii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>viii</td>
</tr>
<tr>
<td>CHAPTER 1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER 2. LITERATURE REVIEW</td>
<td>5</td>
</tr>
<tr>
<td>Importance of dairy in the diet</td>
<td>5</td>
</tr>
<tr>
<td>Dairy intolerances</td>
<td>6</td>
</tr>
<tr>
<td>Probiotics and prebiotics</td>
<td>8</td>
</tr>
<tr>
<td>Social marketing theory</td>
<td>9</td>
</tr>
<tr>
<td>CHAPTER 3. METHODOLOGY</td>
<td>12</td>
</tr>
<tr>
<td>CHAPTER 4. RESULTS</td>
<td>27</td>
</tr>
<tr>
<td>Screening Survey and MFG Population Demographics</td>
<td>27</td>
</tr>
<tr>
<td>CHAPTER 5. CONCLUSIONS</td>
<td>63</td>
</tr>
<tr>
<td>Recommendations for Further Research</td>
<td>64</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>66</td>
</tr>
<tr>
<td>APPENDIX A. INVITATION TO PARTICIPATE IN FOOD CHOICES AND INTOLERANCES QUALTRICS SURVEY</td>
<td>73</td>
</tr>
<tr>
<td>APPENDIX B. FOOD CHOICES AND INTOLERANCES CONSENT FORM</td>
<td>74</td>
</tr>
<tr>
<td>APPENDIX C. FOOD CHOICES AND INTOLERANCES QUALTRICS SURVEY</td>
<td>76</td>
</tr>
<tr>
<td>APPENDIX D. MODIFIED FOCUS GROUP CONSENT FORM</td>
<td>81</td>
</tr>
<tr>
<td>APPENDIX E. MODIFIED FOCUS GROUP PRE-SURVE</td>
<td>84</td>
</tr>
<tr>
<td>APPENDIX F. SCRIPT (CONTROL)</td>
<td>90</td>
</tr>
<tr>
<td>APPENDIX G. NINE ESSENTIAL NUTRIENTS LESSON</td>
<td>97</td>
</tr>
<tr>
<td>APPENDIX H. PROBIOTIC AND PREBIOTIC LESSON</td>
<td>98</td>
</tr>
</tbody>
</table>
APPENDIX I. LACTOSE LESSON .................................................................99
APPENDIX J. ICE CREAM NUTRITION FACTS AND INGREDIENTS PANEL ........100
APPENDIX K. ACCEPTABILITY BALLOT .........................................................101
APPENDIX L. NUTRITION FACTS PANEL INFOGRAPHIC ..............................102
APPENDIX M. NINE ESSENTIAL NUTRIENTS INFOGRAPHIC ...........................103
APPENDIX N. PROBIOTIC AND PREBIOTIC INFOGRAPHIC ..............................104
APPENDIX O. LACTOSE INFOGRAPHIC ..........................................................105
APPENDIX P. MODIFIED FOCUS GROUP POST-SURVEY ...............................106
APPENDIX Q. ONE MONTH POST MODIFIED FOCUS GROUP CONSENT FORM ....110
APPENDIX R. ONE MONTH POST MODIFIED FOCUS GROUP FOLLOW UP SURVEY112
**LIST OF TABLES**

Table 1. Formulations for 3.8% lactose and 7.8% lactose white mixes (the two were combined (50/50) for the 5.8% lactose white mix. .................................................. 24

Table 2. Screening Survey and Modified Focus Group (MFG) Pre-Survey Responses to Demographic Questions asked on Both Surveys.......................................................... 27

Table 3. Responses by the same Modified Focus Group (MFG) panelists to Screening survey, pre-survey, post-survey, and one-month follow-up survey to questions regarding food labels. ............................................................................................... 35

Table 4. Responses (N) to quiz questions asked immediately before (Pre-), after (Post-) and one month after (one-month) Modified Focus Groups (MFG), by treatment group. Mean correctness value* (0 = incorrect, 1 = correct) is specified by treatment group\(^{a,b}\) and by MFG\(^{A,B}\) ............................................................................ 43

Table 5. Summary statistics for MFG participants regarding actions towards dairy products with lactose immediately after (post-survey) and one-month following the MFGs (one-month follow-up). ................................................................................. 49

Table 6. Summary statistics for MFG participants regarding actions towards dairy products with probiotics or prebiotics as the driver. ............................................................. 52

Table 7. Responses (n) to questions asked regarding perceived learning immediately after (Post-survey) Modified Focus Groups, by treatment group. Mean is specified for each treatment group\(^{a,b}\) ........................................................................................................ 56

Table 8. Summary statistics for MFG participants regarding actions towards milk, yogurt, cheese and ice cream prior to (MFG pre-survey) and one-month after the MFGs (one-month follow-up survey) ...................................................................... 59

Table 9. Summary of mean scores for appearance, sweetness, flavor, texture and overall acceptability of 3 ice cream samples with varying levels of lactose (\(n=94\)) ......... 61

Table 10. Summary quartile scores for overall acceptability of 3 ice cream samples with varying levels of lactose (\(n=94\)) ............................................................... 61

Table 11. Summary statistics for individual paired differences in acceptability scores for 3 ice cream samples with varying lactose. .......................................................... 62
LIST OF FIGURES

Figure 1. Yogurt Nutrition Facts Panel provided to panelists when asked to answer a multiple-choice question about how much lactose is in the product. .......................... 22
### NOMENCLATURE

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC&amp;I</td>
<td>Food Choices and Intolerances</td>
</tr>
<tr>
<td>MFG</td>
<td>Modified Focus Group</td>
</tr>
<tr>
<td>NFP</td>
<td>Nutrition Facts Panel</td>
</tr>
</tbody>
</table>
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ABSTRACT

With the increasing presence and competition of plant-based products in the dairy space, dairy nutrition education is more important than ever, to ensure consumers understand consequences of decreasing dairy consumption and are equipped to make informed decisions. The objectives of this research were to 1) educate low-dairy consumers about various topics as they relate to the importance of consuming dairy; 2) educate consumers about food package labels (nutrition facts panels/ingredient statements); 3) motivate purchasing and consumption behaviors towards dairy products; and 4) test retention of information provided in education messages after one month. Iowa State University faculty, staff and students were recruited to participate in a screening survey, designed to screen for low-dairy consumption, via university e-mail invitations. Of the 2,131 respondents, 566 reported consuming fewer than 3 servings of dairy per day and indicated interest in participating in an in-person study. Of those invited 94 participated (16.6% response rate) in one of ten in-person sessions. Sessions were randomly assigned into control or treatment groups (3 Control, 7 Treatments). The control group only received the food label education message. The treatment groups received the food label education message, plus one of three different educational messages (prebiotic/probiotic [2 groups, \(n=14\) participants], nine essential nutrients [3 groups, \(n=31\) participants], lactose message [2 groups, \(n=21\) participants]) along with an infographic, specifically designed for the lesson. Identical scripts were followed at each session, except for the educational message. Participants completed surveys (including demographic and purchasing and consumption behavior questions) at the beginning (pre-survey) and end (post-survey) of the sessions, and one-month later (one-month follow-up) to test retention of information provided during the session. A total of 86 participants completed all aspects of the study (session and 3 surveys). For quiz questions in
surveys to determine learnings of participants, non-parametric Wilcoxon/Kruskal-Wallis tests were conducted in JMP, with Tukey post-hoc test to compare means with significant differences (p<0.05). Mean correctness scores (0 = incorrect and 1 = correct) revealed that participants entered sessions with some knowledge of how to read nutrition facts panels (0.90), but they learned a significant amount during the sessions (0.99) (p<0.05); after one month, correctness declined (0.95), but did not differ from before or after the session. Few participants knew the correct number of essential nutrients in dairy products at the beginning (0.12), but they learned a significant amount during the sessions (0.46); after one month, correctness declined (0.31), but did not differ from before or after the session. Participants who received the nine essential nutrients lesson more effectively learned the information provided (0.90) than all other groups; one month later, mean correctness score remained significantly higher (0.59) than for all but one treatment group (p<0.05).

Only a few individuals (6% to 11%) increased the times they looked at food labels on new foods after the educational message, while a majority of the participants (51% to 54%) decreased their interactions with food labels of new foods after an educational message. Either the panelists did not purchase new food products in the month after the study, or the educational message had an adverse effect, which was neither expected nor wanted. One-half of the participants (50%) increased their consumption and purchasing of one dairy product (milk, cheese, ice cream, or yogurt) after one month. The results indicate that adjustments need to be made to the educational messages and/or infographics about prebiotics and prebiotics and lactose for panelists to better understand, retain the information, and increase dairy purchases.
CHAPTER 1. INTRODUCTION

Within the United States, four nutrients (calcium, dietary fiber, potassium, and vitamin D) have been identified as shortfalls within the human diet, as low intakes are associated with health concerns (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020). Dairy products contain nine essential nutrients at “good” (≥10% of the daily value) to “excellent” (≥20% of the daily value) (protein, calcium, potassium, phosphorus, vitamins A, D and B\textsubscript{12}, magnesium, and riboflavin) levels. Three of the nine essential nutrients found in dairy are also included in the shortfall list, showing the benefit of consuming dairy products (Heaney et al. 2011). Dairy products provide key nutrients that are difficult to obtain from diets with little to no dairy, such as dairy restrictive, or vegan (Rozenburg et al., 2016). Additionally, consuming dairy contributes nutrients (calcium, vitamin D, and high-quality protein) that are critical for healthy growth (Comerford et al., 2021), and consumption of these in adequate amounts is especially important to support skeletal health in children and adolescents (Golden and Abrams, 2014). Furthermore, research suggests that microorganisms found within fermented dairy products, such as yogurt or kefir, may act in concert with vitamin D and calcium to benefit bone health later in life (Rizzoli and Biver, 2020), with the potential to help minimize the risk of osteoporosis in aging adults (Rozenburg et al., 2016).

Unfavorable body weight is a risk factor for many diseases, including obesity, osteoporosis, and osteoarthritis (Bultink and Lems, 2013). Dairy consumption and its effect on body composition has been studied extensively for its role within body weight and body composition regulation. Although sometimes conflicting, evidence suggests that consumption of dairy products reduces body fat, due to the preservation of lean muscle mass (Chen et al., 2010; Mozaffarian et al., 2011). Additionally, consumption of dairy products has been associated with
decrease of metabolic-related disorders (McGregor and Poppitt, 2013), including hypertension (Rice et al., 2011), cardiovascular diseases (Qin et al., 2015), and type 2 diabetes (McGregor and Poppitt, 2013). Even high-fat dairy consumption, such as cheese, butter, and ice cream, in moderation within typical dietary patterns, is shown to be inversely associated with the risk of obesity (Rozenburg et al., 2016).

The primary macroconstituent of several dairy products is the disaccharide, lactose. Lactose is a unique sugar found in mammalian milk, which has the ability to be hydrolyzed within the intestines into glucose and galactose. Although lactose is the link between dairy products and lactose persistence (ability to digest) or lactose intolerance (inability to digest), it is an important part of the diet, as its constituents can be utilized for the synthesis of glycosylated macromolecules (galactose) and provide energy to the body (glucose) (Coelhoet et al., 2015). Additionally, consumption of lactose has been shown to benefit the makeup of individuals’ gut microbiota (Coelhoet et al., 2015).

Males and females ages 19 to 30 years, on average, are consuming about 2 and <1.5 cups of dairy a day (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020). Similarly, those ages 31 to 59 years are consuming an average of <2 and <1.5 cups of dairy per day (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020). Both of which are lower than the average recommendation for most individuals of 3 cups (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020). Some people choose to avoid dairy foods because of allergies and intolerances, cultural practices, or distaste for them (Cifelli et al., 2020). Additionally, the presence of plant-based dairy alternatives has led to competition within the market, leading to a decrease in the consumption of some dairy products, particularly milk (Wolf et al., 2020).
Avoiding dairy products decreases the levels of lactose consumed, potentially leading to a decreased intake of other important nutrients (e.g., high quality protein, calcium, vitamin B₁₂, etc.) (Romero-Velarde, 2019). Additionally, since reducing dairy product consumption reduces the intake of the natural prebiotic, lactose (Markowiak and Slizewska, 2017) dairy avoidance can lead to the suppression of the lactase gene, the gene responsible for producing the enzyme (lactase-phlorizin hydrolase) that hydrolyzes lactose into glucose and galactose (Ugidos-Rodriguez et al., 2018). Many non-dairy consumers confuse lactose intolerance with lactose maldigestion (Szilagyi and Ishayek, 2018) without consulting a doctor (Zingone et al., 2017), and stop the consumption of dairy without realizing these consequences, due to misinformation, or a lack of knowing the health benefits of consuming dairy. Thus, providing educational lessons about dairy consumption and the benefits associated with it, may help keep dairy in individuals’ diets.

The majority of food packages are required to provide a Nutrition Facts label (U.S. Food and Drug Administration, 2021). However, consumers do not always pay attention to it, or in fact, do not understand how to read these labels (Machin et al., 2018). Feteria-Santos et al. (2020), reported that there is no true evidence to show that nutrition labelling plays any effect on consumers’ understanding of nutritional content of food products, possibly due to not understanding what these labels are trying to convey to them. One negative misperception about dairy products is that they are high in fat and sugar, which can lead to avoidance of dairy by those who perceive adverse effects on health (Dekker et al., 2019), specifically high blood pressure (McGrane et al., 2011) and a higher risk of developing diabetes (Pasin and Comerford, 2015). Thus, educating consumers on how to read and understand the nutrition facts label and food labelling may help them make more informed food decisions.
As consumers continue to make decisions about food consumption and purchasing, they are also impacted by what they see or hear on mainstream media (Atabek and Atabek, 2019). Traditional media, or marketing technologies, often influence audiences’ perceptions of ideas or products based on public agenda, or popularity (Atabek and Atabek, 2019), not from research laboratories or registered dietitians. Thus, consumers can be misled into consuming unhealthy foods (Granheim et al., 2021), or acquiring a lifestyle that is detrimental (anorexia) just because the given stimulus is popular (Wang et al., 2019). The Social Marketing Theory (SMT) helps guide and develop audience-centered materials for use in health messaging and promotion. Evans (2006) discussed examples of health promotion programs that applied SMT principles in England that resulted in decreasing smoking and increased consumption of fruits and vegetables. The SMT is comprised of six steps: (1) planning and study design, (2) selecting channels and materials, (3) developing materials and pretesting, (4) implementation, (5) assessing effectiveness, and (6) feedback to refine program (Glanz & Rimer, 1995). This present study focused on creation of educational materials for those screened to be low dairy consumers, (Social Marketing Theory step 3), and implementation of these educational materials based on the target audience (SMT steps 4, 5, and 6). The goal of the present study was to investigate the extent to which targeted nutrition messaging about food labels and dairy foods impacts dairy knowledge and dairy purchasing and consumption behaviors. A secondary objective was to examine the learning and retention of information provided during the educational messages after one month.
CHAPTER 2. LITERATURE REVIEW

Importance of dairy in the diet

According to the United States Department of Agriculture (USDA) Economic Research Service (ERS), the average American consumed 655 pounds of dairy in milk, cheese, yogurt, ice cream, and butter during 2020 (USDA ERS, 2021). Although this represents an increase of 3 pounds per person over the previous year some individuals consume very little dairy. According to the Dietary Guidelines for Americans, 2020-2025, it is recommended that a healthy adult who consumes 2,000 calories include 3 cups or 3 cups equivalent of dairy or soy alternatives per day; however, most individuals aged between 19 and 59 are not doing so (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020).

There are nine essential nutrients, present at more than 10% of the daily value in dairy. They are considered essential because the human body needs them, but is unable to make them; thus, they must be consumed through the diet (Kumar and Asgar, 2017; Rusoff, 1970). Vitamins D, B3 (niacin), B2 (riboflavin), A and B12, protein, calcium, potassium, and phosphorus, are found at “good” to “excellent” levels (at least 10% of the daily value) in all dairy products. Removal of dairy products in the diet without consuming other foods with these nutrients can lead to a deficiency in the macronutrients, vitamins, minerals, and nine essential nutrients present within these products (Scholz-Ahrens et al., 2019). The advantageous effects of dairy arise from the unique composition of proteins, minerals, vitamins, lipids, and carbohydrates that are present within these products (Tunick and Van Hekken 2014; Patil et al., 2015). Consumption of dairy has been shown to reduce the risk of type 2 diabetes, hypertension, and is an important factor in bone health and growth (Thorning et al., 2017; Givens, 2020).
Individuals elect to reduce or eliminate dairy from their diet, for a variety of reasons; cow’s milk allergy and the presence of lactose are two common reasons. While some consider the presence of lactose in many dairy products to be a negative, there are benefits to the presence of lactose in dairy foods. Not only is lactose involved in the absorption of calcium and vitamin D (Romero-Velarde et al., 2019), but lactose can be considered a prebiotic (Markowiak and Slizewska, 2017).

**Dairy intolerances**

Cow’s milk allergy (CMA) is caused by the immune response that follows consuming milk proteins (Crittenden and Bennet, 2005; Heyman, 2012). In most people, the immune system can recognize the ingested milk proteins and deem them as harmless, but in some individuals the proteins are recognized as foreign and an inflammatory response is triggered, leading to an allergic reaction (Wal, 2002). CMA is the most commonly encountered allergy in infancy (Garcia-Ara et al., 2004), with prevalence decreasing significantly by adulthood (Schocker et al., 2019). CMA can be outgrown, however, due to the avoidance of dairy in a child’s diet, these habits are likely to be carried through life. CMA is often confused with lactose maldigestion and lactose intolerance, however they are distinct disorders driven by different mechanisms (Di Costanzo and Berni Canani, 2018; Heyman, 2012).

Lactose is a disaccharide only found in mammalian milk, composed of glucose and galactose (Fassio et al., 2018). Lactose digestion requires a specialized enzyme, beta-galactosidase, or lactase, to break down the lactose into glucose and galactose. If a lactase deficiency is present in the intestinal tract, lactose can reach the large intestine, where it will be fermented by the gut bacteria (Fassio et al., 2018). Through fermentation, short chain fatty acids (SCFAs), and gases such as carbon dioxide and hydrogen can be produced, leading to
gastrointestinal symptoms such as gas, and flatulence (Varjú et al., 2018; Keith and Hullett, 2018). Lactose maldigestion is the term used when the disaccharide is not properly digested. The majority of people with lactose maldigestion do not have medically diagnosed lactose intolerance and perceive the conditions they get after eating dairy products as such (Suchey et al., 2010). However, some of these symptoms seen in lactose intolerance and lactose maldigestion may also result from other conditions such as irritable bowel syndrome (Suchey et al., 2010).

Lactose intolerance is a condition characterized by clinical symptoms (abdominal pain, bloating, etc.) after ingestion of lactose products, or a severe case of lactose maldigestion (Varjú et al., 2018). It is a medically diagnosed condition, with the hydrogen breath test (HBT) being the gold standard for lactose intolerance diagnosis (Fassio et al., 2018; Keith and Hullett, 2018). After consumption of 1 gram (g) of lactose/kilogram (kg) of body weight, breath samples are collected at 20-minute intervals for 2 hours, with the hydrogen and methane levels being tested and compared to a baseline value. A rise in >20 parts per million (ppm) from the baseline for hydrogen and a rise in >10 ppm from the baseline for methane are positive tests for lactose intolerance (Di Costanzo and Berni Canani, 2018).

Even when lactose intolerance is diagnosed, it does not mean consumers should stop consuming dairy, as they may be able to handle small levels of lactose (Heyman, 2006; Matthews et al., 2005). Evidence suggests that even those diagnosed with lactose intolerance can ingest at least 12 grams of lactose at a single sitting without any symptoms and can ingest more if taken with meals and distributed throughout the day (Suchy et al., 2010). Not only can they continue to consume small levels of lactose, but they should, as dairy products contain nutrients essential to human health. Another benefit of lactose is its prebiotic property.
Probiotics and prebiotics

Within the gastrointestinal tract, bacteria line the lumen, some providing benefits to the host, and others (pathogens) being detrimental to the integrity of the stomach lining. The Food and Agriculture Organization of the United Nations and the World Health Organization, define probiotics as live microorganisms, which, when administered in adequate amounts, confer a health benefit on the host (Sarao and Arora, 2015). Although there is no set amount that can assure the health benefit, $10^6$ to $10^8$ colony forming units per gram are perceived as a sufficient number to show probiotic benefits (Champagne et al., 2011). Probiotic bacteria have been shown to benefit health by improving the gut microbiota balance, stimulating the immune system, vitamin synthesis, and have shown anti-microbial properties (Sarao and Arora, 2015). Additionally, some specific strains of probiotics have been shown to be effective against diseases such as obesity, type 2 diabetes, and fatty liver disease in clinical studies (Markowiak and Śliżewska, 2017; Sarao and Arora, 2015).

Dairy products are often used as carriers of probiotic bacteria because milk is an excellent media for the survival and growth of these bacteria. The lactose acts as a metabolite for the bacteria, and the near-neutral pH allows the bacteria to thrive in the high-moisture (~88%) environment. Additionally, the buffering capability of milk (i.e., proteins, citrates, phosphates) helps to ensure the survival of probiotics when they experience competition with the pre-established microflora present within the gastrointestinal (GI) tract (Umer, 2014). Probiotics are most commonly found within fermented dairy products. Yogurt, a product consumed around the world, is traditionally prepared by fermenting milk with *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, potentially probiotic bacteria that remain high in yogurt throughout shelf-life (Gao et al., 2021). Kefir, another fermented milk product, contains a variety of potentially probiotic sub-species of *Lactobacillus* and *Bifidobacterium* species.
To thrive, bacteria need nutrients, or food that allows them to grow and expand to levels greater than that of pathogens (Orel and Trop, 2014). Food for those beneficial probiotics is called prebiotics. Prebiotics are nondigestible food ingredients that benefit the human by stimulating the favorable growth and activity indigenous probiotic bacteria (Gibson et al., 2017). Although prebiotics are typically non-digestible oligosaccharides, several fermentable carbohydrates have been reported to convey a prebiotic effect (Gibson et al., 2017), including lactose.

As stated earlier, lactose maldigestion is the insufficient breakdown of lactose, which allows it to reach the colon, where it is fermented by microorganisms present in the colon. Thus, for people with lactose maldigestion, lactose is a prebiotic because it can reach the colon, and feed beneficial probiotic bacteria. Thus, even lactose maldigesters can benefit from small levels of lactose in their diet, as it can help to shape the gut microbiota by promoting the growth of *Bifidobacteria* and *Lactobacilli*.

A goal of the present research was to improve consumer understanding of the importance of dairy in the diet, to help them make informed decisions in the future. The framework considered in designing the research was the SMT.

**Social marketing theory**

At its most basic ideology, social marketing can be defined as a strategy to stimulate behaviors (Andreasen, 1995; Kolter and Roberto, 1989; Lefebvre et al., 1995). In a more direct sense, social marketing is the application of marketing technologies for the analysis, planning, execution, and evaluation of programs designed to influence the voluntary behavior change of a target audience to improve their personal welfare (Andreasen, 1995). The effectiveness of basing intervention strategies within the context of SMT has three major aspects that are encompassed within it: (1) the outcome is seen as a key benefit to individuals and society, not
focused on one organization or company making a profit, (2) the approaches are based on a focus in behavior, not awareness or a change of attitude, and (3) the target audience must be the focus in all actions that are taken (Storey et al., 2008). It is used because it moves away from the traditional models of health education that only tell people what to do, rather than providing the target audience with a solution to the problem that they believe is important and offers them a benefit that they value (Langford and Panter-Brick, 2013).

The SMT has been used as framework for different health promotion programs. In recent years, the Centers for Disease Control and Prevention (CDC) and the U.S. Department of Agriculture (USDA) have used the SMT as a framework to increase fruit consumption, promote breastfeeding, and influence a wide variety of different health behaviors (Grier and Bryant, 2005).

There are six major steps to the SMT, including: (1) planning and strategy, (2) selecting channels and materials, (3) developing materials and pretesting, (4) implementation, (5) assessing effectiveness, and (6) feedback to refine program (Glanz and Rimer, 1995). The SMT is a cyclic process, not a linear one (Glanz and Rimer, 1995). This is an important aspect of the SMT, because it allows researchers to go back and make changes to the program during development where they see fit if things do not work effectively the first time. If during step 5 listed above, the effectiveness is deemed as low, or not to the desired level, it allows program developers to go back to previous steps to create a better program. The SMT has been used to develop many community-based health programs that resulted in improved dietary intakes of community-residing older women (Francis and Taylor, 2009), increased the use of public health programs (Supplemental Food and Nutrition (SNAP) for women, infants, and children), (Bryant et al., 2001), and increased awareness of tuberculosis medicine and vaccinations (Marks and
Greathead, 1994; Donovan and Henley, 2004). The present work applies the theory to dairy nutrition education.
CHAPTER 3. METHODOLOGY

Study Design and Timeline

The study and related materials were approved for involvement of human subjects by the Iowa State University Institutional Review Board. The study included two phases, 1) Food Choices and Intolerances screening and 2) modified focus groups (MFGs). All participants of the MFGs received a small gift ($30) for their time.

Phase 1: Food Choices and Intolerances Screening

Participants. An invitation to participate in the Food Choices and Intolerances Qualtrics screening survey (Appendix A) was created for dissemination via two listservs, accessed by the Iowa State University Office of the Registrar (for students), and Iowa State Human Resources (for faculty and staff). The goal was to draw attention and make the invitation easy to read and easy to access to encourage a large amount of people to access the link. It was also crucial to not provide participants with any indication that the study was ultimately to involve dairy products, thus a colorful picture of a variety of foods was used to draw participants in. The purpose was to invite all students, faculty, and staff of Iowa State University to participate in a study about food choices and intolerances. The email encouraged those receiving the email to share the invitation with friends and colleagues, with hope of increasing the number and diversity of participants. A link for the Qualtrics survey was included. The criteria for participants included: being at least 18 years of age and personally purchasing food and beverages at least once per month.

Screening. The Food Choices and Intolerances screening survey (Appendix C) was shared with participants over a 31-day period. It was carried out using Qualtrics™ Survey software (Qualtrics, Provo, UT). This 15-question survey asked about demographics, specifically...
proximity to Ames (n=1), consumption/purchasing behaviors for all foods (n=8), nutrition facts panel knowledge (n=4), discomfort after consuming foods (n=1), and medically diagnosed allergies or intolerances to any food (n=1). These questions were designed to get an understanding of the surveyed population and to enable the selection of consumers who were not high dairy product consumers for Phase 2. Questions solely related to dairy were not asked, as the researchers did not want to indicate to the participants that this research was directly related to the dairy industry. However, dairy was one of the options for selection in several questions. Answers to these questions allowed researchers to screen for people of the target population to invite to the next portion of the study. After the 31 days, 2,131 people completed the survey.

**Phase 2: Modified Focus Groups**

Participants. After Phase 1 was closed, a funneling process was conducted to eliminate consumers who consumed at least 3 servings of dairy a day, as well as those who had intolerances to dairy products. An e-mail invitation was sent to the remaining 566 Phase 1 participants who were classified as low dairy consumers to participate in one of 10 in-person sessions. This email included the available time slots for the modified focus group (MFG) and participants were instructed to select all of the time slots that would work for them. Each session was randomly assigned a treatment, namely 1) Control, 2) 9 Essential Nutrients, 3) Lactose and 4) Probiotics and Prebiotics. Participants were notified they would be put into a MFG based on their availability, but not of the control or treatment group placement. The 10 date/time options also offered two locations. One was an on-campus location (Culinary Discovery Lab in the Iowa State Food Science Building located on the university campus), and one was an off-campus location with free parking (Sessions were held at the Iowa State University Nutrition Wellness
Research center, in the Iowa State Research Park, about 2 miles from the Iowa State University campus). The invitation was sent on March 11th, and on April 1st, final notices were sent to the expected 122 participants of the MFGs. Each MFG was designed to accommodate 10 to 15 participants per group. Based upon previous studies with human subjects, only 6 to 12 were expected to follow through. The final notice provided time, date, location, consent form (Appendix D) and what the panelists needed to bring with them (personnel identification, device with the capability of accessing internet).

Modified focus groups. The 10 MFG sessions were conducted over an eight-day period. Reminder emails were sent a day before the running of MFGs to ensure panelists were reminded of time and location. Upon entry, panelists were handed a 3-digit-coded folder which contained all the paperwork related to the group including the MFG consent form, MFG pre-survey QR code, food labels lesson infographic (Appendix L), ice cream acceptability ballot (Appendix K), ice cream nutrition facts panel (Appendix J), treatment group infographic, if applicable (Appendices M, N, O), and MFG post-survey QR code. Materials in the folders were in a specific order, with STOP signs printed between sections to prevent participants from looking ahead before told to do so. Everything about the sessions was designed to be the same (facilitators followed a script (Appendix F)) except that only the educational message differed among sessions.

After introductions of facilitators, the MFGs were run as follows:

1. Consent form
   - One facilitator read the consent form in its entirety.
   - Panelists could excuse themselves or sign the consent form.
2. MFG pre-survey (Appendix E)
   - Thirty-four (34) question Qualtrics™ survey administered using QR code. The survey was more specific to dairy products purchasing and consumptions than the screening survey but included some of the same questions. It included questions regarding demographics ($n=4$), general food consumption ($n=3$), knowledge ($n=10$), and dairy consumption/purchasing behaviors ($n=16$). Questions in this survey may have allowed participants to infer what was going to be happening during the MFG but did not give specifics towards experimental procedures.

3. Nutrition Facts Panel and Ingredients Label educational message
   - The message was designed to help participants better understand the information provided on food packaging. Facilitators read a script that walked the participants through how to read and understand an ingredient statement, nutrition facts panel, and allergen statement and key features were pointed out. An infographic was provided (Appendix L), and panelists were encouraged to take it with them.
   - All received this message. Those who only received this message were part of the control group.

4. Opportunity to ask questions
   - Panelists were encouraged to ask questions at two points during the lesson.

5. Ice Cream acceptability testing
   - Because many people like ice cream, it was thought that including ice cream tasting may provide incentive for participation in the in-person study.
• Panelists were each served three ice cream samples, one at a time, in a random order. They were instructed to taste the ice cream sample and rate the ice cream on a 5-point hedonic scale (dislike very much – like very much) for different attributes of the ice cream (appearance, sweetness, flavor, texture, overall acceptability). The panelists were strongly encouraged to take notes and leave additional comments on the paper forms (Appendix K) to help the researchers better understand the scores provided.

• The 5-point scale was utilized, instead of 7 or 9, to reduce the potential for fatigue in panelists since several questions were asked during the study.

6. Explanation of ice cream samples

• Serving ice cream provided an opportunity to teach participants about lactose. After all samples were served, facilitators explained what was different among the ice cream samples that they had just tested. The script included information about how the level of lactose in the three samples differed because of selection of different dairy ingredients (whey protein concentrate and whey permeate).

• A sheet, with the nutrition facts panel and ingredients of each ice cream, was provided to panelists for reference (Appendix J).

7. Opportunity to ask questions

• Panelists were encouraged to ask questions.

8. Treatment group educational message, if applicable. A specific educational message was inserted to accompany the specific MFG, if applicable.

• Groups received an educational message (Appendices G, H, and I), read from a script by a facilitator.
• One infographic, specific to each message (Appendices M, N and O) was provided to aid the participants in understanding the material read to them during their session. Panelists were welcomed to remove the infographic from their folder and take it with them.

9. Opportunity to ask questions

• Panelists were encouraged to ask questions.

10. MFG post-survey (Appendix P)

• The twenty-one (21) question Qualtrics survey was accessed through a QR code.

• The survey asked about knowledge gained during the session \((n=5)\), purchase intent \((n=5)\), odds of purchase based on info given on package \((n=7)\), and questions to test retention of things discussed during lesson \((n=4)\). Some of these questions were carry-over from the pre-survey to show if learning occurred during the session (i.e., “How many essential nutrients are naturally found in dairy products (milk, yogurt, cheese, ice cream)?”, “Which of these ingredients are considered added sugars? (Check all that apply)”). Additionally, skip logic was built into the Qualtrics™ survey so participants were only asked questions related to their treatment group.

11. Wrap up

• Panelists were asked to not share what happened during the session with other people if they knew they were participating in a later research session to respect the integrity of the study.

• Panelists were invited to participate in the one-month follow up survey and told they would be contacted later with instructions.
• Finally, panelists were given $30 in cash and asked to sign a receipt.

12. Opportunity to ask questions

• Panelists were encouraged to ask any final questions they may have had before leaving the MFG.

One Month Follow-up Survey (Appendix R). One-month following each MFGs, survey links were sent to individuals, based on when the focus group was completed; the survey was open for 10 days; 94 participants responded. The survey had 21 questions about behaviors towards food packaging content \(n=2\), questions to test retention of educational material \(n=4\), purchasing/consumption behaviors since the session \(n=11\), and potential purchase of new dairy products if available \(n=4\) . The survey was designed to see if panelists were able to retain information that was presented to them during the educational session, as well as to show if panelists modified their consumption and purchasing behaviors after learning the material. The last four questions were designed to show if panelists would alter their behaviors based on health claims given on food packaging (“contains 9 essential nutrients”, “probiotics ice cream”, etc.)

Creation and Distribution of Introductory Materials

Selection of Participants/filtering

Although all data were used for part of the analysis investigating the initial population, only a fraction of the data were analyzed for this thesis. The main use of the screening survey was to determine which panelists to invite to modified focus groups (MFGs), through filtering. The goal was to invite panelists to MFGs who were not avid dairy products consumers. To determine
those panelists, responses to specific questions in the initial pre-survey were filtered using the criteria outlined in below.

Filter criteria included:

1. If an e-mail address was repeated, the FIRST attempt (all responses associated with that address) was removed from the list of potential panelists.

2. Those who took less than 80 seconds, or were missing numerous data, were removed from the list of potential panelists.

3. Those who lived out of the area of Story County or surrounding counties were removed, as travel would be necessary to attend MFGs.

4. Participants who answered “no” to wanting to attend focus groups were removed for the simple fact they no longer wanted to participate in the study.

5. Those who indicated going out of their way to avoid dairy were removed because we wanted those who do not completely avoid dairy.

6. Those who indicated going out of their way to consume dairy were removed because we wanted low to moderate dairy consumers.

7. Those who indicated having a medically diagnosed allergy to dairy were removed, however most of those participants also said they went out of their way to avoid dairy, thus already being removed from the list of invitees.

8. The main question used to decide who was to be invited to the next portion of the study, asked “which of the following statements apply to you (check all that apply)?”. Those who did not select 4, “I consume at least 3 cups (3 servings of dairy a day)”, were our target population for the modified focus groups.
Infographics and Lessons

With assistance from an ISU Dietetics Intern, four infographics were developed to help educate participants about food labels and dairy concepts:

1. Nutrition Facts Panel and Ingredients Label (Appendix L)
2. Nine Essential Nutrients (Appendix M)
3. Lactose (Appendix O)
4. Probiotics and Prebiotics (Appendix N)

The purpose of the nutrition facts panel (NFP) and ingredients label lesson (for control and three treatment groups) was to help educate consumers about the labeling that is on food packaging. The lesson showed panelists how to read and understand an ingredient statement, NFP, and allergen statement. Another goal was to teach panelists how to understand percent daily value and what that means in the context of ice cream. The lesson also explained that lactose is not considered an added sugar because it is naturally present in milk. The final purpose of this lesson was to show panelists how to determine the amount of lactose present in dairy products based upon information provided in the NFP.

The purpose of the nine essential nutrients treatment group lesson was to educate panelists about the benefits of consuming dairy products and what deficiencies may occur with dairy avoidance. It contained information about the nine essential nutrients (calcium, protein, vitamin D, vitamin A, riboflavin, niacin, vitamin B-12, pantothenic acid, and phosphorus) and the implications of these nutrients on health.
The lactose treatment group lesson was designed to explain what lactose is and how lactose digestion should occur within the intestines. Panelists learned that lactose is a disaccharide (glucose and galactose), and it must be broken into those sugars for normal digestion. Thus, they learned that during mal-digestion, this does not occur. Additionally, panelists were educated about the difference between lactose mal-digestion and lactose intolerance, which are commonly misused when referring to discomfort after consuming dairy.

The purpose of the prebiotic and probiotic treatment group lesson was to educate panelists about the terms probiotic (health-promoting bacteria) and prebiotic (food for bacteria). It provided definitions and examples of each and showed how lactose can act as a prebiotic. The biggest point of this lesson was to make sure panelists knew that even lactose mal-digesters can benefit from small amounts of lactose because it can provide nutrition to healthy bacteria in the gut.

_Added Sugars Lesson and Quiz_

One goal of the MFGs was to educate the participants about what food ingredients are considered added sugars. Participants (control and three treatment groups) were asked the same question (“Which of these ingredients are considered added sugars? (check any and all that apply)”) three times throughout the entire study to see if panelists changed their answers based upon information provided to all panelists (control and treatments) in the script: in the pre-survey at the beginning of the MFG, in the post-survey after the MFG, and in the one-month follow-up survey.
Daily Value Lesson and Quiz

One goal of the nutrition education was to provide all panelists (control and treatment groups) with some knowledge about percent daily value labeling that is present on food packaging. First, in the MFG pre-survey they were asked “True or false: 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.” During the session, they were taught how to interpret the information. They were asked the same question in the MFG post-survey and one-month follow-up survey.

Lactose Calculation and Quiz

Because we wanted to educate consumers that lactose is not an added sugar, participants were not only taught how to read NFPs, but were also given specific guidance on how to determine the amount of lactose in a food product based on a NFP that was provided to them. Specifically, all panelists (control and treatments) were shown the NFP of a commercial yogurt (Figure 1) and asked, “Using the Nutrition Facts label of this low-fat vanilla yogurt, how much lactose is in a serving?”. The question was more complex than most questions asked in the surveys, because it required them to know where to look on the NFP and involved a little arithmetic (that is also why the question was not asked in the MFG pre-survey). Since total sugars = 14g and added sugars = 8g, the selected answer in the multiple-choice questions should have been 6g for lactose.

Figure 1. Yogurt Nutrition Facts Panel provided to panelists when asked to answer a multiple-choice question about how much lactose is in the product.
Nine Essential Nutrients Lesson and Quiz

Although only one treatment group received the educational message about nine essential nutrients in dairy products, all participants of the MFGs (control and treatments) were asked, 3 times, a multiple-choice question (How many essential nutrients are naturally found in dairy products (milk, yogurt, cheese, ice cream)?)}. Response options included I don't know, none, 1, 3, 5, 7, or 9. This was done to enable evaluation of whether the 9 essential nutrients lesson was effective for teaching the concept to panelists in the 9 essential nutrients treatment group.

Ice Cream Creation

One of the incentives for participation in the MFGs was an opportunity to taste ice cream. The ice cream was formulated and produce by our research team.

Formulation

Three ice cream products were formulated to have equivalent total solids (37%), total fat (12%), and total sugar (20%), composed specifically of 3 levels of lactose (3.8%, 5.8%, and 7.8%). The 5.8% lactose white mix was made by combining the two base mixes 50/50. The use of two different whey ingredients made this possible. One was whey protein concentrate 80 (WPC80), which is high in protein (approximately 82%), and low in lactose (approximately 4%). The other was whey permeate (Versilac®) which is low protein (approximately 2.7%), high lactose (approximately 85%).
Table 1. Formulations for 3.8% lactose and 7.8% lactose white mixes (the two were combined (50/50) for the 5.8% lactose white mix.

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>(%) in 3.8% lactose formulation</th>
<th>(%) in 7.8% lactose formulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whey Protein Concentrate (WPC80)</td>
<td>1.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Versilac whey permeate</td>
<td>0.0</td>
<td>3.3</td>
</tr>
<tr>
<td>Nonfat Dry Milk</td>
<td>2.3</td>
<td>4.9</td>
</tr>
<tr>
<td>Whole Milk</td>
<td>49.8</td>
<td>48.8</td>
</tr>
<tr>
<td>Heavy Cream</td>
<td>27.9</td>
<td>28.0</td>
</tr>
<tr>
<td>sugar (sucrose)</td>
<td>17.4</td>
<td>13.3</td>
</tr>
<tr>
<td>stabilizer/emulsifier</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Water</td>
<td>1.0</td>
<td>1.3</td>
</tr>
<tr>
<td>Total (lb.)</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Manufacture

All ice creams were manufactured in the Iowa State University Creamery in the Food Sciences Building, located on the university campus (Ames, IA). It was a two-day process, with weighing, mixing, pasteurization and aging occurring on the first, and freezing occurring on the latter. Milk (Anderson Erickson Dairy, Des Moines, IA), sugar (Cargill, Wayzata, MN) and cream (Anderson Erickson Dairy, Des Moines, IA & Kemps, St. Paul, MN) were weighed on an industry scale, only reading in half kilogram increments. Smaller weighted ingredients (water (tap), WPC80 (CROPP Cooperative, La Farge, WI), Versilac® (Proliant, Atlanta, GA), nonfat dry milk (Diamond Crystal Brands, Atlanta, GA), stabilizer/emulsifier blend (Cremodan® IcePro-Dupont Danisco, New Century, KS)) were measured on a scientific scale, reading to the hundredths of a gram.

After weighing, milk and water were placed into 39.7 L stainless steel milk cans. Dry ingredients were mixed prior to being added to the milk can to ensure uniform distribution and hydration upon blending. Dry ingredients were slowly added, during high-speed blending (Admix Rotosolver 90RS70SS; Admix Inc, Londonderry, NH) to ensure all ingredients were
properly hydrated to avoid clumping. After blending, cream was added, to minimize butter formation, then the contents were placed in a 195 L batch pasteurizer (16021803 Cheese Vat/Pasteurizer; Anco Equipment LLC, Pulaski, WI). The mixture was pasteurized at 68.3°C for 30 minutes. Mixes were pre-cooled, with circulating cold water, in the same vat. After pasteurization, the mixture was placed in washed and sanitized milk cans, where they were transported to a 4°C cooler for aging.

One 67 kg batch of the 3.8% lactose mix, and one 67 kg batch of the 7.8% lactose mix were made. The 5.8% lactose ice cream base mix was made by mixing blending 29 kg of the 3.8% mix with 39 kg of the 7.8% mix.

On day two, ice cream mixes were pulled from the cooler and walked to the micro-creamery where the vanilla flavoring (Weber Flavors; Wheeling, IL) and freezing occurred. Freezing occurred in a Taylor Dual-Barrel (Taylor 878433B000; McCormack Distributing Company; Le Mars, IA) soft serve ice cream machine. Two ice creams were frozen in properly cleaned and sanitized, adjacent hoppers, simultaneously. Soft ice cream was drawn out of the machine into three-gallon cardboard containers and pint containers for later scooping for MFG participants and a trained panel, respectively. The filled 3-gallon tubs of ice cream were immediately transported to the freezer (-20°C) for hardening and storage.

**Data Handling and Statistical Analysis**

Data were downloaded from Qualtrics™ into Excel, then compiled, by panelist random number, into one document. Column headings were coded to indicate which questions corresponded to screening survey, pre-survey, post-survey, and one-month follow-up survey.
Distribution analyses of demographics, purchasing behaviors, and consumption behaviors
Statistical analyses of all ice cream acceptability data were performed using JMP. One-way
ANOVA with Dunnett’s multiple comparison to a control and a significance level of P<0.05
were selected.

To evaluate the effectiveness of lessons on learning between the MFG pre-survey and
MFG post-survey, responses to quiz questions were coded as incorrect (0) or correct (1), then the
non-parametric Wilcoxon/Kruskal-Wallis test was conducted in JMP to assess for changes.
When the chi-square test revealed significance (p < 0.05), the Tukey post hoc test was conducted
to separate means. The Wilcoxon/Kruskal-Wallis test was also used to determine if knowledge
was retained between the MFG post-survey and one-month follow-up survey. The same test was
used to determine if mean scores for responses were the same or differed between treatment
groups. To survey the panelists’ perceived knowledge gain after MFGs, panelist responses to
select questions on the MFG post-survey were analyzed with the non-parametric
Wilcoxon/Kruskal-Wallis test in JMP. When the chi-square test revealed significance (p < 0.05),
the Tukey post hoc test was conducted to separate means.
CHAPTER 4. RESULTS

Screening Survey and MFG Population Demographics

Screening survey population

After removal of repeats, a total of 2,131 adults participated in the Food Choices and Intolerances screening survey. A summary of some key demographics of the initial population, as well as those who participated in the MFGs are included in Table 2. They are presented side-by-side to show that the participants were representative of the larger population who initially participated in the screening survey.

Table 2. Screening Survey and Modified Focus Group (MFG) Pre-Survey Responses to Demographic Questions asked on Both Surveys.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Screening Participants (%) (n=2,131)</th>
<th>MFG Participants (%) (n=94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>*</td>
<td>0</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>68</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>*</td>
<td>0</td>
</tr>
<tr>
<td>18 – 24</td>
<td></td>
<td>54</td>
</tr>
<tr>
<td>25 – 34</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>35 – 44</td>
<td></td>
<td>16</td>
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<tr>
<td>45 – 54</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>55 and above</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>*</td>
<td>0</td>
</tr>
<tr>
<td>Prefer not to answer</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Asian American or Asian origin</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>African American or African origin</td>
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<td>0</td>
</tr>
<tr>
<td>White</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>Latin American, Latino or Spanish origin</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Importance of Eating Healthy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
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<td>0</td>
</tr>
<tr>
<td>Not important</td>
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<td>0</td>
</tr>
<tr>
<td>Somewhat important</td>
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<td>16</td>
</tr>
<tr>
<td>Moderately Important</td>
<td>23</td>
<td>22</td>
</tr>
<tr>
<td>Important</td>
<td>43</td>
<td>47</td>
</tr>
<tr>
<td>Very Important</td>
<td>22</td>
<td>15</td>
</tr>
</tbody>
</table>
Most of the participants (96%) were from Iowa, specifically the Ames area (85%), likely because the link for the survey was distributed to all Iowa State University students, faculty, and staff, with a message inviting those who receive it to share with family and friends. Invitations to friends may explain why 3% of individuals who completed the survey were located outside of Iowa, the primary location where the studies were being performed.

As food and health have become major discussion points in today’s age, it is no surprise that the majority (65%) of initial survey participants considered eating healthy to be important to

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Screening Participants (%) (n=2,131)</th>
<th>MFG Participants (%) (n=94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medically Diagnosed intolerance or allergy</td>
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<td></td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>**</td>
</tr>
<tr>
<td>None</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>Cereal Grains</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
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<td></td>
</tr>
<tr>
<td>Meat</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>Peanuts</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pulses</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>Seafood</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Soy</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>Tree Nuts</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Foods Avoided Due to Discomfort</td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>48</td>
<td></td>
</tr>
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<td>Cereal Grains</td>
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</tr>
<tr>
<td>Dairy</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
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<td></td>
</tr>
<tr>
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</tr>
<tr>
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<td>2</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>Seafood</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Soy</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tree Nuts</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>Not asked</td>
<td></td>
</tr>
</tbody>
</table>

* Question not asked in screening survey

** Question not asked in MFG surveys
very important to them. We expected these individuals to be the ones interested in participating in the survey and in the MFGs. In particular, we wanted people who would be open-minded to expanding their knowledge about nutrition or diet. It is surprising that some participants did not consider eating healthy to be as important, as obesity will soon overtake smoking as the number one cause for preventable deaths in the U.S. (Oliver and Lee, 2005).

Table 2 also summarizes the participants’ answers regarding medical diagnosis of intolerance to specific foods and foods they avoid due to discomfort after eating them. The majority of the participants did not have any medical conditions related to food (77%), but for those that did, dairy was the highest percentage (8%). In the U.S., it is estimated that 5 to 15% of adults have medically diagnosed lactose intolerance (Oak and Jha, 2018), representative of the population in this study. However, it is not clear whether the people in this study had diagnosed lactose intolerance or cow milk allergy. We did not ask for specification since dairy was not the focus of the Food Choices and Intolerances screening survey. The other responses were also expected, as the major food allergens in the U.S. are milk, eggs, fish, shellfish, tree nuts, peanuts, wheat, and soybeans (U.S. Food and Drug Administration, 2021). These allergens make up 90% of all documented food allergens, thus seeing responses for these foods was expected.

Within the U.S., it is estimated that 4% of the population is sensitive to fruit, and about 1% of individuals are sensitive to vegetables (Sicherer and Sampson, 2010). Evidently, those who took the survey were less sensitive to fruit than what the American population shows, but consistent with the percentage sensitive to vegetables seen around the U.S. Based on previous research, it is assumed that around 2% of all individuals over the age of 18 in the U.S. are allergic to peanuts, consistent with the findings found in this study. Additionally, it is estimated that less than 1% of people are allergic to soy, also consistent with the data seen from the study,
indicating that our sample size may be a proper representation of the U.S. population (Gupta et al., 2019).

After removal of incomplete data and funneling of the Food Choices and Intolerances screening survey, 566 people (27%) were eligible for and were invited to participate in MFGs. Thus, 27% of the initially surveyed population 1) were located within driving distance, 2) completed the survey (spent adequate time on it), 3) did not go out of their way to consume dairy, 4) did not have a diagnosed dairy intolerance, and 5) indicated interest in participating in a follow-up study. The 566 individuals who were eligible for participation in the MFGs represented the initial population well (data tables not included here). The majority of the 566 individuals answered that eating healthy was very important or important (63%) to them. An area that was expected to be different was in the medial diagnosed intolerance responses. Indeed, the 566 data set displayed an increase in those without an intolerance (89%), in part because those who listed dairy as an intolerance in the 2,131 data set were removed. Although all who participated in the Food Choices and Intolerances screening survey who indicated medically diagnosed complication with dairy were removed, those that said they avoid dairy due to digestive discomfort were still invited to participate in the MFGs because they said they were interested in participating in the next part of the study that included ice cream. It is interesting to note that 26% of participants avoided dairy due to discomfort in the 2,131 data set, but in the 566 data set, about 34% avoided dairy and still wanted to participate in the MFGs. This increase was very unexpected, as we expected to see those who avoid dairy to not want to participate in the next part of the study. It is possible that these individuals may have only avoided specific types of dairy, while still enjoying ice cream.
**MFG population**

Although all 566 initially expressed interest in participating in a follow-up study (MFG), only 126 (22%) responded to three invitation e-mail messages and scheduled themselves for one of ten MFGs. Ultimately, 94 people (82% of eligible respondents) participated in the MFGs. A 28% no-show rate is a little higher than what is typical for in-person studies (20%) (Wong, 2008), but not surprising since the study was conducted during the COVID-19 pandemic.

According to the U.S. Census, 61% of Americans are white, 6% are of Asian origin, 18% are of Hispanic or Latino origin, and 10% are of multiracial origin (U.S. Census Bureau, 2020). The fact that the 94 MFG participants are not a representation of the U.S. population, may be due to the study being held in a university setting, and in a predominantly white state. However, it should also be noted that lactose intolerance is more prevalent in people of African-American, African, Asian-American, Asian, Latin-American, Hispanic, Latino, and Spanish origin than people of northern European (white/Caucasian) origin (Fassio et al., 2018), which may have led to removal of more diverse potential panelists.

When comparing the responses of participants in the screening survey and MFG pre-survey, there is no obvious difference between the two, indicating that the group of low dairy consumers who were invited to participate in the MFGs were representative of the screening survey. In both groups of people, 84% either always or sometimes looked at NFPs, and 80-81% looked at ingredient statements when purchasing new products. Similarly, 69-70% of individuals could very easily or easily understand what they were reading on NFPs, and 63-65% of individuals could do the same with ingredient statements.

The Food Choices and Intolerances screening survey focused on food consumption and intolerances, as a goal of the research was to consider ways to increase dairy consumption in
those who do not consume the recommended daily amount of dairy. An intent of the Food Choices and Intolerances screening survey response filtering process was to invite low-dairy (<3 servings per day) consumers to educational sessions. Our intent was to not invite those who loved dairy or hated dairy, as they would be unlikely to modify behavior with intervention.

The overwhelming majority (91%) of the MFG participants (86) did not have a medical diagnosis for an allergy/intolerance towards any food. However, each of the following foods or combinations of foods was cited for intolerance by 1 individual: cereal grains, cereal grains/peanuts, eggs/peanuts, meat, peanuts, peanuts/tree nuts, and greasy/fatty foods. The percent of individuals who did not have an allergy/intolerance to a food increased from the Food Choices and Intolerances Survey to the 566 eligible for the MFG, and then increased again from the 566 eligible to the 94 participants of the MFGs. The 94 participants of the MFGs were a suitable representation of the U.S. population regarding food intolerances, as it is expected around 10% of the entire U.S. adult population has a food intolerance/allergy (Gupta 2019).

Survey participants who indicated avoiding foods specified seafood (including shellfish) (29%), and dairy (26%). Although we did not invite those who indicated a medically diagnosed issue with dairy, people who avoided dairy were not removed from the MFG as they were given a clear indication that ice cream would be served at the MFG. It was believed that if they completely avoided dairy, they would not seek to participate in the focus groups with ice cream. Additionally, if they attended the MFG, there was a chance we could educate them about the importance of consuming even a little dairy in their diet. Again, a goal of the research was to investigate the impact of a variety of messages on the potential to modify dairy purchasing behavior.
Other commonly avoided foods included soy (20%), meat (18%), and cereal grains (14%). Peanuts, tree nuts, pulses, fruits, and vegetables were selected, but only appeared in one or two responses. About one-third 30% (n=29) of participants did not avoid any foods.

When asked about foods that were avoided due to discomfort after eating, the majority (57%) of MFG participants (n=54) did not avoid any foods due to discomfort. Of those that did avoid foods because of discomfort, dairy appeared in 67% (n=27) of the answers. Again, these panelists still consumed some dairy, since panelists’ responses were screened to remove dairy complete avoiders. The survey did not ask in what way panelists avoided dairy (e.g., if they avoid certain dairy products only, if panelists took lactase pills, if they avoided them because a household member had an intolerance, etc. It is estimated that around 65-70% of the world population has lactose non-persistence, indicating they are unable to digest large amount of lactose, which could potentially lead to digestive discomfort after consuming dairy products (Bayless et al., 2017), potentially leading to the explanation of why dairy was a high response.

Cereal grains were avoided by 7% (n=7) of participants. Meat, seafood (including shellfish), vegetables, eggs, seafood, pulses (beans, peas, lentils, etc.), soy, and fruit were selected, but very sparingly compared to the other two (<3%).

Other reasons for avoiding foods were provided, other than digestive discomfort. The top reasons selected for avoiding foods were that people did not like the taste of them (35%), did not like the texture, weight control, and nutrition concern (all ~23%). Other reasons listed in more than 5% of answers included doctor recommendation, cost, following a diet that excludes one or more of the food categories, concern for the environment, and concern for animal welfare. It is no surprise that individuals will not consume a food if they do not enjoy the flavor and texture of it. Secondly, health has become the ultimate driver in food and beverage consumption choices, as
it provides a direct benefit to the individual (Van Dam and van Trijp, 2013). Concern for animal welfare and concern for the environment can be seen at lower levels, as they are non-personal and long-term impact issues. Though considered, because there is no immediate reward for the consumer, it is less of a driver than taste, texture, and health-related concerns (Hoek et al., 2017).

When provided a list of prompts about going out of their way to consume foods and beverages, “less added sugar” was the number one reason for going out of their way to consume a food (64%), followed by “less total sugar” (54%) and “more protein” (45%). Other answers selected frequently (>19% of the time) included “more vitamin D”, “more prebiotics”, “less carbohydrates”, “less fat”, and “less sodium”. At a motivational level, it is shown that the major driver in food consumption habits is based on the health level of the food (Hoek et al., 2017), explaining why the majority of the participants alter their consumption based on the nutrition level of different foods. The fact that only 17% of participants did not go out of their way to consume foods based on nutritional content or other factors (calcium, protein, less added sugar, etc.) backs up the earlier question indicating the importance of healthy eating to the MFG population.

**Screening Survey and MFG Population Behavior Towards Food Labels**

Table 3 shows participants’ behaviors towards information provided on food packaging (nutrition facts panels (NFPs) and ingredient statements). There was a trend for NFPs to be looked at just a little more than ingredient statements. Similarly, there was a trend for NFPs to be perceived as easier to understand by participants than ingredient statements. Later, during the MFG, their actual understanding was tested. Perhaps participants identified NFPs as easier to
understand, thus enabling them to look at them more. Additionally, this result may indicate that people looked at the food labelling if they believed they understood the information.

Table 3. Responses by the same Modified Focus Group (MFG) panelists to Screening survey, pre-survey, post-survey, and one-month follow-up survey to questions regarding food labels.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Screening (%)(n=94)</th>
<th>MFG Pre (%)(n=94)</th>
<th>MFG Post (%)(n=94)</th>
<th>Follow-up (%)(n=85)</th>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Never</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Rarely</td>
<td>11</td>
<td>16</td>
<td>26</td>
<td>33</td>
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<tr>
<td>Sometimes</td>
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</tr>
<tr>
<td>Always</td>
<td>34</td>
<td>21</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
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<td>2.97**</td>
<td>2.85*</td>
<td>2.79*</td>
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<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td><strong>Understand Nutrition Facts Panel</strong></td>
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</tr>
<tr>
<td>Missing</td>
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<td>2</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Not easily</td>
<td>4</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderately easily</td>
<td>30</td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easily</td>
<td>36</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very easily</td>
<td>30</td>
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<td>Mean</td>
<td>3.93*</td>
<td>2.79**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
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<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Look at Ingredient Statements</strong></td>
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<td></td>
<td></td>
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<tr>
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<td>0</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Never</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Rarely</td>
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<td>19</td>
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<tr>
<td>Sometimes</td>
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<td>3.04*</td>
<td>2.86a</td>
<td>2.49b</td>
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<td>3</td>
<td>3</td>
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<tr>
<td><strong>Understand Ingredient Statements</strong></td>
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<td>Moderately easily</td>
<td>36</td>
<td>44</td>
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<tr>
<td>Easily</td>
<td>34</td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very easily</td>
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<tr>
<td>Mean</td>
<td>3.76*</td>
<td>2.66**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* question not asked

1 question asked “I look at the Nutrition Facts panel when buying a new product”
2 question asked “I can read and easily understand Nutrition Facts panels”
3 question asked “I look at the the ingredients label when buying a new product”
4 question asked “I can read and easily understand ingredients labels”

a, b, c mean scores in a row not sharing a superscript significantly differ (p < 0.05)
Previous research indicated that about 53% of individuals check food labelling (either NFPs or ingredient statements) most of the time or always (38% and 15%, respectively) (Viola et al., 2016). Our research, however, indicated that more than 80% of individuals looked at some sort of food labelling when purchasing new products. As most of our study participants were college students, or those associated with the university, perhaps those with a higher-level education are more likely to understand the food packaging labelling, thus allowing them to use them more often than those with lower levels of education, as reported by Oostenbach et al. (2019).

Table 3 includes responses to questions asking how often the 94 participants of the MFG looked at NFPs and ingredient statements when purchasing new products. The first column shows the summary statistics for the 94 participants’ responses in the original screening survey. The second column shows their responses in the MFG pre-survey. The third column summarizes the question asking how often the participants planned to look at NFP after the MFG. The fourth column summarizes their responses to how often they looked at nutrition facts panels one month after the MFG. Approximately the same percent of panelists never looked at NFPs throughout the study (3 to 6%), indicating little to no change in behavior. The sometimes/frequently category had the highest number of panelists (46 to 60%). A moderate number of panelists selected always/every time (9 to 38%) and rarely/a few times (13 to 39%). Interestingly, there was a significant decrease in looking at NFPs and ingredients labels over time (mean score decreased from screening survey to one-month follow-up survey). Additionally, understanding NFPs and ingredients labels declined between the pre-screening and pre-survey.
Comparing the survey conducted at the end of the MFG to the one-month post survey, 55% \((n=46)\) of participants kept their answers consistent and looked at NFPs like they said they planned to after the MFG. However, 14% \((n=12)\) of participants looked at NFPs less than they planned to; 30% \((n=26)\) looked more frequently than they said they would look at NFPs.

Regarding the ingredient statements, 47% \((n=40)\) of participants kept their answers the same, essentially showing that they looked at ingredient panels like they said they would after a month. Over one-third 39% \((n=34)\) of the participants looked less often than what they presumed they would do and 14% \((n=12)\) of the individuals increased the times compared to what they expected they would.

From the Food Choices and Intolerances screening survey to the one-month follow up survey, 38% \((n=32)\) of the individuals did not change their behaviors towards ingredient labels, 51% \((n=42)\) decreased the number of times, and 11% \((n=9)\) increased the number of times they looked at ingredient labels on new foods. Regarding the ingredients statements, 40% \((n=32)\) of the individuals did not change their behavior towards looking at NFPs, 54% \((n=43)\) of participants decreased the number of times they looked at NFPs, and 6% \((n=5)\) increased the level at which they looked at NFPs when purchasing new food products.

These results indicate that the NFP lesson provided to participants either elicited no change in behavior or led to an increase in frequency of looking at them by individuals, directly after the MFG. One reason for the increase of looking at NFPs could be that these panelists learned how to interpret the information presented on these food labels, and thus wanted to apply the knowledge gained. However, when examining the panelists’ behaviors from the start of the study to the end, these results tell us that education about NFPs dissuades people from looking at them—which is not a result we would expect or want. One explanation may be that participants
inflated their frequency numbers in the initial survey, then, when were more conscious of the number of times they actually looked, realized they did not look at them as often, and expressed more realistic numbers in the one-month post survey.

Different from the NFPs, panelists seemed less motivated to look at ingredient’s labels, and their actions matched this. An explanation for this could be that looking at ingredient labels is situational. Because we specifically asked about new food products they considered purchasing, it could be that few new food products were purchased within one month of the MFGs. Because most people buy products they are familiar with, the follow-up survey may not have fully reflected behavior in response to the educational lesson. Additionally, it may be that panelists have a harder time understanding the ingredients than NFPs, as we did not go into depth about what specific ingredients are, just briefly mentioned that they are placed in order by weight, and that most (in the example we used) were from natural sources. Thus, in relation to the SMT of this research design, we may re-consider how the questions related to NFPs and ingredients labels are asked in the future, to obtain more useful responses. Additional improvements may be to include more simple verbiage or to slow down more during that part of the lesson.

MFG Population Knowledge and Learning

Added Sugars Lesson and Quiz

One goal of the MFGs was to educate participants about what food ingredients are considered added sugars, in particular, since lactose is not an added sugar. Table 4 shows the number of correct responses and mean correctness values for the question about added sugars asked of panelists three times. At the beginning of the MFGs (pre-survey), very few people got the correct answer when asked to select all added sugars from the list of six options (Table 4).
Mean correctness scores hovered around 0.30/1.00 (0=incorrect, 1=correct) and there were no significant differences between treatment groups (p > 0.05). Statistically the same overall mean correctness score was seen immediately after the MFGs and 1 month later (p > 0.05), regardless of treatment group. While it is not surprising that treatment groups and control did not differ, since all received the same educational message about added sugars, these findings demonstrate that the lesson about added sugars was not effective since no significant knowledge was gained or retained across surveys (p > 0.05). Nonetheless, 15% (n=13) of the participants went from getting the answer wrong in the MFG pre-survey to getting the answer right in the MFG post-survey, indicating they were able to learn the information provided. Of those 13 who got their answer right, 46% (n=6) were able to retain the information after one month.

An explanation for these findings is that the question was not simple. To get it correct, participants had to select all of the correct added sugars from a list of choices (corn syrup, table sugar and honey had to be selected, and milk, 100% fruit juice, and whey needed to not be selected). The complexity of the question, in large part, likely explains the low correctness mean score every time. The fact that every group (control and treatments) received the same lesson explains why no significant differences in knowledge were seen across groups.

Thirty-eight of the individuals who participated in the MFGs never got the answer right, indicating the educational message was not effective in helping them learn the material, or they did not understand the materials, or they did not care/did not listen. Only 8% (n=7) of individuals got the question right in all three of the surveys, indicating they knew this material very well and likely had some prior knowledge before entering the MFG; 14% (n=12) only got the answer once in either the pre-survey or the one-month post survey, indicating some inconsistencies, most likely from guessing.
Based on our outcomes, some minor improvements could be made to that lesson for future interventions. The verbal part of the lesson only included the fact that lactose is not an added sugar. Additionally, the infographic included examples of added sugars (i.e., cane sugar, corn syrup, honey and concentrated fruit juices). Thus, learning and retention could likely be improved by verbally explaining that fruit juice and vegetable juices contain natural sugars, but concentrated fruit juices are added sugars and showing them where to look to find the information on the infographic.

Daily Value Lesson and Quiz

When quizzed, 84% (n=69) of the MFG participants were able to get the question (“True or false: 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.”) right every time they took the survey. Overall mean correctness value was 0.90/1.00 on the pre-survey (and mean correctness value did not differ between treatment groups (p > 0.05)), suggesting a lot of the panelists had some prior knowledge about daily values (Table 4). Alternatively, the true/false question may have been very simple to guess correctly. If asked a more difficult question (open-ended), the number of correct responses (and mean correctness score) likely would have been lower.

Although a lot of panelists knew the correct answer coming into the MFGs, a significant number learned the information, as demonstrated by the 0.99/1.00 mean correctness score on the MFG post-survey (p < 0.05). Even one month after the MFGs, the majority of participants correctly answered the question again, demonstrated by the non-significant (p > 0.05) decrease in mean correctness score (0.95/1.00).

About 10% (n=8) of the individuals did not know the answer before the MFG, were able to learn the correct answer during the MFG and were able to retain the information after one
month, indicating the material was understood and easily retained by them. One individual learned the information during the MFG; however, they were not able to retain the information after one month. Surprisingly, 4% \((n=3)\) of individuals got the answer right in the first two surveys but wrong in the one-month follow-up survey.

Based on the outcomes, some minor improvements may be necessary to that lesson for future interventions to test knowledge and increase the retention of the knowledge. For instance, including another example, later in the lesson, might help cement the knowledge.

Lactose Calculation and Quiz

Panelists were not asked to calculate lactose from the yogurt nutrition facts panel in the MFG pre-survey because we wanted to keep the pre-survey as short as possible and the calculation question was complex and could have frustrated participants. Based upon the MFG post-survey, nearly all participants (control and 3 treatment groups) learned the material and got the correct answer \((0.92/1.00)\), which demonstrates the effectiveness of the lesson. Only 7% \((n=6)\) of the individuals were unable to answer the lactose calculation question correctly, while 93% \((n=79)\) were able to get it right. Since the question was not asked in the MFG pre-survey, we do not know how many people came in knowing how to obtain the correct answer. However, since only 31% of participants got the added sugars question correct in the pre-survey, it is possible that 31% came in with knowledge of how to read NFPs and calculate lactose content in a food. Thus, between 62 and 93% learned how to calculate lactose content during the lesson.

After one month, the mean correctness score dropped to 0.79/1.00, a significant drop \((p < 0.05)\). Approximately 21% \((n=18)\) of individuals were unable to answer the lactose calculation question correctly and 79% \((n=67)\) got the correct answer. If 31% of participants knew how to
calculate the number prior to our lesson, an additional 48% learned and retained the information taught during the MFGs. Regardless, only 15% (n=13) of MFG participants were unable to retain the information that was taught to them, suggesting effectiveness of the lesson. This information is particularly useful to people who are concerned about their added sugar intake.

Only some minor improvements may be necessary to that lesson for future interventions. For instance, including a second example (e.g., with cheese or ice cream) may help cement the information in the minds of participants.
Table 4. Responses (N) to quiz questions asked immediately before (Pre-), after (Post-) and one month after (one-month) Modified Focus Groups (MFG), by treatment group. Mean correctness value* (0 = incorrect, 1 = correct) is specified by treatment group\textsuperscript{a,b} and by MFG\textsuperscript{A,B}.

<table>
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<tr>
<th>Quiz</th>
<th>Pre (n=94)\textsuperscript{a}</th>
<th>Post (n=94)\textsuperscript{b}</th>
<th>Follow-Up (n=94)\textsuperscript{b}</th>
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<td></td>
<td>Control (n=28)</td>
<td>Lactose (n=21)</td>
<td>Nine Essential (n=31)</td>
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<td>Added Sugars</td>
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</tr>
<tr>
<td>Correct</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Mean</td>
<td>0.20\textsuperscript{a}</td>
<td>0.00\textsuperscript{a}</td>
<td>0.13\textsuperscript{a}</td>
</tr>
<tr>
<td>Lactose calculation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Incorrect</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Correct</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Mean</td>
<td>0.93\textsuperscript{a}</td>
<td>1.00\textsuperscript{a}</td>
<td>0.94\textsuperscript{a}</td>
</tr>
<tr>
<td>MEAN</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
</tbody>
</table>

\textsuperscript{a,b} means not sharing the same superscript within a row and quiz significantly differ (p < 0.05).

\textsuperscript{A,B} MEANS not sharing the same superscript within a row significantly differ (p < 0.05).

*Missing values (question skipped) are not included in mean correctness scores.

**Question not asked in the specified survey.
Nine Essential Nutrients Lesson and Quiz

Although only one treatment group received the educational message about nine essential nutrients in dairy products, all participants of the MFGs were asked, 3 times, how many essential nutrients are naturally found in dairy products in order to test the effectiveness of the nine essential nutrients lesson. Table 4 shows the mean value for the question asking participants how many essential nutrients are naturally found in dairy products, separated by treatment group. The question specifically asked, “How many essential nutrients are naturally found in dairy products (milk, yogurt, cheese, ice cream)?”, with answer options: I don't know, none, 1, 3, 5, 7, 9. For those who selected the correct answer (9), their value became a 1. For those who selected any of the other responses (wrong), their number became zero (0).

In the MFG pre-survey, there was no difference in mean correctness score among the four treatment group populations, which is what was expected, since nobody had received the educational message yet. This helps us conclude that participants had little to no prior knowledge of the fact that dairy products naturally contain nine essential nutrients. After the MFG, however, those who received the nine essential nutrients educational message got the question right significantly more often than the three other groups (mean 0.90/1.00; approximately 89% \( n=27 \) than those who did not receive any information regarding the content \( p < 0.05 \), showing that the message communicated by researchers was effective in immediate retention of the information. After a month, this trend continued. The nine essential nutrients treatment group mean correctness score was 0.59/1.00, which was significantly higher than two of the three groups. Differences between groups were less pronounced than immediately after the MFG lesson, demonstrating that some of the individuals who received the lesson were not able to retain the information after one month.
Of the 27 individuals who got the correct answer after the nine essential nutrients lesson, 63% \( (n=17) \) of the participants were able to retain the information after one month. Additionally, some of those who did not get the nine essential nutrients message got the question right in the one-month post survey. It is possible that they guessed, or used a resource to find the correct answer, since the one-month follow-up surveys could be taken at home on a person’s personal computer, with freedom to explore the internet.

It is interesting to note that when comparing the percentage of those who were able to retain the information from the added sugars lesson and the nine essential lesson, people had greater retention of the nine essential nutrients lesson than the added sugars lesson (a lesson everyone received). This fact can be seen in the MEAN row of Table 4. For the nine essential nutrients quiz question, the overall mean correctness score increased significantly between the pre-survey and the post-survey, then did not drop significantly after a month. For the added sugars lesson, no significant increase in the overall mean correctness was seen across the three surveys. This was somewhat unexpected, as we thought learning and retaining information about added sugars would be more important to people than nine essential nutrients. However, based upon the data, it is evident that people had more to learn regarding nine essential nutrients than about added sugars. Additionally, the lesson about added sugars, as well as the quiz was more complex, further confirming our realization that the lesson could be made more clear for better knowledge gain.

Some improvements are recommended for the nine essential nutrients lesson to ensure the information presented and learned can have a lasting effect on those who received the educational message. One consideration would be to make the lesson more interactive, since the MFGs did not involve any interaction of panelists or instructors (other than questions). Perhaps
asking panelists to pick a nutrient from the list that surprised them might help them remember
the nine essential nutrients even better and to retain the information longer.

*Lactose Maldigestion Lesson*

No quiz question was designed to test retention of lactose maldigestion information. Instead, all participants were asked “based on what you learned about lactose maldigestion today, how will it change your dairy products purchasing and consumption in the future?” Table 5 shows the summary statistics for the question asked immediately after the session and a month later. The first column question was asked of all participants after the MFGs to see how participants would act after the session. The third column represents the answers to the question “how often have you modified a purchase based on amount of lactose in a product in the past 3 weeks?”. Only 58 participants answered the questions in both surveys. This may be due to the first question asked specifically about lactose maldigestion, and some of the participants did not learn about lactose maldigestion (skipped the question).

Out of the 17 individuals who received the lactose educational message, one participant said they were going to decrease their dairy product purchasing based on what they learned about lactose and lactose maldigestion. The other 16 participants said they were not going to change their behavior based on the educational message, showing that the message did not have any effect on them. After one month, only one individual in the lactose research group altered their purchasing of dairy products based on the lactose level of it. The rest of the individuals did not alter their behaviors towards dairy products based on what they learned during their session. It is important to note that although people did not modify their behavior, it may be because they had no aversions to lactose in the first place and did not feel a need to do so after the lesson.
Based on the outcomes, the ability to provide panelists with a clear benefit to them appears to be necessary to motivate behavior change. Since the lesson was mostly about lactose maldigestion, and most people in the group did not suffer from lactose maldigestion, the lesson may not have interested them, thus did not motivate behavior change.

Additional questions were asked about plans to purchase dairy products with lactose. Table 5 summarizes the question asking, “how much less or more likely will you be to purchase milk with extra lactose if it costs less than regular milk?”, which was asked to all participants of the MFG in the post-survey, as well as the one-month follow-up survey. Percentages represent those who responded for each in that category. Since panelists were told that the lactose in the ice cream they tasted was manipulated with whey-based ingredients, a goal was to see if the interest in lactose-containing products might increase as a result.

Immediately after the MFGs, 48% of the panelists indicated that they would be more likely to purchase milk with extra lactose than regular milk if it cost less; approximately 25% were equally likely, and 28% were less likely. Consumers are very loyal to milk brands and types (Joubert and Poalses, 2012), so it is interesting to see such a high percentage that showed interest in milk with extra lactose. We largely attribute this increase to the fact that the milk would cost less. We partially attribute the increase in likelihood to purchase milk with extra lactose to the fact that they tasted ice cream with extra lactose and accepted it (discussed later). This was likely the first time any of them had tasted ice cream with varying levels of lactose side-by-side; panelists were unlikely to have interacted with any dairy products with extra lactose.

Because milk with extra lactose is not currently available, the post-survey could not ask if panelists purchased such a product. Comparing the post-survey to the one-month post survey,
only 36% \((n=30)\) of the individuals kept their answers consistent; 27% \((n=22)\) participants said they would be more likely to purchase milk with extra lactose if it cost less, if available and 37% \((n=31)\) of the individuals said they would be less likely to purchase it. These data can be a little misleading because in the one-month follow-up survey, a higher percentage of the participants went from “much less likely” and “somewhat less likely” to one of the other three options. Some of those who selected “much more likely” decreased their choice to one of the other options leading to the changes in the data above. However, 47% still indicated greater likelihood to purchase milk with extra lactose than regular milk if it cost less.

It is important to note that those who received the lactose message during the MFG did not say they would purchase these products more than those who did not receive the message. This may be explained by panelists having prior knowledge of what added lactose may bring to them as a consumer. Alternatively, the experience of tasting the ice cream with extra lactose had a greater impact on purchasing behavior than the lactose lesson itself. Some panelists found the product with higher lactose more enjoyable than the others (later in thesis).

Over half (55% and 51%) of the participants in all MFGs said they would be “somewhat more likely” or “much more likely” to purchase “ice cream with extra lactose if it cost less” in the post-survey and one-month follow-up survey, respectively. Less than a quarter of participants (19% and 22%) said they would be “much less likely” or “somewhat less likely” to purchase these products. Similar to the milk with extra lactose question, approximately 25% would be equally likely to buy ice cream with extra lactose as regular ice cream. These findings support our assertion that a positive interaction with the ice cream with extra lactose improved the likelihood that panelists might consider purchasing dairy products with extra lactose.
However, as with milk, the high response may have been largely to do with the lower cost of such a product.

Table 5. Summary statistics for MFG participants regarding actions towards dairy products with lactose immediately after (post-survey) and one-month following the MFGs (one-month follow-up).

<table>
<thead>
<tr>
<th>Post</th>
<th>%</th>
<th>Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Based on what you learned about lactose maldigestion today, how will it change your dairy products purchasing and consumption in the future?” (n=58)</td>
<td></td>
<td>“How often have you modified a purchase based on amount of lactose in a product in the past 3 weeks?” (n=58)</td>
</tr>
<tr>
<td>“I will decrease my dairy product purchasing”</td>
<td>2</td>
<td>Never</td>
</tr>
<tr>
<td>“I will not change my behavior”</td>
<td>93</td>
<td>A few times</td>
</tr>
<tr>
<td>“I will increase my dairy product purchasing”</td>
<td>5</td>
<td>Frequently</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How much less or more likely will you be to purchase milk with extra lactose if it costs less than regular milk? (n=83)</th>
<th>How much less or more likely will you be to purchase milk with extra lactose if it costs less than regular milk? (n=83)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much less likely to purchase than regular milk</td>
<td>Much less likely to purchase than regular milk</td>
</tr>
<tr>
<td>Somewhat less likely</td>
<td>Somewhat less likely</td>
</tr>
<tr>
<td>Equally likely</td>
<td>Equally likely</td>
</tr>
<tr>
<td>Somewhat more likely</td>
<td>Somewhat more likely</td>
</tr>
<tr>
<td>Much more likely</td>
<td>Much more likely</td>
</tr>
<tr>
<td>Much less likely</td>
<td>9</td>
</tr>
<tr>
<td>Somewhat less likely</td>
<td>19</td>
</tr>
<tr>
<td>Equally likely</td>
<td>24</td>
</tr>
<tr>
<td>Somewhat more likely</td>
<td>9</td>
</tr>
<tr>
<td>Much more likely</td>
<td>39</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How much less or more likely will you be to purchase ice cream with extra lactose if it costs less than regular ice cream?” (n=85)</th>
<th>How much less or more likely will you be to purchase ice cream with extra lactose if it costs less than regular ice cream?” (n=85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much less likely</td>
<td>Much less likely</td>
</tr>
<tr>
<td>Somewhat less likely</td>
<td>Somewhat less likely</td>
</tr>
<tr>
<td>Equally likely</td>
<td>Equally likely</td>
</tr>
<tr>
<td>Somewhat more likely</td>
<td>Somewhat more likely</td>
</tr>
<tr>
<td>Much more likely</td>
<td>Much more likely</td>
</tr>
<tr>
<td>Much less likely</td>
<td>6</td>
</tr>
<tr>
<td>Somewhat less likely</td>
<td>13</td>
</tr>
<tr>
<td>Equally likely</td>
<td>26</td>
</tr>
<tr>
<td>Somewhat more likely</td>
<td>14</td>
</tr>
<tr>
<td>Much more likely</td>
<td>41</td>
</tr>
</tbody>
</table>

Those that received the lactose educational lesson were not more likely to purchase these products than the other groups. This again supports our assertion that the ice cream tasting had a bigger impact than the educational message--all panelists experienced what ice cream with added
lactose would taste like, and some liked it more than ice cream with the standard level of lactose. Because ice cream with extra lactose is not currently available, the post-survey could not ask if panelists actually purchased such a product.

Probiotics/Prebiotics Lesson

Table 6 shows the summary statistics for participants’ actions towards dairy products, based on probiotic/prebiotic nature of those foods. Column 1 represents the answers to the question “based on what you learned about probiotics and prebiotics today, how will it change dairy products purchasing and consumption in the future,” that participants were asked after the MFG, with the percentage representing how many answered that question. Although only 20 panelists were supposed to answer the question (because it was a skip-logic question in the Qualtrics survey (only those who received the probiotic and prebiotic lesson were supposed to answer the question) a total of 38 participants answered the first question, only 12 of whom participated in the probiotic and prebiotic lesson. This suggests that people did not understand whether or not they were part of the probiotic and prebiotic lesson, and our instructions need to be more explicit and clear in the future.

Unfortunately, most respondents to the first question said they were going to decrease their purchasing and consumption of probiotic dairy products based on the probiotic and prebiotic educational lesson. Since probiotics are positive for health, this is not a positive finding, and is surprising. However, only 12 of the people that answered the question actually received the lesson, showing that the others did not have the new knowledge, to make an informed decision, that the treatment group individuals did. Eight (8) treatment group individuals did not answer the question as they were instructed to do. Based only on the 12 who did receive
the message and answered the question, 34% \((n=4)\) answered “I will not change my behavior”. Two-thirds 66\% \((n=8)\) answered, “I will decrease my dairy purchases/consumption”, showing that the educational message had an adverse effect—opposite to what the researchers wanted to see. It was supposed to motivate purchasing of probiotic and prebiotic dairy foods, however for those individuals who did receive the message it appeared to do the opposite or have no effect at all.

Column 3 represents the answers to the question, “how often have you modified a purchase based on probiotics or prebiotics in a product in the past 3 weeks”, that participants were asked in the one-month follow-up survey to see how their behaviors changed. All one-month follow-up participants were invited to (and did) answer the second question \((n=84)\). It is difficult to determine if participants increased or decreased their behaviors since we did not specifically ask if they increased or decreased consumption and purchasing of dairy products, just if they altered their behaviors based on probiotics and prebiotics in foods. Again, improving the questions asked would be a priority with follow-up research in this area. Few individuals who did not receive the message \((n=11)\) said they altered their behaviors towards these food products. They likely based their decisions off prior knowledge of these topics, or just assuming some knowledge. All the individuals \((100\%)\) in the probiotic/prebiotic group who said they were going to decrease their purchasing and consumption of dairy did not alter their behavior based on the contents of the food, showing they did not actively use what they learned during the session. However, the four individuals who said they were going to not change their behavior, ended up either altering their behavior a few times or frequently based on the probiotic or prebiotic content of the food.
Table 6. Summary statistics for MFG participants regarding actions towards dairy products with probiotics or prebiotics as the driver.

<table>
<thead>
<tr>
<th>Post (n=38)</th>
<th>%</th>
<th>Follow-Up (n=84)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Based on what you learned about probiotics and prebiotics today, how will it change dairy products purchasing and consumption in the future?”</td>
<td></td>
<td>“How often have you modified a purchase based on probiotics or prebiotics in a product in the past 3 weeks?”</td>
<td></td>
</tr>
<tr>
<td>I will decrease my dairy purchases/consumption</td>
<td>84</td>
<td>Never</td>
<td>84</td>
</tr>
<tr>
<td>I will not change my behavior</td>
<td>16</td>
<td>A few times</td>
<td>12</td>
</tr>
<tr>
<td>I will increase my dairy purchases/consumption</td>
<td>0</td>
<td>Frequently</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every time</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>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?</th>
<th>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?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much less likely</td>
<td>2</td>
</tr>
<tr>
<td>Somewhat less likely</td>
<td>7</td>
</tr>
<tr>
<td>Equally likely</td>
<td>47</td>
</tr>
<tr>
<td>Somewhat more likely</td>
<td>36</td>
</tr>
<tr>
<td>Much more likely</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 6 also summarizes the answers to the question, “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” asked to participants after the MFG and then in the one-month follow-up to test impact of information from the MFG. It is interesting to note that the individuals who received the prebiotics/probiotics message did not have a higher average score than the other individuals who participated in the MFGs, since those other individuals did not receive the message; thus, they possibly would not have known the benefits of consuming foods that contain prebiotics/probiotics, unless they had prior knowledge about this topic.

When looking at the data overall, most individuals said they would either be equally likely or somewhat more likely to purchase ice cream if it was prebiotic or probiotic. Two individuals who received the prebiotics/probiotics educational message answered they would be
much less likely and somewhat less likely to purchase ice cream with probiotics and prebiotics, indicating the lesson needs revision if a goal is to increase consumption of prebiotic/probiotic dairy foods.

From the MFG post survey to the one-month follow up survey, 65% (n=55) of the individuals kept their answer consistent. Nearly a quarter, 20% (n=17), said they would purchase probiotic or prebiotic ice cream more than what they did in the post survey, and 15% (n=12) said they would be less likely to purchase probiotic or prebiotic ice cream if it were available, indicating they either forgot what they said in the post-survey, or their thoughts changed one-month post MFG. Considering the SMT framework, all of this leads us to think we need more clearly write questions and set up skip logic in future surveys. For instance, more clear questions and better ways to track food consumption (perhaps a food frequency questionnaire) would be beneficial. Additionally, aligning the questions in pre-, post- and one-month follow-up surveys to better understand if panelists’ purchases/consumption would be beneficial.

**MFG Population Perceived Learning**

The post-survey, conducted immediately after completing MFGs, included questions to assess participants’ perceptions of how much they learned during the education sessions. Questions included: “How much did you learn about how to read and use food ingredients labels today?”, “How much did you learn about how to read and use Nutrition Facts panels today?”, “How much did you learn about essential nutrients in dairy products today?”, “How much did you learn about lactose maldigestion today?”, and “How much did you learn about probiotics and prebiotics today?”. Mean values were calculated for every treatment group and then compared and complied in Table 7.
In the first row, those in the prebiotic/probiotic group statistically (p<0.05) self-reported higher learning than the other treatment groups (lactose maldigestion and nine essential) when asked about NFPs. Comparing “control” treatment group mean scores, it is promising to see that for a majority of the columns labelled with “learning”, the self-reported values for learning was lower in the control group than the treatment group of interest (p < 0.05). This is a positive finding, as the control group did not receive lessons related to lactose maldigestion, nine essential nutrients, or prebiotics and probiotics. Thus, it is expected, and validated, that the panelists in treatment groups typically learned more about the specified lesson than those not in the treatment groups. Although panelists may have not significantly retained the information over the month, they believe that they learned something. Furthermore, while all groups (even control) received the lesson about ingredients and NFPs, the self-reported learning appeared to increase on these topics for panelists who were in treatment groups, suggesting perceived enhancement of learning with the subsequent lessons about lactose maldigestion, nine essential nutrients, and prebiotics and probiotics.

When examining the “lactose maldigestion learning” row, it is good to see that those in the lactose maldigestion group, as well as the prebiotics and probiotics group felt they learned about this topic, significantly more than the other groups (p < 0.05). One explanation for why the prebiotics and probiotics group reported higher learning could be that questions asked during the session led the researchers to discuss things that panelists perceived as lactose maldigestion topics.

Similar to the lactose group, the group that received the nine essential nutrients message and the prebiotics and probiotics message reported more learning (p<0.05) than the other groups when asked about nine essential nutrients learning. One explanation for this could be that when
providing the panelists with information about the ice cream with varying lactose levels, some knowledge was provided about whey and lactose, which panelists may have perceived as essential nutrients in dairy. Although these words were never said, the panelists may have perceived that they were. Thus, questions and skip logic notations need to be more clear to ensure panelists know when they are “not in that group” if they did not receive a given lesson.

Looking at the “prebiotics and probiotics learning” section of Table 7, the results match the ones previously discussed. Those in the prebiotics and probiotics treatment group self-reported more learning than those in other groups (p<0.05), verifying that the educational message had a positive effect, even if it did not increase interest in purchasing dairy products with prebiotics and probiotics. It is also interesting to note that within all of the columns, those in the prebiotics and probiotics treatment group had high means for self-reported learning. They appear to think that they learned a lot about all of the topics, which is very interesting to see. It may be worth investigating why they thought their educational message was so effective. In future surveys, asking panelists more specific questions about where their learning came about may be useful.

Moving forward with this or similar research considering the SMT framework, it will be critical to focus on methods to enable panelists to better learn and retain information. Greater interaction with panelists and additional examples or repetition should help in future interventions. Additionally, survey questions need to be clearly designed to best reflect knowledge retention and consumer behaviors.
Table 7. Responses (n) to questions asked regarding perceived learning immediately after (Post-survey) Modified Focus Groups, by treatment group. Mean is specified for each treatment group\textsuperscript{a,b}.

<table>
<thead>
<tr>
<th>Question (numeric response)</th>
<th>Control (n=28)</th>
<th>Lactose Maldigestion (n=21)</th>
<th>Nine Essential (n=31)</th>
<th>Probiotic and Prebiotic (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition facts panels\textsuperscript{1}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nothing new (1)</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>A little (2)</td>
<td>9</td>
<td>6</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Moderate amnt. (3)</td>
<td>13</td>
<td>13</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>A lot (4)</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Mean</td>
<td>2.68\textsuperscript{ab}</td>
<td>2.57\textsuperscript{b}</td>
<td>2.61\textsuperscript{b}</td>
<td>3.00\textsuperscript{a}</td>
</tr>
<tr>
<td>Food ingredients labels\textsuperscript{2}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nothing new (1)</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>A little (2)</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Moderate amnt. (3)</td>
<td>17</td>
<td>11</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>A lot (4)</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Mean</td>
<td>2.68\textsuperscript{a}</td>
<td>2.57\textsuperscript{a}</td>
<td>2.74\textsuperscript{a}</td>
<td>3.00\textsuperscript{a}</td>
</tr>
<tr>
<td>Essential nutrients in dairy\textsuperscript{3}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in group (1)</td>
<td>8</td>
<td>6</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Nothing new (2)</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Very little (3)</td>
<td>11</td>
<td>4</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Moderate amnt. (4)</td>
<td>6</td>
<td>8</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>A lot (5)</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Mean</td>
<td>2.54\textsuperscript{b}</td>
<td>2.70\textsuperscript{b}</td>
<td>4.10\textsuperscript{a}</td>
<td>3.62\textsuperscript{a}</td>
</tr>
<tr>
<td>Lactose maldigestion\textsuperscript{4}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in group (1)</td>
<td>14</td>
<td>1</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Nothing new (2)</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Very little (3)</td>
<td>6</td>
<td>1</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Moderate amnt. (4)</td>
<td>3</td>
<td>13</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>A lot (5)</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td>1.93\textsuperscript{b}</td>
<td>3.95\textsuperscript{a}</td>
<td>2.35\textsuperscript{b}</td>
<td>3.69\textsuperscript{a}</td>
</tr>
<tr>
<td>Probiotics and prebiotics\textsuperscript{5}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in group (1)</td>
<td>20</td>
<td>16</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>Nothing new (2)</td>
<td>6</td>
<td>1</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Very little (3)</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Moderate amnt. (4)</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>A lot (5)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Mean</td>
<td>1.39\textsuperscript{b}</td>
<td>1.48\textsuperscript{b}</td>
<td>1.65\textsuperscript{b}</td>
<td>3.92\textsuperscript{a}</td>
</tr>
</tbody>
</table>

\textsuperscript{a,b} means not sharing the same superscript within a row and quiz significantly differ (p < 0.05).

\textsuperscript{1}How much did you learn about how to read and use Nutrition Facts panels today?
1=nothing new, 2 = a little, 3 = a moderate amount, 4 = a lot

\textsuperscript{2}How much did you learn about how to read and use food ingredients labels today?
1=nothing new, 2 = a little, 3 = a moderate amount, 4 = a lot

\textsuperscript{3}How much did you learn about essential nutrients in dairy products today?
1=not in that group, 2=nothing new, 3=very little, 4 = a moderate amount, 5 = a lot

\textsuperscript{4}How much did you learn about lactose maldigestion today?
1=not in that group, 2=nothing new, 3=very little, 4 = a moderate amount, 5 = a lot

\textsuperscript{5}How much did you learn about probiotics and prebiotics today?
1=not in that group, 2=nothing new, 3=very little, 4 = a moderate amount, 5 = a lot
MFG Population Behavior Towards Dairy Products

Dairy Consumption

The summary statistics for questions asking participants about their behaviors towards different dairy products for three weeks up until the time of the MFG and then for three weeks after the MFGs are included in Table 8. When examining the behaviors towards milk, the majority of individuals decreased the amount of milk that was purchased one month after the MFG, with a significant decrease in purchasing for milk and ice cream and consumption of ice cream ($p < 0.05$). No other significant changes in mean purchasing or consumption were observed ($p > 0.05$).

More specifically, 48% ($n=40$) of individuals purchased less milk after one month compared to the 3 weeks before the MFG. Although the purchasing of milk went down, only 19% ($n=16$) of the participants drank less milk, showing that people were still consuming milk, even if they weren’t purchasing it (likely a shopping and survey timing issue). Sixteen percent ($n=13$) of the individuals drank more milk after one month. Based on these findings, it is possible that some behavior change may have been motivated by the educational lessons, but the impact is not clear.

The amount of yogurt that was purchased and consumed both seemed to decrease after the MFG. Only 20% ($n=17$) of the individuals purchased more yogurt and 19% ($n=16$) consumed more yogurt. Eleven people increased both actions towards yogurt in one month after the MFG. Eighty percent ($n=66$) and 81% ($n=67$) of the participants either decreased the consumption and purchasing of yogurt or kept it the same.

Very similar to the actions towards yogurt, cheese was purchased less and consumed less after the MFG than the three weeks prior to the MFG. Only 7% ($n=6$) of the individuals both
increased their purchase of cheese, as well as their consumption of these products. Eighteen percent \( (n=15) \) of the individuals both decreased their consumption and purchasing of cheese. It is possible that the educational messages may have had a negative impact on their actions towards cheese.

It is hard to determine a major trend in how the participants changed their behaviors towards ice cream after the MFG. It appears that ice cream was purchased less after the MFG, and consumed more, but the values are very close. Twenty-four percent \( (n=20) \) of individuals increased the amount of ice cream they purchased, and 38% \( (n=33) \) decreased the amount, however the consumption habits do not match that of the purchasing habits. Twenty-seven percent \( (n=22) \) of the participants increased their consumption, and 13% \( (n=4) \) of the individuals who purchased less actually consumed more. It is unfortunate that changes were not seen in ice cream purchases, since ice cream was served as part of this study.

Overall, 50% \( (n=43) \) of the individuals who participated in the MFG, and the MFG one-month follow-up survey changed their behavior in a positive way towards at least one of the dairy products asked about. They increased both their consumption and purchasing of one of the common dairy products that was asked about, suggesting an effort to use the learning and make a change in their behaviors towards dairy.

Considering the SMT framework, some significant improvements are necessary to survey purchasing and consumption behavior to interpret data more effectively. Question wording should be clarified and a better system for panelists to record their behaviors, possibly a food frequency questionnaire, would be beneficial.
Table 8. Summary statistics for MFG participants regarding actions towards milk, yogurt, cheese and ice cream prior to (MFG pre-survey) and one-month after the MFGs (one-month follow-up survey)

<table>
<thead>
<tr>
<th>Amount (numeric response)</th>
<th>Pre % (n=94)</th>
<th>Post % (n=94)</th>
<th>Pre % (n=94)</th>
<th>one-month Follow-Up % (n=94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much milk did you purchase in the past 3 weeks?</td>
<td>How much milk did you (personally) drink in the past 3 weeks?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1 gallon (4)</td>
<td>36</td>
<td>25</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>1 gallon (3)</td>
<td>22</td>
<td>27</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>&lt; 1 gallon (2)</td>
<td>20</td>
<td>25</td>
<td>39</td>
<td>55</td>
</tr>
<tr>
<td>None (1)</td>
<td>22</td>
<td>23</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>3.09</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.52</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td><strong>2.15</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.12</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>How much yogurt did you purchase in the past 3 weeks?&lt;sup&gt;1&lt;/sup&gt;</td>
<td>How much yogurt did you (personally) consume in the past 3 weeks?&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;5 (4)</td>
<td>30</td>
<td>23</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>3-5 (3)</td>
<td>16</td>
<td>19</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>&lt; 3 (2)</td>
<td>23</td>
<td>19</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>None (1)</td>
<td>31</td>
<td>39</td>
<td>29</td>
<td>34</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>2.45</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.25</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.26</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.07</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>How much cheese did you purchase in the past 3 weeks?&lt;sup&gt;2&lt;/sup&gt;</td>
<td>How much cheese did you (personally) eat in the past 3 weeks?&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1 lb. (4)</td>
<td>35</td>
<td>25</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>1 lb. (3)</td>
<td>30</td>
<td>27</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>&lt; 8 oz (2)</td>
<td>26</td>
<td>33</td>
<td>55</td>
<td>68</td>
</tr>
<tr>
<td>None (1)</td>
<td>9</td>
<td>15</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>2.88</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.95</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.45</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.65</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>How much ice cream did you purchase in the past 3 weeks?</td>
<td>How much ice cream did you (personally) eat in the past 3 weeks?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1 quart (5)</td>
<td>26</td>
<td>20</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>1 quart (4)</td>
<td>24</td>
<td>16</td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>1 pint (3)</td>
<td>20</td>
<td>27</td>
<td>29</td>
<td>32</td>
</tr>
<tr>
<td>1-3 scoops (2)</td>
<td>11</td>
<td>15</td>
<td>27</td>
<td>39</td>
</tr>
<tr>
<td>None (1)</td>
<td>19</td>
<td>22</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>3.26</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.61</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td><strong>2.77</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><strong>2.31</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup>8-oz containers of yogurt

<sup>2</sup>instructed to consider a serving 1.5 ounces

<sup>a, b</sup>means in the same row, in the same shaded region, that do not share a common superscript, significantly differ (p<0.05)
MFG Population Acceptance of Ice Cream with Varying Levels of Lactose

After tasting the three samples of ice cream with varying levels of lactose, panelists were informed about the amount of lactose in each product, how the products’ lactose contents were controlled by using whey-based ingredients, and were shown the ingredients lists and Nutrition Facts panels for each product. It was explained that since lactose is not an added sugar, to balance carbohydrates in the mix, the lowest-lactose product (5g/serving, or 3.8% lactose) had the highest added sugar (23g/serving or 82% of total sugars); the standard-lactose product (5.5g/serving, or 5.8% lactose) had the moderate level of added sugar (20g/serving or 77% of total sugars); the highest-lactose product (6g/serving, or 7.8% lactose) had the lowest added sugar (18g/serving or 75% of total sugars).

We assumed that the panelists were untrained in their knowledge of judging dairy products but that they liked ice cream, since they elected to participate in the study, even some who indicated dairy avoidance. Thus, coupled with the demographic data presented earlier, the participants were a suitable representative sample of the greater population. Table 9 represents the analysis of variance of acceptability data from the 94 panelists. All scores for appearance, sweetness, flavor texture and overall acceptability hovered around 4.0 (like moderately) out of 5.0 (like very much) and no differences were significant. However, there was a trend for the flavor of the ice cream with standard lactose (5.8%) to be liked more than the others (p = 0.06) and a trend for the texture of the ice cream with low lactose (3.8%) to be liked less than the others (p = 0.06). The sample with 3.8% lactose may have been perceived as sweeter than the 7.8% lactose ice cream because lactose is less sweet sugar than the sucrose added in the 3.8% sample. Note that in Table 9, the 7.8% lactose ice cream received a numerically higher acceptability score for the sweetness than 3.8%, showing a trend that panelists preferred the
lower sweetness. The sweetness levels were verified by a trained panel (data not shown). They were able to determine 7.8% was less sweet than the sample with 3.8%.

It should be noted that the mean score is a little misleading since central tendencies with consumer data are common (Xiang et al. 2021). For one, panelists resist using the extreme because they anticipate better and worse samples to come. Additionally, if one panelist liked a sample very much (5.0) and another panelist disliked the same sample very much (1.0), the mean score ended up exactly in the middle (3.0 = neither dislike nor like). Therefore, it is useful to look at data in multiple ways.

Table 9. Summary of mean scores for appearance, sweetness, flavor, texture and overall acceptability of 3 ice cream samples with varying levels of lactose (n=94).

<table>
<thead>
<tr>
<th>Ice Cream Sample</th>
<th>Appearance</th>
<th>Sweetness</th>
<th>Flavor</th>
<th>Texture</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8% lactose</td>
<td>4.02a</td>
<td>3.72a</td>
<td>3.80a</td>
<td>3.71b</td>
<td>3.82a</td>
</tr>
<tr>
<td>5.8% lactose</td>
<td>3.90a</td>
<td>3.83a</td>
<td>4.00a</td>
<td>3.89ab</td>
<td>3.97a</td>
</tr>
<tr>
<td>7.8% lactose</td>
<td>3.99a</td>
<td>3.95a</td>
<td>3.80a</td>
<td>4.13a</td>
<td>3.89a</td>
</tr>
</tbody>
</table>

a mean scores in the same column sharing the same letter do not significantly differ (p > 0.05)

Looking at quartiles allowed us to decide that the most liked ice cream was the one made with a familiar level of lactose (typically what is seen with ice creams in stores), 5.8% (Table 10). The ice cream with 5.8% lactose was most liked, because its upper quartile and lower quartile are higher than those demonstrated for the other ice cream samples.

Table 10. Summary quartile scores for overall acceptability of 3 ice cream samples with varying levels of lactose (n=94).

<table>
<thead>
<tr>
<th>Ice Cream Sample</th>
<th>Lower Quartile</th>
<th>Upper Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8% lactose</td>
<td>3.64</td>
<td>3.96</td>
</tr>
<tr>
<td>5.8% lactose</td>
<td>3.85</td>
<td>4.18</td>
</tr>
<tr>
<td>7.8% lactose</td>
<td>3.68</td>
<td>4.00</td>
</tr>
</tbody>
</table>
Another way to look at the data, to determine if panelists preferred one sample over another is to compare differences in individual acceptability scores. Panelist scores for ice cream with 7.8% lactose were subtracted from panelist scores for ice cream with 3.8% lactose; scores for ice cream with 5.8% lactose were subtracted from panelist scores for ice cream with 3.8% lactose; and scores for ice cream with 7.8% lactose were subtracted from panelist scores for ice cream with 5.8% lactose. Those mean differences in scores are summarized in Table 11. In the table, positive scores indicate preference for the first listed sample over the second listed sample. Neutral numbers indicate that individuals did not prefer one sample over the other in the pair. Negative numbers indicate preference for the second listed sample over the first listed sample. The results tell us that individuals tended to give similar scores to samples based upon appearance, sweetness, and texture. However, there was a significant preference of individual panelists for the flavor of ice cream with 5.8% lactose over the flavor of the samples with 3.8% or 7.8% lactose (p < 0.05). There was also a tendency (p = 0.06) for individual panelists, overall, to prefer the ice cream with 5.8% lactose over the samples with 3.8% or 7.8% lactose. These results support what was reported previously in this document. Panelists tended to prefer the ice cream made with a typical amount of lactose over ice cream with lower or higher lactose. Nonetheless, the results suggest that acceptable ice cream can be made with the novel ingredient, whey permeate (Versilac), which is a cheaper source of whey than WPC80.

Table 11. Summary statistics for individual paired differences in acceptability scores for 3 ice cream samples with varying lactose.

<table>
<thead>
<tr>
<th>Ice Cream Sample</th>
<th>Appearance</th>
<th>Sweetness</th>
<th>Flavor</th>
<th>Texture</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8%-7.8% lactose</td>
<td>0.12&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.13&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.01&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>-0.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.04&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>3.8%-5.8% lactose</td>
<td>0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.24&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-0.27&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.21&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>5.8%-7.8% lactose</td>
<td>0.10&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.10&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.17&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>ab</sup> mean scores in the same column not sharing the same letter significantly differ (p < 0.05)
CHAPTER 5. CONCLUSIONS

The objectives of this research were to 1) to educate low-dairy consumers about various topics as they relate to the importance of consuming dairy, 2) educate consumers about labeling found on food packages (nutrition facts panels/ingredient statements) 3) motivate purchasing and consumption behaviors towards dairy products, and 4) test retention of health information provided in education messages after one month.

Overall, panelists self-reported high levels of learning during the modified focus groups, specifically for nutrition facts panels, ingredient statements, and information pertaining to the educational message they received. A high proportion of panelists who were in specific treatment groups reported learning a significant amount more about lactose maldigestion, nine essential nutrients in dairy, or prebiotics and probiotics, than the other groups who did not receive that educational message. These results were validated by correct answers to quizzes about added sugars, meaning of daily value, a lactose calculation from a nutrition facts panel, and the number of essential nutrients in dairy foods. Although the lessons seemed to motivate purchasing and consumption behavior change initially, these actions did not last, as panelists rarely increased dairy products purchasing or consumption in the month following the MFGs.

Considering the outcomes guided by the Social Marketing Theory, the materials and methodology in this study can be relatively easily revised, by incorporating more interaction among panelists and facilitators, and improving clarity of instructions and survey questions, to not only improve learning, but promote lasting change in positive behaviors with dairy products. Addition of at least one food frequency questionnaire may also help track food consumption more effectively.
A trend was shown that panelists enjoy ice cream they are familiar with, ice cream with 5.8% lactose, more than ice cream with lower (3.8%) or higher (7.8%) lactose. For appearance, sweetness, flavor, texture, and overall acceptability, the three samples received similar “like moderately” scores, indicating the potential to use whey permeate in ice cream. The fact that some participants liked the high lactose containing ice cream over the low-level lactose ice cream may have inspired thoughts about potential behavior changes in those panelists. When asked about potentially purchasing ice cream with added lactose if it cost less than regular ice cream, half of participants said they would be likely to do this. This supports the aspect of Social Marketing Theory that suggests creating change is improved through showing panelists the benefit of what you are trying to motivate their behaviors towards.

Overall, this study demonstrates that carefully constructed dairy educational messages can be learned and retained by consumers. However, it also revealed the complexity of trying to motivate lasting behavior change in nutrition education and dairy purchasing and consumption. Consumers tend to like, purchase and consume what is familiar to them and continue to do it until a major change is made within their life unless motivated to make a change. A strength of the SMT is that it is a cyclic process, allowing people utilizing this theory to go back and make corrections/additions to their material. Some recommendations to motivate more pronounced and lasting changes are included in the next section.

**Recommendations for Further Research**

The current study utilized SMT steps 3 (creation of educational materials for those screened to be low dairy consumers) and 4 (implementation of these educational materials based on the target audience) for the creation and distribution of materials. Researchers must utilize SMT steps 5 (assessing effectiveness) and 6 (refine materials) to make changes to their educational messages, or data collection to ensure change is motivated and maintained.
Additionally, ways to ensure panelists are reminded frequently about these topics can ensure proper retention of the information. This may be hard to do once panelists leave the MFG, as they are on their own, but during the MFG, walking panelists through the information a second time before they leave may help. Another way to help retention would be to have panelists come back for additional MFGs to increase the times they see the content, and then test retention after panelists have seen it many times. It is also important for researchers to evaluate the effectiveness of different methods used in this study to try to motivate behavior change. This could be done through questions asking about how methods used impacted the panelists. Once researchers understand which methods were effective in learning and motivating behavior change, these methods should be implemented into all areas of the study to improve effectiveness in all areas.

With the multitude of data received off these surveys, further data analysis should be done to find trends and correlations within the data. Future mining may be able to show correlation between different demographics and the importance of eating healthy, different and trends in consumption, demographics and effectiveness of messages, etc. Additionally, finding trends in population segments (which ones are more open minded, which ones may be open to changing behaviors, which ones may be more intrigued to consume dairy, etc.) should be evaluated. There are many trends that can be examined from the data, which may be beneficial in some sense and may lead to further research down the road.

This study is also being replicated by researchers at Kansas State University, with their data analysis ongoing at the time. Once completed, all data will be compiled and will be further analyzed.
REFERENCES


APPENDIX A. INVITATION TO PARTICIPATE IN FOOD CHOICES AND INTOLERANCES QUALTRICS SURVEY

Study Participants Needed!

Food Choices and Intolerances Survey (chance at a $25 Amazon gift card)!

We invite you to participate in a research study (Qualtrics survey) to understand consumer choices for and intolerances to foods and beverages.

To participate, you must:

1. be at least 18 years old
2. personally purchase foods and beverages at least once per month
3. follow this link: https://iastate.qualtrics.com/jfe/form/SV_1NzG8MRMkG5Nlx

The survey should take no longer than 15 minutes to complete.

Compensation: chance at one of two randomly selected $25 Amazon gift certificates!

Feel free to share this invitations with friends and colleagues!

If you have questions about the collaborative study, please contact Dr. Stephanie Clark (milkmade@iastate.edu) or Dr. Karen Schmidt (kschmidt@kstate.edu).

IOWA STATE UNIVERSITY
Food Science and Human Nutrition

This study has been approved for involvement of human subjects by the Iowa State University Institutional Review Board.
APPENDIX B. FOOD CHOICES AND INTOLERANCES CONSENT FORM

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

If you agree to the terms, please type your name, and continue to the survey.
APPENDIX C. FOOD CHOICES AND INTOLERANCES QUALTRICS SURVEY

Q1 1. Please indicate the nearest city you are located.
   a) Ames, IA (1)
   b) Ankeny, IA (2)
   c) Nevada, IA (3)
   d) Des Moines, IA (4)
   e) Iowa City, IA (5)
   f) Manhattan, KS (6)
   g) Junction City, KS (7)
   h) Topeka, KS (8)
   i) Salina, KS (9)
   j) Outside of Iowa and Kansas (10)

Q2 2. Eating healthy is __________ to me.
   a) Not important (1)
   b) Somewhat important (2)
   c) Moderately important (3)
   d) Important (4)
   e) Very important (5)

Q3 3. I go out of my way to consume foods containing (check any and all responses that are true for you at this point in time):
   a) I don't go out of my way to consume any of the listed options (12)
   b) Cereal grains (e.g., oat, rice, wheat) (1)
   c) Dairy (e.g., milk, yogurt, ice cream, etc.) (2)
   d) Eggs (3)
   e) Meat (e.g., beef, pork, poultry) (4)
   f) Peanuts (5)
   g) Pulses (e.g., beans, peas, lentils, etc.) (6)
   h) Seafood (including shellfish) (7)
   i) Soy (including tofu) (8)
   j) Tree nuts (e.g., almonds, pecans) (9)
   k) Vegetables (e.g., zucchini, broccoli, etc.) (10)
   l) Fruits (e.g., kiwi, banana, avocado) (14)
   m) Other not listed (11) ________________________________________________

Q4 4. I go out of my way to avoid foods containing (check all responses that are true for you at this point in time):
   a) I do not avoid any of the listed options (12)
   b) Cereal grains (e.g., oat, rice, wheat) (1)
   c) Dairy (e.g., milk, yogurt, ice cream, etc.) (2)
   d) Eggs (3)
   e) Meat (e.g., beef, pork, poultry) (4)
   f) Peanuts (5)
   g) Pulses (e.g., beans, peas, lentils, etc.) (6)
h) Seafood (including shellfish) (7)
i) Soy (including tofu) (8)
j) Tree nuts (e.g., almonds, pecans) (9)
k) Vegetables (e.g., zucchini, broccoli, etc.) (10)
l) Fruits (e.g., kiwi, banana, avocado) (14)
m) Other not listed (11) ________________________________________________

Q5 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):
   a) I have not been diagnosed with a food allergy or food intolerance (12)
   b) Cereal grains (e.g., oat, rice, wheat) (1)
   c) Dairy (e.g., milk, yogurt, ice cream, etc.) (2)
   d) Eggs (3)
   e) Meat (e.g., beef, pork, poultry) (4)
   f) Peanuts (5)
   g) Pulses (e.g., beans, peas, lentils, etc.) (6)
   h) Seafood (including shellfish) (7)
   i) Soy (including tofu) (8)
   j) Tree nuts (e.g., almonds, pecans) (9)
   k) Vegetables (e.g., zucchini, broccoli, etc.) (10)
   l) Fruits (e.g., kiwi, banana, avocado) (13)
   m) Other not listed (11) ________________________________________________

Q6 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):
   a) I experience no digestive discomfort or issues from any of these foods (12)
   b) Cereal grains (e.g., oat, rice, wheat) (1)
   c) Dairy (e.g., milk, yogurt, ice cream, etc.) (2)
   d) Eggs (3)
   e) Meat (e.g., beef, pork, poultry) (4)
   f) Peanuts (5)
   g) Pulses (e.g., beans, peas, lentils, etc.) (6)
   h) Seafood (including shellfish) (7)
   i) Soy (including tofu) (8)
   j) Tree nuts (e.g., almonds, pecans) (9)
   k) Vegetables (e.g., zucchini, broccoli, etc.) (10)
   l) Other not listed (11) ________________________________________________

Q7 7. In the past week, I have experienced (check any and all responses that are true for you at this point in time):
   a) I experienced none of these symptoms (1)
   b) Bloating (2)
   c) Constipation (3)
   d) Cramping (4)
   e) Diarrhea (5)
Q8. **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):

- a) I do not avoid any of these foods (18)
- b) I generally do not like the taste of it/them (1)
- c) I do not like the texture of it/them (2)
- d) I had a bad experience with it and won’t eat it anymore (3)
- e) I am a vegetarian (4)
- f) I am a vegan (5)
- g) Follow a diet that excludes one or more food category (e.g., Keto, Paleo, Whole) (6)
- h) Doctor recommendation (7)
- i) Registered Dietitian Nutritionist recommendation (8)
- j) Friend recommendation (9)
- k) Website recommendation (10)
- l) Cost is prohibitory (11)
- m) Religious reason (12)
- n) Culture/ethnicity reasons (19)
- o) Concern for environment (13)
- p) Concern for animal welfare (14)
- q) Weight control (15)
- r) Nutrition concern (16)
- s) Other not listed (17) ____________________________________________

Q9. 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):

- a) Not applicable (11)
- b) More calcium (1)
- c) More protein (2)
- d) More vitamin D (3)
- e) More prebiotics (10)
- f) More probiotics (9)
- g) Less added sugar (4)
- h) Less carbohydrates (5)
- i) Less fat (6)
- j) Less sodium (7)
- k) Less sugar (8)

Q10. I go out of my way to (check any and all responses that are true for you at this point in time):

- a) Buy local (1)
- b) Buy lactose-free (2)
- c) Buy probiotic foods (3)
d) Buy prebiotic foods (10)
e) Buy organic foods (4)
f) Buy more plant-based foods (5)
g) Buy more nutrient-dense foods (11)
h) Cook for myself (6)
i) Move regularly (7)
j) Learn about what I put in my body (8)
k) Reduce my carbon footprint (9)
l) I don’t pay attention to any of these things (14)

Q11 11. I look at the Nutrition Facts panel when buying a new product:
   a) Never (1)
   b) Rarely (2)
   c) Sometimes (3)
   d) Always (4)

Q12 12. I can read and easily understand Nutrition Facts panels:
   a) Cannot (1)
   b) Not easily (2)
   c) Moderately easily (3)
   d) Easily (4)
   e) Very easily (5)

Q13 13. I look at the ingredients label when buying a new product:
   a) Never (1)
   b) Rarely (2)
   c) Sometimes (3)
   d) Always (4)

Q14 14. I can read and easily understand ingredients labels:
   a) Cannot (1)
   b) Not easily (2)
   c) Moderately easily (3)
   d) Easily (4)
   e) Very easily (5)

Q15 15. Which of the following statements apply to you (check all that apply)?
   a) I consume at least 5.5 ounces (5 1/2 servings) of protein each day (1)
   b) I consume at least 2 cups (2 servings) of fruits each day (2)
   c) I consume at least 2.5 cups (2 1/2 servings) of vegetables each day (3)
   d) I consume at least 3 cups (3 servings) of dairy each day (4)
   e) At least half of the grains that I consume are whole grains (5)
   f) I limit my consumption of added sugars, solid fats, and salt (6)
   g) I drink more water than sugary drinks (7)

Q16 16. Would you like to be invited to participate in a follow-up study that involves ice cream?
a) Yes (4)  
b) No (2)

Display This Question:
If Q16 = 4

Q17 Write your email.

___________________________________________________

NOTE: E-mail address was only for invitations to Modified Focus Groups and was NOT directly associated with data.
APPENDIX D. MODIFIED FOCUS GROUP 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 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)

**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 E. MODIFIED FOCUS GROUP PRE-SURVEY

Q0 Please type the 3-digit code (on your folder) into the box to continue the survey. __________
As you fill out the survey, note that you do not have to tap the “Done” button each time. Just scroll down to proceed.

Q1 1. What best describes your gender?
   a) Prefer not to answer (2)
   b) Male (3)
   c) Female (4)
   d) Prefer to self-describe as: (5) _______________________________________________

Q2 2. Within what range does your age fall?
   a) 18-24 (1)
   b) 25-34 (2)
   c) 35-44 (3)
   d) 45-54 (4)
   e) 55 and above (5)
   f) prefer not to answer (6)

Q3 3. Which of the following best describe(s) your race and ethnicity? (Check all that apply)
   a) Prefer not to answer (12)
   b) American Indian, Alaskan Native, Indigenous Person of Americas (1)
   c) Native Hawaiian or Other Pacific Islander (2)
   d) Asian American or Asian Origin (3)
   e) Latin American, Hispanic, Latino or Spanish Origin (6)
   f) African American, Black or African Origin (20)
   g) White (22)
   h) Other (23) ________________________________________________

Q6 6. What is the number of people who live in your household (including self)?
   a) 1 (12)
   b) 2 (1)
   c) 3 (2)
   d) 4 or more (3)

Q7 7. Eating healthy is __________ to me
   a) not important (1)
   b) somewhat important (2)
   c) moderately important (3)
   d) important (4)
   e) very important (5)
Q8 8. I look at the Nutrition Facts panels when buying a new product:
   a) Never (1)
   b) Rarely (2)
   c) Sometimes (3)
   d) Always (4)

Q9 9. I can ______ understand Nutrition Facts panels:
   a) not easily (1)
   b) moderately easily (2)
   c) easily (3)
   d) very easily (10)

Q10 10. I look at the ingredients labels when buying a new product:
   a) Never (1)
   b) Rarely (2)
   c) Sometimes (3)
   d) Always (4)

Q11 11. I can ______ understand ingredients labels:
   a) not easily (2)
   b) moderately easily (3)
   c) easily (10)
   d) very easily (4)

Q12 12. Which of the following statements apply to you? (Check all that apply)
   a) 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)
   b) I consume at least 2 servings of fruits each day (1 svg = 1 cup fruit, 1/2 cup fruit juice, etc.) (2)
   c) I consume at least 2 1/2 servings of vegetables each day (1 svg = 1 cup raw vegetable, 2 cups leafy greens, etc.) (3)
   d) 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)
   e) At least half of the grains that I consume are whole grains (5)
   f) I limit my consumption of added sugars, solid fats, and salt (6)
   g) I drink more water than sugary drinks (7)

Q13 13. To what extent do you make an effort to limit lactose consumption?
   a) not at all (4)
   b) sometimes (2)
   c) always (5)

Q0 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.

Q14 14. 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.
   a) false (1)
   b) true (2)

Q15 15. Which of these ingredients are considered added sugars? (Check any and all that apply)
   a) Corn syrup (1)
   b) Milk (2)
   c) 100% Fruit juice (3)
   d) Table sugar (4)
   e) Honey (5)
   f) Whey (6)

Q16 16. How many essential nutrients are naturally found in dairy products (milk, yogurt, cheese, ice cream)?
   a) I don't know (1)
   b) none (2)
   c) 1 (3)
   d) 3 (4)
   e) 5 (5)
   f) 7 (6)
   g) 9 (7)

Q17 17. I know _________ about lactose maldigestion.
   a) nothing (1)
   b) a little (2)
   c) a moderate amount (3)
   d) a lot (4)

Q18 18. I know ____________ about probiotics.
   a) nothing (1)
   b) a little (2)
   c) a moderate amount (3)
   d) a lot (4)

Q19 19. I know _____________ about prebiotics.
   a) nothing (1)
   b) a little (2)
   c) a moderate amount (3)
   d) a lot (4)
Q00 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.)

Q20 20. Do you consider yourself the primary food purchaser in your household?
   a) no, someone else is (1)
   b) no, shopping is shared equally with another (2)
   c) yes, I am the primary purchaser (4)

Q21 21. How much milk did you purchase for home use this month?
   a) none (1)
   b) <1 gallon (2)
   c) 1 gallon (3)
   d) > 1 gallon (5)

Q22 22. How much milk did you (personally) consume at home this month?
   a) none (1)
   b) <1 gallon (2)
   c) 1 gallon (3)
   d) > 1 gallon (4)

Q23 23. Which of the following MOST influences the milk you buy for your home?
   a) family member's brand or flavor preference (1)
   b) my personal brand or flavor preference (2)
   c) product's ingredients or nutrition (3)
   d) price (5)
   e) other not listed: (4) ________________________________

Q24 24. How much yogurt did you purchase for home use this month?
   a) none (1)
   b) up to 3 servings (2)
   c) 3 - 5 servings (3)
   d) more than 5 servings (4)

Q25 25. How much yogurt did you (personally) consume at home this month?
   a) none (1)
   b) up to 3 servings (2)
   c) 3 - 5 servings (3)
   d) more than 5 servings (4)

Q26 26. Which of the following MOST influences the yogurt you buy for your home?
   a) family member's brand or flavor preference (1)
   b) my personal brand or flavor preference (2)
   c) product's ingredients or nutrition (3)
   d) other not listed: (4) ________________________________
   e) price (5)
Q27. How much cheese did you purchase for home use this month?
   a) none (1)
   b) up to 1 package (8 oz) (2)
   c) 1 - 2 packages (1 lb.) (3)
   d) more than 1 lb. (4)

Q28. How much cheese did you (personally) consume at home this month?
   a) none (1)
   b) up to 1 package (8 oz) (2)
   c) 1 - 2 packages (1 lb.) (3)
   d) more than 1 lb. (4)

Q29. Which of the following MOST influences the cheese you buy for your home?
   a) family member's brand or flavor preference (1)
   b) my personal brand or flavor preference (2)
   c) product's ingredients or nutrition (3)
   d) other not listed: (4) _____________________________________________
   e) price (5)

Q30. How much ice cream did you purchase for home use this month?
   a) none (1)
   b) 1 - 3 scoops (2)
   c) about 16 ounces (1 pint) (3)
   d) about 32 ounces (1 quart) (4)
   e) more than 1 quart (5)

Q31. How much ice cream did you (personally) consume at home this month?
   a) none (1)
   b) 1 - 3 scoops (2)
   c) about 16 ounces (1 pint) (3)
   d) about 32 ounces (1 quart) (4)
   e) more than 1 quart (5)

Q32. Which of the following MOST influences the ice cream you buy for your home?
   a) family member's brand or flavor preference (1)
   b) my personal brand or flavor preference (2)
   c) product's ingredients or nutrition (3)
   d) other not listed: (4) _____________________________________________
   e) price (5)
Q33 33. How often do you try something different in the dairy category? (Brand, packaging, product, flavor, etc.)?
   a) never (1)
   b) maybe every 3-4 months (2)
   c) maybe every 1-2 months (3)
   d) at least once a month (4)

Q34 34. 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)
   a) higher protein (1)
   b) lower sugar (2)
   c) lower added sugars (3)
   d) lower lactose (4)
   e) higher lactose (5)
   f) plant-based ingredients (6)
   g) prebiotic ingredients (7)
   h) probiotic bacteria (8)
   i) more information about the product (11)
   j) other (12) ________________________________________________

Q35 35. 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)
   a) I would not read more about any of these things (1)
   b) sustainability about the product, ingredients, or packaging (2)
   c) the purpose of ingredients with unfamiliar names (e.g., annatto, carrageenan) (3)
   d) the natural and added sources of sugar in the product (4)
   e) animal welfare conditions surrounding the product (5)
   f) a summary of scientific research demonstrating benefits or risks from consuming the type of product (6)
   g) information about the animals, farm, farmer, or manufacturer who handled the product (8)
   h) the natural and synthetic sources of ingredients in the product (9)
SPEAKER: Derek

Hello, my name is Derek, 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. Stephanie Clark (point), Dr. Karen Schmidt (point), and Derek Schweiger (who is 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. Clark will read out loud. After Dr. Clark leads 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. Clark [Read the consent form; answer questions without divulging information about stages of the experiment beyond what has been revealed in the consent form]

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

SPEAKER: Derek

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 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: Dr. Clark**

In the next part of the study, we will ask you to taste three sample of vanilla ice cream, ONE AT A TIME.

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 sample associated with that number. We ask you to taste the product, but you do not have to eat the entire scoop of ice cream. The upside-down cup may be used to spit it out if you do not like a sample.

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 2\textsuperscript{nd} or 3\textsuperscript{rd} sample.

When you finish a sample, please raise your hand, and we will bring you your second sample, which you should score on your second sheet. When done with that one, move the sheet over to the left, and raise your hand for the third sample, which, again, we ask that you evaluate on the third sheet.
Are there any questions?

\textit{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. When done with 3 samples, please turn your sensory sheets over and exhibit the STOP sign.

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

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).**

**SPEAKER: Derek**

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. We will now distribute the $15 cash to each of you. Please count the cash, then turn to the receipt and sign that form.

We ask that you leave that signed form, and all other white pages in the folder BUT we welcome you to take any of the colored pages with you.

**Do you have any final questions?**

Thank you once again for participating in this study—enjoy your day!
APPENDIX G. NINE ESSENTIAL NUTRIENTS LESSON

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 H. PROBIOTIC AND PREBIOTIC LESSON

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?
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 J. ICE CREAM NUTRITION FACTS AND INGREDIENTS PANEL

Sample # 976: 3.8% lactose.  Sample # 434: 5.8% lactose  Sample # 236: 7.8% lactose

### Nutrition Facts

**Sample # 976**

<table>
<thead>
<tr>
<th>Amount per serving</th>
<th>Calories</th>
<th>% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>15g</td>
<td>19%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>10g</td>
<td>50%</td>
</tr>
<tr>
<td>Trans Fat</td>
<td>0g</td>
<td></td>
</tr>
<tr>
<td>Cholesterol</td>
<td>60mg</td>
<td>20%</td>
</tr>
<tr>
<td>Sodium</td>
<td>60mg</td>
<td>3%</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>31g</td>
<td>11%</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>0g</td>
<td>0%</td>
</tr>
<tr>
<td>Total Sugars</td>
<td>28g</td>
<td></td>
</tr>
<tr>
<td>Includes 23g Added Sugars</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>4g</td>
<td></td>
</tr>
<tr>
<td>Vitamin D</td>
<td>2mcg</td>
<td>10%</td>
</tr>
<tr>
<td>Calcium</td>
<td>132mg</td>
<td>10%</td>
</tr>
<tr>
<td>Iron</td>
<td>2mg</td>
<td>10%</td>
</tr>
<tr>
<td>Potassium</td>
<td>138mg</td>
<td>2%</td>
</tr>
</tbody>
</table>

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

**CONTAINS:** Milk

### Nutrition Facts

**Sample # 434**

<table>
<thead>
<tr>
<th>Amount per serving</th>
<th>Calories</th>
<th>% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>15g</td>
<td>19%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>10g</td>
<td>50%</td>
</tr>
<tr>
<td>Trans Fat</td>
<td>0g</td>
<td></td>
</tr>
<tr>
<td>Cholesterol</td>
<td>60mg</td>
<td>20%</td>
</tr>
<tr>
<td>Sodium</td>
<td>85mg</td>
<td>4%</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>31g</td>
<td>11%</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>0g</td>
<td>0%</td>
</tr>
<tr>
<td>Total Sugars</td>
<td>28g</td>
<td></td>
</tr>
<tr>
<td>Includes 23g Added Sugars</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>5g</td>
<td></td>
</tr>
<tr>
<td>Vitamin D</td>
<td>2mcg</td>
<td>10%</td>
</tr>
<tr>
<td>Calcium</td>
<td>165mg</td>
<td>15%</td>
</tr>
<tr>
<td>Iron</td>
<td>2mg</td>
<td>10%</td>
</tr>
<tr>
<td>Potassium</td>
<td>185mg</td>
<td>4%</td>
</tr>
</tbody>
</table>

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

**CONTAINS:** Milk

### Nutrition Facts

**Sample # 236**

<table>
<thead>
<tr>
<th>Amount per serving</th>
<th>Calories</th>
<th>% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>15g</td>
<td>19%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>10g</td>
<td>50%</td>
</tr>
<tr>
<td>Trans Fat</td>
<td>0g</td>
<td></td>
</tr>
<tr>
<td>Cholesterol</td>
<td>60mg</td>
<td>20%</td>
</tr>
<tr>
<td>Sodium</td>
<td>105mg</td>
<td>5%</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>31g</td>
<td>11%</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>0g</td>
<td>0%</td>
</tr>
<tr>
<td>Total Sugars</td>
<td>24g</td>
<td></td>
</tr>
<tr>
<td>Includes 18g Added Sugars</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>5g</td>
<td></td>
</tr>
<tr>
<td>Vitamin D</td>
<td>3mcg</td>
<td>15%</td>
</tr>
<tr>
<td>Calcium</td>
<td>199mg</td>
<td>15%</td>
</tr>
<tr>
<td>Iron</td>
<td>2mg</td>
<td>10%</td>
</tr>
<tr>
<td>Potassium</td>
<td>235mg</td>
<td>6%</td>
</tr>
</tbody>
</table>

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

**CONTAINS:** Milk
APPENDIX K. ACCEPTABILITY BALLOT

Sample #:           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**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>dislike very much much</td>
<td>dislike slightly</td>
<td>neither dislike nor like</td>
<td>like slightly</td>
<td>like very</td>
</tr>
</tbody>
</table>

**Sweetness**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>dislike very much much</td>
<td>dislike slightly</td>
<td>neither dislike nor like</td>
<td>like slightly</td>
<td>like very</td>
</tr>
</tbody>
</table>

**Flavor**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>dislike very much much</td>
<td>dislike slightly</td>
<td>neither dislike nor like</td>
<td>like slightly</td>
<td>like very</td>
</tr>
</tbody>
</table>

**Texture/Mouthfeel**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>dislike very much much</td>
<td>dislike slightly</td>
<td>neither dislike nor like</td>
<td>like slightly</td>
<td>like very</td>
</tr>
</tbody>
</table>

**Overall Liking**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>dislike very much much</td>
<td>dislike slightly</td>
<td>neither dislike nor like</td>
<td>like slightly</td>
<td>like very</td>
</tr>
</tbody>
</table>

Comments are welcome:
APPENDIX L. NUTRITION FACTS PANEL INFOGRAPHIC

UNDERSTANDING NUTRITION FACTS PANELS
YOUR DAILY TOOL FOR MAKING NUTRITIONAL CHOICES

% 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 Lactase Education Project
Adapted from FDA.gov/nutritioneducation
Contact milkmade@iastate.edu
APPENDIX M. NINE ESSENTIAL NUTRIENTS INFOGRAPHIC

NINE ESSENTIAL NUTRIENTS IN DAIRY

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

- Calcium
- Protein
- Vitamin D
- Phosphorus
- Vitamin A
- Pantothenic Acid
- Vitamin B-12
- Riboflavin
- Niacin

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

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 malabsorption, 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
APPENDIX O. LACTOSE INFOGRAPHIC

LACTOSE
Naturally found in most dairy products.

LACTASE
the enzyme lactase
"cuts" lactose into 2
simple sugars:
GLUCOSE & GALACTOSE

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
APPENDIX P. MODIFIED FOCUS GROUP POST-SURVEY

Please enter the 3-digit code written on your folder: ______
Please respond to each question regarding what you know or how you feel right now. (NOTE: you do not have to tap the "Done" button each time. Just scroll down.)

Q1. How much did you learn about how to read and use **food ingredients labels** today?
   a) nothing new (1)
   b) very little (2)
   c) a moderate amount (3)
   d) a lot (4)

Q2. I plan to look at **food ingredient labels** when buying new products in the future.
   a) Never (1)
   b) Sometimes (2)
   c) Frequently (3)
   d) Every time (4)

Q3. Which of these ingredients are considered added sugars? (Check all that apply)
   a) Honey (1)
   b) Table sugar (2)
   c) Milk (3)
   d) Corn syrup (4)
   e) 100% fruit juice (5)
   f) Whey (6)

Q4. 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.
   a) False (1)
   b) True (2)

Q5. How much did you learn about how to read and use **Nutrition Facts panels** today?
   a) nothing new (1)
   b) very little (2)
   c) a moderate amount (3)
   d) a lot (4)

Q6. I plan to look at **Nutrition Facts panels** when buying new products in the future.
   a) Never (1)
   b) Sometimes (2)
   c) Frequently (3)
   d) Every time (4)
Q7 7. Using the Nutrition Facts label of this low-fat vanilla yogurt, how much lactose is in a serving?
   a) I don't know (2)
   b) 6 grams (3)
   c) 8 grams (4)
   d) 14 grams (5)

Q8 8. How much did you learn about essential nutrients in dairy products today?
   a) I was not in that focus group (1)
   b) nothing new (2)
   c) very little (3)
   d) a moderate amount (4)
   e) a lot (5)

Q9 9. How many essential nutrients are naturally found in dairy products (milk, yogurt, cheese, ice cream)?
   a) I don't know (1)
   b) none (2)
   c) 1 (3)
   d) 3 (4)
   e) 5 (5)
   f) 7 (6)
   g) 9 (9)

Q10 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?
   a) I will decrease my dairy purchases/consumption (2)
   b) I will not change my behavior (3)
   c) I will increase my dairy purchases/consumption (4)

Q11 11. How much did you learn about lactose maldigestion today?
   a) I was not in that focus group (1)
   b) nothing new (2)
   c) very little (3)
   d) a moderate amount (4)
   e) a lot (5)
Q12. Based on what you learned about lactose maldigestion today, how will it change your dairy products purchasing and consumption in the future?
   a) I will decrease my dairy purchases/consumption (2)
   b) I will not change my behavior (3)
   c) I will increase my dairy purchases/consumption (4)

Q13. How much did you learn about probiotics and prebiotics today?
   a) I was not in that focus group (1)
   b) nothing new (2)
   c) very little (3)
   d) a moderate amount (4)
   e) a lot (5)

Q14. Based on what you learned about probiotics and prebiotics today, how will it change dairy products purchasing and consumption in the future?
   a) I will decrease my dairy purchases/consumption (2)
   b) I will not change my behavior (3)
   c) I will increase my dairy purchases/consumption (4)

0000 Please answer the following questions regarding possible new dairy products in the market.

Q15. 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?
   a) Much less likely (1)
   b) Somewhat less likely (2)
   c) Equally likely (4)
   d) Slightly more likely (5)
   e) Much more likely (6)

Q16. How much less or more likely are you to purchase milk with extra lactose if it would cost less than regular milk?
   a) much less likely (1)
   b) somewhat less likely (2)
   c) equally likely (3)
   d) somewhat more likely (4)
   e) much more likely (5)

Q17. How much less or more likely would you purchase cheese with extra lactose if it would cost less than regular cheese?
   a) Much less likely (1)
   b) Somewhat less likely (2)
   c) Equally likely (5)
d) Somewhat more likely (4)
e) Much more likely (6)

Q18 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?
   a) much less likely (1)
   b) somewhat less likely (2)
   c) equally likely (3)
   d) somewhat more likely (4)
   e) much more likely (5)

Q19 19. How much less or more likely might you be to purchase “probiotic” or “prebiotic” milk than regular milk?
   a) Much less likely (1)
   b) Somewhat less likely (2)
   c) Equally likely (3)
   d) Somewhat more likely (4)
   e) Much more likely (5)

Q20 20. How much less or more likely might you be to purchase cheese labelled with "probiotic" or "prebiotic" compared to cheese without the statement?
   a) Much less likely (1)
   b) Somewhat less likely (2)
   c) Equally likely (3)
   d) Somewhat more likely (4)
   e) Much more likely (5)

Q21 21. If “probiotic” or “prebiotic” ice cream were available in stores, how much less or more likely might you bet to purchase it than regular ice cream?
   a) Much less likely (1)
   b) Somewhat less likely (2)
   c) Equally likely (3)
   d) Somewhat more likely (4)
   e) Much more likely (5)

Q22 22. Additional comments are welcome below:

________________________________________________________________
APPENDIX Q. ONE MONTH POST MODIFIED FOCUS GROUP CONSENT FORM

Consent form for participation in 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

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.)
APPENDIX R. ONE MONTH POST MODIFIED FOCUS GROUP FOLLOW UP SURVEY

Q2 2. How often have you looked at food ingredient labels in the past 3 weeks?
   a) Never (1)
   b) A few times (fewer than 3 food products I have considered purchasing) (2)
   c) Frequently (at least 3 food products I have considered purchasing) (3)
   d) Every time (4)

Q3 3. How often have you looked at Nutrition Facts panels in the past 3 weeks?
   a) Never (1)
   b) A few times (fewer than 3 food products I have considered purchasing) (2)
   c) Frequently (at least 3 food products I have considered purchasing) (3)
   d) Every time (4)

Q4 4. Which of these ingredients are considered added sugars? (Check all that apply)
   a) Honey (1)
   b) Table sugar (2)
   c) Milk (3)
   d) Corn syrup (4)
   e) 100% fruit juice (5)
   f) Whey (6)

Q5 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.
   a) False (1)
   b) True (2)

Q6 6. Using the Nutrition Facts label of this low-fat vanilla yogurt, how much lactose is in a serving?
   a) I don't know (1)
   b) 6 grams (2)
   c) 8 grams (3)
   d) 14 grams (4)

Q7 7. How many essential nutrients are naturally in dairy products?
   a) I don't know (1)
   b) none (2)
   c) 1 (3)
   d) 3 (4)
   e) 5 (5)
   f) 7 (6)
000 Answer the next few questions based on purchases for your household in the past 3 weeks.

Q8 8. How often have you modified a purchase based on amount of lactose in a product in the past 3 weeks?
   a) Never (1)
   b) A few times (fewer than 3 food products I have considered purchasing) (2)
   c) Frequently (at least 3 food products I have considered purchasing) (3)
   d) Every time (4)

Q9 9. How often have you modified a purchase based on added sugars in a product in the past 3 weeks?
   a) Never (1)
   b) A few times (fewer than 3 food products I have considered purchasing) (2)
   c) Frequently (at least 3 food products I have considered purchasing) (3)
   d) Every time (4)

Q10 10. How often have you modified a purchase based on probiotics or prebiotics in a product in the past 3 weeks?
   a) Never (1)
   b) A few times (fewer than 3 food products I have considered purchasing) (2)
   c) Frequently (at least 3 food products I have considered purchasing) (3)
   d) Every time (4)

Q11 11. How much milk did you purchase in the past 3 weeks?
   a) None (1)
   b) Less than one gallon (2)
   c) A gallon (3)
   d) More than one gallon (4)

Q12 12. How much milk did you (personally) drink in the past 3 weeks?
   a) None (1)
   b) Less than one gallon (2)
   c) A gallon (3)
   d) More than one gallon (4)

Q13 13. How much yogurt did you purchase in the past 3 weeks?
   a) None (1)
   b) Up to 3 servings (2)
   c) 3-5 servings (3)
   d) More than 5 servings (4)
Q14 14. How much yogurt did you (personally) consume in the past 3 weeks?
   a) None (1)
   b) Up to 3 servings (2)
   c) 3-5 servings (3)
   d) More than 5 servings (4)

Q15 15. How much cheese did you purchase in the past 3 weeks? (Consider a serving 1.5 ounces)
   a) None (1)
   b) One package (8 oz) (2)
   c) Two packages (1 lb.) (3)
   d) More than 1 lb. (4)

Q16 16. How much cheese did you (personally) eat in the past 3 weeks? (Consider a serving 1.5 ounces)
   a) None (1)
   b) One package (8 oz) (2)
   c) Two packages (1 lb.) (3)
   d) More than 1 lb. (4)

Q17 17. How much ice cream did you purchase in the past 3 weeks?
   a) None (1)
   b) 1-3 scoops (2)
   c) about 16 oz (1 pint) (3)
   d) about 32 oz (quart) (4)
   e) more than 32 oz (5)

Q18 18. How much ice cream did you (personally) eat in the past 3 weeks?
   a) None (1)
   b) 1-3 scoops (2)
   c) about 16 oz (1 pint) (3)
   d) about 32 oz (quart) (4)
   e) more than 32 Fl oz (5)

0000 Please answer the following questions considering possible new dairy products in the market.

Q19 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?
   a) Much less likely (1)
   b) Somewhat less likely (2)
c) Equally likely (3)
d) Somewhat more likely (4)
e) Much more likely (5)

Q20 20. How much less or more likely will you be to purchase milk with extra lactose if it costs less than regular milk?
   a) Much less likely (1)
   b) Somewhat less likely (2)
   c) Equally likely (3)
   d) Somewhat more likely (5)
   e) Much more likely (4)

Q21 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?
   a) Much less likely (1)
   b) Somewhat less likely (2)
   c) Equally likely (3)
   d) Somewhat more likely (5)
   e) Much more likely (4)

Q22 22. If “probiotic” or “prebiotic” ice cream available in stores, how much less or more likely will you be to purchase it?
   a) Much less likely (1)
   b) Somewhat less likely (2)
   c) Equally likely (3)
   d) Somewhat more likely (4)
   e) Much more likely (5)

Q23 23. Additional comments related to last month's focus group, or your dairy products purchases and consumption are welcome below: