5-2022

Calcium Intake Among Parents and Caregivers of Children with a Milk Allergy or Intolerance : A Comparative Analysis

Ilana Dubrovsky-Razam

Abstract

Food allergies have become a global epidemic, affecting over 10% of the general population and 8% of children worldwide. Eliminating or limiting a food group from the diet can have adverse effects on micronutrient consumption. Milk allergies, for instance, can influence the amount of calcium consumed in the diet, particularly when limiting or excluding milk/milk-containing products from the diet. As milk products tend to be a primary source of dietary calcium, a milk allergy can serve as a barrier to meeting daily calcium needs.

Previous literature has analyzed the influence parents and caregivers have on their children's diet, however, there is a gap in literature that analyzes the impact a child's diet may have on members of their household. Moreover, there are no studies to the researchers' knowledge that investigate the dietary impact that a child's milk allergy may have on their parent or caregiver. To investigate the correlation between a child's milk allergy and their parent's or caregiver's calcium consumption, this study surveyed parents and caregivers of a child with a milk allergy, intolerance, or suspected milk allergy (experimental group) and parents and caregivers of a child without a milk allergy (control group). A comparative analysis of mean calcium intake among the two groups was conducted using the validated Calcium Assessment Tool (CAT) to determine if a child's allergy influences their parent's or caregiver's diet. The results demonstrated that the experimental group (272 mg/day) consumes a significantly lower quantity of calcium than the control group (520 mg/day; p=0.002). Notably, both groups consume inadequate calcium relative to the recommended dietary allowance of calcium of 1,000 mg/day.

Factors such as demographics, elimination and specialty diets, as well as satisfaction of healthcare provider care were also evaluated. Future research could investigate the impact a

child's milk allergy may have on their parent's intake of additional micronutrients, as well as the impact other food allergies have on their parent's micronutrient intake.

Keywords: calcium intake, food allergy, food allergies, parent-child diet

MONTCLAIR STATE UNIVERSITY

Calcium Intake Among Parents and Caregivers of Children with a Milk Allergy or Intolerance: A Comparative Analysis

by

Ilana Dubrovsky-Razam

A Master's Thesis Submitted to the Faculty of

Montclair State University

In Partial Fulfillment of the Requirements

For the Degree of

Master of Science

May 2022

College of Education and Human Services
Department of Nutrition and Food Studies

Thesis Committee:

[redacted]
Adrian Kerrihard, PhD
Thesis Sponsor

[redacted]
Mousumi Bose, PhD
Committee Member

[redacted]
Jamie Miller, MS, RD
Committee Member

CALCIUM INTAKE AMONG PARENTS AND CAREGIVERS OF CHILDREN WITH A MILK ALLERGY OR INTOLERANCE: A COMPARATIVE ANALYSIS

A THESIS

Submitted in partial fulfillment of the requirements

For the degree of Master of Science

by

Ilana Dubrovsky-Razam

Montclair State University

Montclair, NJ

2022

Acknowledgments

There are several individuals who have contributed to the completion of this research, whom I would like to acknowledge and extend my sincerest gratitude. First, I would like to express my deepest appreciation to Dr. Adrian Kerrihard, my thesis advisor, who provided invaluable guidance and encouragement throughout the development of this research. His patience, support, and expertise made this research possible. I would also like to thank my thesis committee members Dr. Mousumi Bose and Jamie Miller for their insightful feedback and contributions. I am grateful to have had such a supportive group of professionals, encouraging me every step of this research; it was an honor and privilege to work with all of you.

Last, but most certainly not least, I would like to thank my family: my husband, Allen, for his endless support of my academic journey and to my children, Dylan and Mia, who both inspired this research with their own history of food allergies.

Table of Contents

List of Tables

List of Figures

1. Introduction

An expert panel of the National Institute of Allergy and Infectious Diseases, an agency within the U.S. Department of Health and Human Services, defines a food allergy as "an adverse health effect arising from a specific immune response that occurs reproducibly on exposure to a given food" (Boyce et al., 2011). This abnormal immune reaction is due to Immunoglobulin E (IgE) antibodies, which are produced in response to allergens (Pastorello et al., 1995). IgE is responsible for producing a variety of symptoms for individuals with food allergies, and different allergic responses and reactions can vary in severity. For instance, an allergic reaction may present itself as hives on the skin or can evolve into life-threatening anaphylaxis, a systemic response that is marked by vasodilation, vascular permeability, tissue swelling, fluid retention, and/or edema (Nakamura & Murata, 2018).

The Food and Drug Administration recognizes eight "major" food allergens that are responsible for the majority of food allergies in the United States and typically produce more serious, life-threatening allergic reactions, include milk, eggs, tree nuts, peanuts, fish, shellfish, wheat, and soybeans; and the prevalence of allergies from these foods have been increasing (Cannon, 2018). The most common food allergens among children are peanuts, milk, shellfish, and tree nuts, respectively (Messina & Venter, 2020).

According to Food Allergy Research & Education (F.A.R.E.), a non-profit organization dedicated to food allergy research, education, and awareness, 32 million Americans–and one in 13 children–have been diagnosed with food allergies in the United States (Chad, 2001; *Food Allergy Research & Education*, n.d.). The U.S. Centers for Disease Control and Prevention (CDC) estimate that the rate of allergies has increased 4.6% since 1997 (Jackson et al., 2013). The CDC also reports that approximately 8% of children worldwide currently suffer from food

allergies, compared to 3.4% of children diagnosed in 1997. Individuals that have been diagnosed with food allergies oftentimes have multiple allergic conditions such as asthma, hay fever, and eczema (Gore et al., 2016). Although the cause for the rise in food allergies is unknown, many allergists and immunologists, along with other experts in the field, hypothesize that environmental allergens, genetic factors, and/or hygiene may contribute to the current high rate and increased prevalence of allergies (Abrams & Sicherer, 2016).

While many sources, such as government agencies, researchers, as well as non-profit organizations, report on food allergy rates, there is a lack of homogeneity among food allergy prevalence data (Hadley, 2006; Sicherer et al., 2010). One possible cause for this could be due to inconsistencies regarding methods of recording self-reported food allergies without a formal diagnosis. The discrepancies between self-reported allergies (which may include any perceived food reactions or possible intolerances) and medically diagnosed allergies may be substantial. To this point, the European Community Respiratory Health Survey conducted a cohort epidemiological study of randomly selected adults aged 26-50 years old (n=457) to determine if the participants' perceived food allergies aligned with the results of skin prick testing, a diagnostic tool to measure the extent of an allergy (Woods et al., 2002). Five of the most common allergens were assessed: milk, peanut, eggs, shrimp, and wheat. Participants self-reported if they perceived or anticipated developing an illness to the allergen(s), and skin prick testing was conducted to determine if there was an agreement between the self-reported data and the skin prick testing results. For participants who received a positive skin prick test for both milk and wheat, identifying the presence of an allergy, none of those individuals reported a perceived allergy to cow's milk or wheat, respectively. There was, however, agreement between skin prick testing and reported perceived allergies among peanuts (two individuals were in

agreement, or 0.4%), shrimp (four individuals were in agreement, or 0.9%), and egg white (one individual had a positive test and reported allergy).

While prevalence may be overestimated due to inaccuracies among self-reported data, there is sufficient evidence that suggests food allergies are on the rise. Data collected from an individual's clinical history, health services utilized, along with allergy testing "provide compelling data that the prevalence of food allergy is increasing in both Western and developing countries" (Loh & Tang, 2018; Warren et al., 2019).

1.1 Prevention & Therapeutic Treatments

The most effective way to prevent a food-related allergic reaction is to eliminate known allergens from an individual's diet (Polloni et al., 2013). While there is currently no cure for food allergies, there are therapeutic treatments that have successfully modified and controlled, or mediated, this abnormal immune response (Chen & Land, 2017). The most common treatments include oral immunotherapy, where patients orally ingest microdoses of their allergen, or epicutaneous immunotherapy, where a topical patch is worn on the skin to deliver small fragments of the allergen into the body (Jin, 2017). Research has demonstrated that, in some patients, these therapies may be effective in desensitizing individuals to their allergens, ultimately reducing the frequency and severity of adverse reactions (Begin et al., 2014). The objective of these treatments is to reduce the threshold of an allergic response, and oftentimes the allergic response is eliminated altogether, over time.

Oral immunotherapy (OIT) has been gaining popularity over the past 10 years for its disease-modifying potential and high level of efficacy (Anagnostou, 2021). While OIT has the potential to desensitize up to 70% to 90% of patients, it is not without its risks (Anagnostou, 2021; Anvari & Anagnostou, 2018). Brożek and others (2012) conducted a systematic review

and meta-analysis to evaluate OIT effectiveness, compared to elimination diets, in individuals with a cow's milk allergy. To assess tolerance induction, six randomized trials and five observational studies were included in the analysis. Study results suggest that OIT provides greater protection against allergic reactions by increasing the tolerance of cow's milk through oral desensitization, as compared to eliminations diets. However, many studies included in this review identified potentially serious adverse effects during therapy, such as hives, bronchospasm (a contraction of the airways), and a higher need for epinephrine (Brożek et al., 2012). While OIT presents mild to severe clinical risks, the effectiveness of the treatment depends on an individual's allergen-specific immune response, including the duration of desensitization following after OIT treatments conclude (Heine, 2018). Elimination diets remain the most common therapy method to prevent and manage food allergies (Chafen et al., 2010).

1.2 Food Allergies and Nutrient Deficiencies

Calcium is the most abundant mineral in the human body and is stored in the bones and teeth to provide structure, as well as is critical for carrying out important functions throughout the body (National Institutes of Health, Office of Dietary Supplements, n.d.). In addition to providing rigidity and hardness to bones and teeth, calcium is vital to aid in the stabilization of hormones, muscle contractions, aids in blood clotting, supports nerve functionality, as well as supports the regulation of normal heart rhythms (Harvard T.H. Chan School of Public Health, n.d.). A recent meta-analysis investigated the correlation between dairy products (or milk/milk-containing products) and bone fracture risk in 14 prospective studies and 12 of the 14 studies demonstrated a significant association between intake of milk/milk-containing products and a decreased bone fracture risk (Van Den Heuvel & Steijns, 2018). The majority of the studies investigated, compared milk consumption to bone fracture risk, as milk is the most prominent

source of dairy consumption. Other studies included yogurt and cheese, in addition to milk, however these serving sizes were typically smaller than the serving size for consumed milk. Van Den Heuvel and Steijns (2018) also investigated the impact of non-dairy beverages (e.g. sugar-sweetened and calcium-fortified soy beverages) on fracture risk as compared to dairy products, and found milk/milk-containing products more effectively build and maintain bone mass.

The Recommended Daily Allowance (RDA) for daily calcium is 700 milligrams per day for children one to three years of age, 1,000 milligrams for children four through eight years old, 1,300 milligrams for children aged nine through 18 years old, and 1,000 milligrams for men and women over the age of 18 years (Ross et al., 2011). The recommendation increases to 1,200 milligrams per day for females over the age of 50 years and males over the age of 70 years.

Individuals with food allergies have an increased risk of developing nutritional disorders such as malnutrition, micronutrient deficiencies, failure to thrive and poor growth in children, and feeding difficulties (Meyer, 2018). According to Mowszet and others (2005), food allergies are the leading cause of malnutrition for children under the age of five years old. In a retrospective study, they examined a sample population that included children aged three weeks to five years old (n=172). The results demonstrated that malnutrition due to food allergies accounted for 40.7% of participants, while other common causes included celiac disease (5.8%), malabsorption syndromes (5.8%), gastroesophageal reflux disease (4.7%), and chronic diarrhea (2.3%).

Another study determined that a milk allergy diagnosis is associated with long-term, negative implications on the growth, development, and overall nutritional status of children (Mehta et al., 2013). Without proper nutritional substitutions, eliminating cow’s milk from a

child's diet may contribute to calcium and vitamin D deficiencies, malnutrition, and even rickets (Mehta et al., 2013). Children require sufficient vitamin D and calcium intake for bone, and overall, growth and development. In addition, children with milk allergies are at an increased risk of developing a low or decreased bone mineral density, as cow's milk and milk products such as butter, cheese, and yogurt are some of the richest dietary sources of calcium (Hodges et al., 2019).

Another recent study (n=131) documented the correlation between a lack of milk/milk-containing products in an individual's diet and a possible concern of nutritional deficiencies (Bouziani et al., 2018). Calcium intake was assessed among children and adolescents aged six to 18 years old living in Rabat, Morocco and surrounding regions. This Moroccan study used a descriptive cross-sectional survey to evaluate intake of healthy children and adolescents–63 girls and 68 boys–through 24-hour dietary recalls, food frequency questionnaires, and parent interviews. The results demonstrated a mean calcium intake of 521.51 ± 298.06 mg/day with no significant difference between girls and boys (p=0.972). This mean intake is significantly lower than the recommended values range of consuming 700 milligrams to 1,300 milligrams of dietary calcium daily–which varies depending upon an individual's age (Ross et al., 2011).

This study's dietary recall and intake analysis demonstrated that milk consumption contributed to only 14% of participants' daily calcium intake; the largest contributing food was bread and derivatives, providing 37% of dietary calcium. The food frequency questionnaire showed similar results: dairy products represented 18% of participants' daily consumed foods and bread and cereals represented 38% of their daily food consumption. As the typical Moroccan diet consists primarily of cereal, fruits, and vegetables with limited dairy products, a diet with

inadequate dairy consumption may be a factor in the high levels of calcium deficiencies among Moroccan residents.

Lim, Kim, and Hong (2018) conducted a study for individuals suffering from inflammatory bowel disease and discovered that 22.4% of participants were classified as having mild-moderate malnutrition and 12.2% of participants were severely malnourished (n=104). This study included two groups of participants: an experimental group, which excluded milk, fish, spicy food, and ramen, and a control group, which did not exclude any foods from their diets. Following a nutrient intake analysis, it was concluded that calcium, zinc, and vitamin A intake were significantly lower in the experimental group, compared to the control group (Lim et al., 2018). Low levels of particular nutrients may lead to a deficiency and can have systemic consequences. For example, an iron deficiency may lead to anemia, a deficiency in iodine may contribute to hypothyroidism, and a vitamin B12 deficiency may cause cognitive impairment and decline (Black, 2003).

Eliminating an entire food group from one's diet places an individual at a greater risk of developing malnutrition and/or nutrient deficiencies. If an individual's diet is not monitored by a healthcare provider, nutrient deficiencies may go undetected for months or even years, placing the individual at risk for developing adverse health impacts and complications.

2. Manuscript I

Calcium Intake Among Parents and Caregivers of Children with a Milk Allergy or Intolerance: A Comparative Analysis

2.1 Abstract

The prevalence of food allergies have doubled every 10 years among both children and adults. Food allergies can lead to negative implications on the nutritional status of those who suffer from allergies. While research has been conducted that evaluates the nutritional impact food allergies may have on children diagnosed with food allergies, there is a marked gap in literature that investigates the impact that a child's allergy may have on their parent or caregiver. This research study evaluates the impact a child's milk allergy may have on the dietary calcium intake among their parents and caregivers by comparing mean calcium intake between parents and caregivers of milk-allergic children, and parents and caregivers of children without a milk allergy.

A comparative analysis of calcium consumption among the two groups was conducted using the validated Calcium Assessment Tool (CAT) to determine if a child's allergy influences their parent's or caregiver's diet. The results demonstrate that the experimental group consumes a significantly lower quantity of calcium than the control group (272 mg/day vs. 520 mg/day, p=0.002). Notably, both groups consume inadequate calcium relative to the recommended dietary allowance of calcium of 1,000 mg/day.

Future research could investigate the impact a child's milk allergy may have on their parent's intake of additional micronutrients, as well as the impact other food allergies have on their parent's micronutrient intake.

2.2 Introduction

The rate, significance, and prevalence of diagnosed food allergies are on the rise in the United States, affecting approximately 2% to 10% of the total population (Abrams & Sicherer, 2016; Messina & Venter, 2020). It is estimated that approximately 5% of the total population in the United States have experienced anaphylaxis, a systemic response that is marked by vasodilation, vascular permeability, tissue swelling, fluid retention, and/or edema (Nakamura & Murata, 2018; Turner et al., 2017). It is also estimated that over 40% of children diagnosed with food allergies in the United States have received treatment in an emergency department due to an allergic reaction, however, approximately 0.1% of all children and adults who visit an emergency department due to an allergic reaction have a fatal outcome (CDC, 2020; Turner et al., 2017).

2.2.1 'The Big 8' Food Allergens

There are many foods that have the potential to elicit an allergic reaction. According to the United States Food and Drug Administration (FDA), there are eight 'major' food allergens that are responsible for 90% of food allergies. Oftentimes referred to as 'The Big Eight,' these items include milk, eggs, tree nuts, peanuts, fish, shellfish, wheat, and soybeans (*Food Allergies*, 2021). These foods are also associated with more serious, oftentimes life-threatening allergic responses. In addition to these allergens, the FDA has identified 160 other food allergens that may cause allergic reactions in sensitive individuals. In addition to foods, this list of other allergens includes food coloring, food additives, sesame, and gluten.

In 2021, sesame was included as a ninth 'major allergen' in the United States due to the growing number of adults and children diagnosed with a sesame allergy (Warren et al., 2019). Recent research from 2019 estimates that 0.2% of children and adults have been diagnosed with a sesame allergy, while older studies from 2010 showed the rate was 0.1% of individuals in the

United States had a sesame allergy (Sicherer et al., 2010; Warren et al., 2019). In response to this growing rate of sesame allergies, the Food Allergy Safety, Treatment, Education, and Research Act of 2021 or the FASTER Act of 2021 was enacted, requiring manufacturers to label and highlight sesame as an ingredient, along with the other top eight allergens by January 1, 2023 (*S.578 - 117th Congress*, 2021). This food allergy policy also requires the Secretary of Health and Human Services to conduct surveillance and data collection on the prevalence of allergies, the severity of food allergy reactions, the status of allergy diagnostics and therapeutics, as well as allergy prevention efforts. Furthermore, the FASTER Act of 2021 also stipulates specific recommendations and strategies to improve the accuracy of allergy prevalence data and identify gaps in surveillance and data collection.

The rate of allergies to foods included in 'The Big Eight' has been increasing in prevalence over the past several years. The rate of peanut allergies, for instance, has tripled over the past 20 years (Cannon, 2018). A recent study concluded that the most prevalent food allergen among children and adolescents is peanuts, followed by cow's milk, shellfish, and tree nuts, and 40.0% of children with food allergies reported having multiple food allergies (n=38,408) (Messina & Venter, 2020). This data was collected through a population-based survey of U.S. households that included children and adolescents with food allergies. Cow's milk is not only one of the most common childhood allergens but also one of the leading causes of anaphylaxis (Flom & Sicherer, 2019). It is estimated that 0.5% to 3.0% of children develop a milk allergy by their first birthday, and infants typically present with this allergy within their first six months of life (Flom & Sicherer, 2019; Lifschitz & Szajewska, 2015). Research that investigates the increased prevalence of milk allergies in children estimates that 2.0% to 3.0% of children living

in developed countries have a milk allergy, claiming that milk is the most common pediatric food allergy (Lifschitz & Szajewska, 2015).

2.2.2 Calcium Importance

Calcium is typically obtained through the consumption of milk/milk-containing products and is essential in carrying out important bodily functions, such as providing rigidity to bones and teeth, stabilizing hormones, enabling muscle contractions, aiding in blood clotting, supporting nerve functionality, and supporting a normal heart rhythm (Harvard T.H. Chan School of Public Health, n.d.).

While individuals may not notice signs and symptoms of insufficient calcium consumption, more serious complications can arise with a prolonged deficiency, such as hypocalcemia which may result in kidney failure and an abnormal heart rate. Another serious complication of prolonged insufficient calcium intake is osteopenia, which is marked by a decrease in bone mass and weakened bones, leading to osteoporosis, characterized by increased bone fragility, deterioration, and compromised bone strength all of which contribute to an increased risk of bone fractures (Sözen et al., 2017). Interventions to prevent bone deterioration and preserve bone strength include adequate intake of calcium and vitamin D, which aids in calcium absorption (Burt et al., 2019).

Adequate calcium intake is integral in overall bone health, particularly in preventing bone loss, osteoporosis, and hypertension, as well as maintaining healthy low-density lipoprotein (LDL) levels and high-density lipoproteins (HDL) levels (Cormick & Belizán, 2019). However, the majority of Americans are not consuming sufficient amounts of this essential mineral. The United States Department of Agriculture (USDA) published results from the 2010 National Health and Nutrition Examination Survey (NHANES) and shared that “42% of Americans do not

meet the Estimated Average Requirement for age, and calcium has been identified as a nutrient of concern in the 2010 Dietary Guidelines" (Hoy & Goldman, 2014). NHANES results also showed that 37% of participants' daily calcium intake came from milk/milk-containing (dairy) products. Rozenberg and others (2016) estimate that dairy products contribute to 52% to 65% of an individual's recommended daily allowance for calcium, and claim that it is difficult to consume adequate amounts of dietary calcium on a vegan or dairy-restricted diet. Rozenberg and others (2016) also highlight additional nutrients that are provided by dairy products, such as protein, phosphorus, and potassium.

2.2.3 Research Study

This study examined calcium intake among parents and caregivers of children under the age of 18 years old who have been diagnosed with a milk allergy, have a suspected allergy, or have a milk intolerance. Dietary calcium was measured using the Calcium Assessment Tool (CAT), a validated, self-administered food frequency questionnaire that assesses weekly dietary calcium intake (Hung et al., 2011). The hypothesis for this study was that the elimination of milk in a child's diet due to an allergy is associated with inadequate calcium intake among parents and caregivers.

This study's inclusion criteria featured parents and caregivers of at least one child under the age of 18 years old who has been diagnosed with a cow's milk allergy, has a suspected milk allergy, or has an intolerance to milk. For the purpose of comparison to an experimental group, this study design included a control group of parents and caregivers of a child under the age of 18 years old who has not been diagnosed with a milk allergy, does not have a suspected milk allergy, nor does the child have an intolerance to milk. Both groups include parents and caregivers who are at least 18 years old and live in the United States.

2.3 Materials and Methods

2.3.1 Study Design Overview

Two surveys were designed to capture data from the experimental group and control group, and each survey had its own digital consent form. (See Figure 1 for a flow chart illustrating the survey design.) Both consent forms outlined the study objectives and provided examples of survey questions. It was disclosed that the survey data would be collected online and confidentiality would be kept to the degree permitted by the technology used. Identifying information of the participants was not captured and responses were anonymized. Recruitment methods and survey materials were approved through the Montclair State University Institutional Review Board and conducted in accordance with CITI Human Subjects ethics and compliance protocols *(FY20-21-2026)*.

Once participants confirmed that they read the digital consent form, by clicking the 'submit' button at the bottom of the form, participants were directed to a screening question. This question confirmed if the participant belonged in the experimental or control group by asking if the participant is a parent or caregiver of a child diagnosed with a milk allergy, has an intolerance to milk, has a suspected allergy, or "none." If the participant selected "none," indicating that their child does not have an allergy, suspected allergy, or intolerance, the control group survey questions populated. If the participant selected that their child has an allergy, suspected allergy, or intolerance, they were directed to the experimental group survey.

2.3.2 Participants & Eligibility Criteria

Eligible participants were over the age of 18, resided in the United States at the time of recruitment, and self-identified as being a parent or caregiver of at least one child under the age of 18 years old. Experimental group participants reported having at least one child with a

diagnosed or suspected milk allergy or milk intolerance. The online survey was designed in English, using Qualtrics XM Experience Management (June 2021; Provo, UT, USA) to capture participant demographic information, any present dietary restrictions for individuals within the household, as well as average calcium intake. Anonymity was maintained for all participants.

Parents and caregivers for both the experimental and control groups were recruited via social media using Facebook community groups; parent-focused, allergy-specific groups were identified along with national, non-specific community interest groups. Facebook groups were selected to recruit experimental and control group participants, while ensuring that the number of individuals reached among all groups was similar between recruitment categories (experimental and control groups). Facebook groups were identified by analyzing the group members' geographic location to ensure members resided in various states across the United States. Another Facebook group selection factor was the groups' membership size, ensuring there were at least 100 members to reach an adequate population and sample size. Parent-focused Facebook community groups, as well as non-parent-focused groups, were considered for both the experimental and control groups. General interest groups were also identified and included in the recruitment strategy.

A digital consent form was shared with each Facebook administrator. Upon receipt of administrator consent, the study was announced on the Facebook page with an image outlining details of the research study as well as a hyperlink directing participants to the Qualtrics XM digital informed consent page of the survey.

Experimental group participants were recruited through five food allergy-related Facebook groups. Two out of the five groups are designed for parents of children with milk allergies or other food allergies. The other three Facebook groups are food allergy-specific pages,

however not specific to milk-allergic children. The five Facebook groups include: Milk Allergy Mommies (9,500 members), Moms of Kids with Milk Allergy and Food Allergies (3,000 members), Deliciously Dairy Free (40,100 members), Living with Food Allergies in SOMA [South Orange-Maplewood] (200 members), and NC FACES [North Carolina Food Allergic Children Excelling Safely] (1,300 members). Following the initial recruitment post in each of the groups, a follow-up post was submitted one month later.

Similarly, the control group was recruited through four general interest or parent-related community groups. These four groups are not food allergy-related Facebook channels; two out of the four groups specifically target mothers ("mom groups"), while the other two Facebook groups are general-interest community groups. The four Facebook groups include SOMA [South Orange-Maplewood] Lounge NJ (15,800 members), Maplewood Moms (5,500 members), Apex/Cary Moms (18,000 members), and Ask the Village (42,800 members). The administrators of these pages were also contacted for each Facebook group in order to obtain consent prior to sharing the research study in each of the groups. Once consent was provided, the study was announced on the pages with an image and a direct hyperlink to the Qualtrics XM online consent form.

2.3.3 Demographics and Survey

In order to better understand the demographics of experimental and control group participants, 10 demographic variables were gathered for both groups (see Appendix). These include gender, race, marital status, employment status, household income, education, and state of residence. In addition, the number of children that live in the participants' household and their ages, along with a matrix table to capture all members of the household was also included in this demographic section. Participant demographics can be seen in Table 1. Following the

demographics questions, the control group completed a specialty diet assessment to capture data on any dietary restrictions followed, including vegan, vegetarian, gluten-free, paleo, kosher, dairy-free, plant-based, as well as "other" which required a text entry. Experimental group participants completed questions on their child's food allergy history, household food consumption, specialty diets, as well as comfort and stress levels in caring for a child with a milk allergy or intolerance. Finally, a series of questions investigated healthcare providers that the participants have visited for their child with the allergy or intolerance, as well as satisfaction with the amount of information received from the provider.

Food allergy history questions identified any other food allergies present among members of the participants' household, along with if the participants' milk-allergic child has multiple allergies, as multiple allergies and other household allergies may influence the diets of parents, caregivers, children, and other household members. Participants also reported if they have a milk-free household or eliminate any foods from the household, which may influence the nutrient intake of all household members.

Participants were also asked if their child with the milk allergy or intolerance has ever experienced anaphylaxis; if "yes" was selected, a follow-up question populated on the survey to better understand if that experience has changed the way the parent or caregiver shops or cooks. Furthermore, data on the participant's confidence in meeting their family's nutrient needs utilizing a numerical five-point Likert scale (1=not confident at all; 5=extremely confident).

2.3.4 Healthcare Providers

Healthcare provider type, including a nurse practitioner, pediatrician, family allergist or immunologist, pediatric allergist or immunologist, pulmonologist, dietitian or nutritionist, or other practitioner, was also investigated to identify the primary adviser for the child's allergies

and the participant's satisfaction with the education and information received from their provider. Participants' trust in their child's provider, who manages the child's allergy, was evaluated by investigating if participants 'frequently distrust' their child's provider's opinion and seek a second one, 'sometimes distrust' their provider's opinion but do not see a second one, 'always trust' their provider's opinion, agreeing with the statement that if their provider tells themes something, that it must be true, as well as agreeing with the statement that they trust their child's provider's judgments about their child's care. Participants' comfort in managing their child's allergy was also collected and assessed; this measure utilized a five-point Likert scale from 'strongly agree' to 'strongly disagree.'

2.3.5 Calcium Assessment

Daily and weekly average calcium intake were collected and evaluated through a self-reported food frequency questionnaire (FFQ) for all participants. Both the experimental group and control group utilized the validated Calcium Assessment Tool (CAT) to compare weekly dietary consumption patterns, specifically their estimated weekly calcium intake. This Calcium Assessment Tool (see Appendix) has been validated for postmenopausal women in Canada (Hung et al., 2011), and is a modified version of the Calcium Calculator, an interactive online calcium assessment tool that individuals use to evaluate their own intake (BC Dairy Association, n.d.).

The Calcium Assessment Tool measures dietary calcium intake by assessing an individual's average weekly intake of specific calcium-rich foods which are organized by category: vegetables, fruits, legumes, and dairy products. Calcium-rich foods included in the survey tool include broccoli, oranges, tahini, chickpeas, and milk/milk-containing products, among others. Standard portion sizes for each item were included for each item name as a guide,

and participants recorded the number of servings they consumed of 26 different calcium-rich food items in a typical week over the past month. The instructions stipulated that if a food is eaten regularly but less than once per week, to record "0" servings for that food item.

The Calcium Assessment Tool provided the amount of calcium within one serving of each item. During the preliminary data analysis, the responses to the CAT were used to extrapolate weekly calcium intake. This was conducted for each item, providing the information to calculate the total dietary calcium intake for all participants on a daily and weekly basis.

Upon completion of the data collection, finalized survey data were exported from Qualtrics XM Experience Management, including all questions and responses. Finalized data were imported into Microsoft Excel to code participant and demographic data, as well as finalize dietary calcium totals. JASP, an open-source statistical analysis program, was utilized to perform statistical analyses to interpret the study results. To investigate whether the elimination of milk in a child's diet due to an allergy leads to inadequate dietary calcium consumption among their parents and/or caregivers, a quantitative, comparison analysis was conducted to analyze average daily and weekly calcium intake levels between an experimental and control group. Using JASP, a one-way ANOVA was utilized to determine if there was a significant difference between the calcium intake among experimental and control group participants.

In order to have a complete picture of participants' total calcium intake, data was collected on multivitamin and calcium supplementation among experimental group participants to further assess this group's calcium intake beyond dietary calcium consumed from foods and beverages. To calculate calcium supplementation, The National Institutes of Health's Dietary Supplement Label Database (DSLD) was referenced, which collects and catalogs historical and current label information on products sold in the United States. The database estimates that

multivitamins commonly contain 200 milligrams to 300 milligrams of calcium, and calcium supplements contain 500 milligrams to 600 milligrams of calcium (*Calcium: Fact Sheet for Health Professionals*, 2021). Median values were utilized to estimate total calcium supplementation: 250 milligrams for multivitamins and 550 milligrams for calcium supplements.

2.3.6 Statistical Analysis

To control for demographic characteristics as potential confounding variables, demographics were evaluated and compared between the control group and the experimental group using a one-way ANOVA. This analysis compared categorical variables between the two groups, including gender, race, region of residence, marital status, employment status, and household income level. Prior to the analysis, state-level data were categorized into regions of the United States (e.g. midwest, northeast, etc.). In addition, a one-way ANOVA was used to assess the significance of specialty and/or elimination diets, including vegan, vegetarian, gluten-free, paleo, kosher, dairy-free, and plant-based, by comparing mean calcium intake across both groups.

When comparing the experimental group and control group surveys, the experimental group's survey included a few additional categories to evaluate potential predictive factors of calcium intake, such as the child's food allergy history including any previous anaphylactic reactions, as well as household milk consumption patterns. One-way ANOVA was also used to determine any present statistical significance of prior anaphylaxis in determining the amount of daily calcium consumed. In addition, multiple independent samples t-tests were conducted to evaluate the significance of food variables assessed in the calcium tool among all participants.

2.4 Results

2.4.1 Participants & Eligibility Criteria

A total of 159 individuals participated in the experimental group and control group surveys. Researchers excluded 80 participants from the experimental group analysis: 66 participants did not complete the calcium assessment questions, four individuals were not residents of the United States, seven belonged in the control group, and three participants did not complete the screening question, which prevented participants from proceeding to the remainder of the survey. A total of 22 participants were excluded from the control group, as 5 did not complete the survey and 17 participants belonged to the experimental group. Following participant exclusions among both groups, 41 participants were included in the experimental group and 16 participants were included in the control group.

The results demonstrated a lack of significant difference in calcium intake among all demographic variables: gender, marital status, employment status, education level, income level, and race (see Table 1). The vast majority of all participants were female, however, one male participated in the control group. The majority of participants among both groups were married (81.3% control; 87.8% experimental), White (68.8% control; 92.7% experimental), and highly educated (56.3% of control group participants and 34.1% of experimental group participants have at least a Master's Degree). In addition, most participants within each group have an annual household income of more than $150,000 (81.3% control; 26.8% experimental). The majority of participants reside in the northeast of the United States (87.5% control; 41.5% experimental); however, the experimental group participants represented all four regions of the United States whereas the control group participants were predominantly located in the northeast, followed by two (12.5%) in the southeast.

Experimental group participants were asked if they have a child with a milk allergy, suspected allergy, or milk intolerance. A total of 36 (87.8%) participants have one child with a

milk allergy, 3 (7.3%) have two children with a milk allergy, and 2 (4.9%) have a child with a milk intolerance or suspected allergy (see Table 2).

2.4.2 Survey Results

The experimental group's milk-allergic child's allergy history was investigated, including the identification if the child has any additional allergies. Participants reported that in addition to their child's milk allergy, 31.7% (n=13) of the children also have an egg allergy, 19.5% (n=8) have a peanut allergy, and 19.5% (n=8) have a tree-nut allergy. Other allergens reported by participants include pineapple, garlic, pork, celery, avocado, fish, shellfish, and sesame. Experimental group participants were also asked if anyone else in the household has food allergies and 22.0% (n=9) reported themselves as having an allergy, while 17.1% (n=7) have other children in the household with food allergies, and 14.6% (n=6) have a partner or spouse with a food allergy.

Experimental group participants rated their opinion on several statements using a five-point Likert scale: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. The majority of participants (61.0%, n=25) agreed or strongly agreed with the statement: 'My child's allergy causes me to restrict my own milk intake.' However, 73.2% (n=30) of participants disagreed or strongly disagreed with the statement: 'I do not have any milk products in my home due to my child's allergy.' Interestingly, 48.8% (n=20) participants reported that they eliminate foods from their household, while 51.2% (n=21) do not. Of those that eliminate foods from their home, 80.0% limit or exclude milk or milk products, such as milk, yogurt, cheese, and other milk/milk-containing products, from their home. A one-way ANOVA was conducted among control and experimental group participants to analyze specialty and elimination diets further, and statistical significance was found among those who followed a dairy-free diet (p=0.020);

participants following a vegetarian and gluten-free diet were found to be insignificant (p=0.780; p=0.180). Other diets assessed in the survey included vegan, paleo, kosher, and plant-based, however, there were not enough individuals who identified as following these diets to conduct the analysis.

In addition, 46.3% (n=19) of experimental group participants reported that their child has experienced previous anaphylaxis, however, this was not found to be statistically significant in determining calcium intake (p=0.680). Prior anaphylaxis, however, has altered the way 57.9% of participants (n=11) have shopped or cooked. Specifically, participants noted eliminating food items from their household, not purchasing allergenic foods, and/or keeping allergens in a separate area of their home.

Furthermore, almost half of experimental group participants (46.3%, n=19) reported feeling confident that they are meeting their family's nutrient needs, while 12.2% (n=5) were not confident, and 41.5% were unsure if they were meeting their family's nutritional needs.

2.4.3 Calcium Assessment According to Demographic Variables

One-way ANOVA was used to determine if there was statistical significance among demographic variables when comparing mean daily calcium intake. Marital status and employment status both reported a lack of significance. While race demonstrated statistical significance (p=0.009), when assessing against calcium intake, researchers concluded this was due to the very small sample size of participants who identified as Asian (control group, n=4; experimental group, n=0). Similarly, while there was an apparent discrepancy in household income, after conducting a one-way ANOVA, this was not found to be a significant factor (p=0.660) in predicting calcium intake.

2.4.4 Calcium Intake Among Parents and Caregivers of Children with a Milk Allergy or Intolerance

Results of a one-way ANOVA analysis demonstrated that there is a significant difference in mean calcium intake between the experimental and control groups (p=0.002). When assessing calcium intake among both groups independently, control group participants consumed a mean daily intake of 519.63 milligrams of calcium, compared to 273.00 milligrams for experimental participants (see Figure 2). While both groups are not consuming sufficient amounts of calcium, the experimental group consumed 52.3% less calcium than the control group. However, both groups are consuming less calcium than the Recommended Daily Allowance (RDA) of 1,000 milligrams per day (Ross et al., 2011).

To further compare total calcium intake, including dietary and supplemented calcium, multivitamin and calcium supplementation were investigated among experimental group participants. Over half (53.7%, n=22) of participants reported taking a daily multivitamin, while 19.5% (n=8) reported consuming a daily calcium supplement, however, comparative data was not obtained for control group participants.

Calcium intake was also assessed between the two groups by grouping food items analyzed on the CAT survey into milk/milk-containing products and non-milk-containing products (see Figure 2). Milk/milk-containing products included cottage cheese, firm cheese, ice cream, milk, pancakes/waffles, parmesan cheese, plain yogurt, processed cheese, soft/semi-soft cheese, soup (made with milk), and yogurt. Non-milk-containing products included almonds, bok choy, bread, broccoli, calcium-fortified beverages, chickpeas, kidney beans, orange, sardines, tahini, tofu, and total beans. Control group participants consumed 65.5% of their daily dietary calcium from milk/milk-containing products, compared to experimental group

participants consuming 48.0% of their calcium from milk/milk-containing products. Interestingly, in each milk/milk-containing food item except processed cheese, the control group demonstrated a higher intake (30 milligrams of calcium from processed cheese per day, compared to 13 milligrams of calcium per day consumed by the control group) (see Figure 3).

The CAT results provided the data to stratify top calcium sources from each of the groups (see Figure 3). The top five calcium sources for the experimental group include calcium-fortified beverages, milk, processed cheese, firm cheese, and bread, whereas most of the calcium sources for the control group are milk/milk-containing products. These milk/milk-containing sources include milk, firm cheese, plain yogurt, calcium-fortified beverages, and soft/semi-soft cheese. Milk was a substantial source of calcium for the control group; contributing an average of 101.79 milligrams of calcium per day, compared to the experimental groups's top contributor of dietary calcium being calcium-fortified beverages, contributing 48.08 milligrams of calcium per day.

The results also showed consumption of five specific food items to be significantly lower among those in the experimental group versus the control group. These were firm cheese (p=0.003), milk (p=0.043), pancakes/waffles (p=0.024), plain yogurt (p=0.013), and soft/semi-soft cheese (p=0.021) (see Figure 3).

2.4.5 Healthcare Providers

The majority of participants (82.9%, n=34) had an interdisciplinary medical team supporting their child's health by selecting two or more providers, while 17.1% (n=7) of participants have visited one provider for their child's allergy. A majority (82.9%, n=34) visit a pediatrician, 70.7% (n=29) see a pediatric allergist or immunologist, 56.1% (n=23) see a family allergist or immunologist, and 34.2% (n=14) visit a nurse practitioner for their child's allergy. A

total of 14.6% (n=6) of participants have visited a dietitian or nutritionist to support their child's health.

Participants rated their trust in their child's healthcare provider and their level of comfort with the amount of information received from their healthcare providers. These results demonstrated that 22.0% (n=9) of participants 'sometimes or frequently' distrust their child's provider's opinion or medical advice, 17.1% (n=7) feel that they have not received adequate information from their child's provider on their allergy, and 34.2% (n=14) of participants do not receive ongoing education about their child's allergy.

2.5 Discussion

With the current trajectory of rising food allergy rates among individuals in the United States, and around the globe, there is an urgent need to identify and address any present gaps in nutritional care within the food allergy population. Individuals that restrict or eliminate entire food groups from their diet due to a food allergy are at a greater risk of consuming insufficient nutrients and developing nutrient deficiencies. More specifically, a population not often addressed in literature are parents and caregivers of children with food allergies, especially in investigating any nutritional risk they may face due to their child's allergy. Research has been conducted, however, to evaluate the dietary connection between children and their parents or caregivers more broadly, however, there is a significant gap in research that investigates the impact a child's allergy has on the diet of their parent or caregiver. Furthermore, there is no literature that explores the dietary impact a child's milk allergy has on their parent or caregiver.

2.5.1 Demographics & Survey

The majority of experimental group participants, or 61.0%, reported that their child's milk allergy causes them to restrict their own milk intake, however, the majority of respondents

(73.1%) reported having milk products in their home. Of those participants that restrict foods, 80.0% limit or exclude milk or milk products from their home. Restricting or limiting any food from the home environment leads to a decreased consumption of those food items (Story et al., 2008). This has been demonstrated in various studies and food environments. where the environment dictates eating behaviors. Individuals that restrict or eliminate milk/milk-containing products from their home may be at a greater risk of consuming insufficient dietary calcium, as well as other key macro- and micronutrients provided by milk/milk-containing products, such as protein, potassium, and phosphorus (Rozenberg et al., 2016). The results of this study suggest that dairy-free diets may be correlated with limiting or restricting dairy products from the home, contributing to a decrease in dietary calcium intake.

Additional variables investigated the number of individuals living within the same household that have food allergies and the results showed that there is a significant presence of food allergies within many of the households surveyed. The majority of children diagnosed with the milk allergy, intolerance, or suspected allergy have multiple allergies. Nearly 25.0% of participants themselves reported having a food allergy, and almost 20.0% of participants have another child in the same household with food allergies. Genetics and family history may play a role in the development of allergies, as well as influence the intake of allergens, food items, and even food groups (Koplin et al., 2013).

When evaluating if prior anaphylaxis is a predictor of calcium intake among experimental group participants, this was found to not be a statistically significant factor (p=0.680). However, almost half of participants (46.3%) reported that their child had previously experienced anaphylaxis and this has changed how the majority of participants (57.9%) have shopped or cooked foods since the anaphylactic experience. In fact, prior anaphylaxis led 21.1% of

participants to eliminate allergenic foods from their household. Research has demonstrated a correlation among parents of children with food allergies, particularly with children who have a history of anaphylaxis and a heightened level of stress, anxiety, and worry (Lau et al., 2014; Roberts et al., 2021).

While this study demonstrates that the nutritional needs of parents and caregivers of children with a milk allergy are not currently being met, nearly half of the experimental group participants feel confident that they are meeting their family's nutritional needs. This supports the importance of effective nutritional education to improve the health of those indirectly impacted by food allergies.

2.5.2 Calcium Intake Among Parents and Caregivers of Children with a Milk Allergy or Intolerance

The majority (87.8%) of experimental group participants have one child with a milk allergy, intolerance, or suspected allergy while the remaining participants have two children with a milk allergy or intolerance. When comparing calcium intake among participants with one or two children with an allergy, intolerance, or suspected allergy, as well as participants in the control group, statistical significance (p=0.022) was identified between the control group and experimental participants with one child with the allergy, intolerance, or suspected allergy. The results of this study demonstrated that individuals following a dairy-free diet had significantly lower calcium intake (p=0.020). However, all participants following a dairy-free diet fell within the experimental group. While other specialty diets were assessed and compared to calcium intake among both groups, the remaining diets (e.g. vegan, vegetarian, gluten-free, paleo, kosher, and plant-based) were found to be not significant predictors of calcium intake.

Researchers hypothesized in this research study that parents or caregivers of milk-allergic children are consuming insufficient calcium, and the findings of this study align with expectations. Specifically, the results of this study demonstrate that a child's milk allergy or intolerance significantly impacts their parent's or caregiver's calcium intake, attributed to a decrease in consumption or complete elimination of milk/milk-containing products in the parent's or caregiver's diet. When comparing dietary calcium intake among the experimental group and control group, as expected, experimental group participants demonstrated that they consume inadequate daily calcium (meeting 27.0% of their daily needs), however, control group participants also demonstrated that they do not meet their recommended daily intake of calcium (meeting 52.0% of their daily needs). When comparing these two groups, the mean calcium intake is statistically different (p=0.002), demonstrating that the experimental group is at a significantly greater risk of becoming deficient in calcium, leading to adverse, untoward health outcomes.

When investigating overall calcium intake in experimental group participants, combining both dietary calcium from food and beverages as well as supplementation, over half of participants (53.7%) reported consuming a multivitamin, contributing approximately 250 milligrams of calcium to their daily intake. A smaller proportion of participants (19.5%) reported consuming a calcium supplement, which contributes approximately 500 milligrams of calcium to their daily intake. Viewing overall calcium intake among experimental group participants holistically, participants consumed a total of 513.33 milligrams of daily calcium through both their diet and supplementation. Interestingly, this data point closely aligns with the dietary intake of calcium among control group participants (519.63 milligrams of dietary calcium). However, the experimental group remains consuming insufficient calcium, meeting only 51.3% of their

daily calcium needs with supplementation, and only 27.2% of their calcium needs from their diet alone.

2.5.3 Healthcare Providers

When analyzing healthcare providers visited for the child's milk allergy and intolerance, the majority of experimental group participants (82.9%) reported that they have a multidisciplinary team of healthcare professionals supporting their child's health. While most participants see a pediatrician and/or a pediatric allergist or immunologist to track and help manage their child's food allergy, only 14.6% of participants have visited a dietitian or nutritionist to support their child's allergic condition. Research has been conducted that examines the important role a dietitian or nutritionist plays in assisting patients to understand ingredient labeling, the concerns of cross-contamination, as well as ensuring patients are aware of potential nutrient insufficiencies resulting from the exclusion of food items or food groups from the diet (Groetch et al., 2010; Mofidi, 2003).

Satisfaction with the quality of participants' healthcare provider(s) was assessed through the measurement of trust and satisfaction with the amount of information or education received on their child's food allergy. While the majority of respondents trust their provider's opinion or medical advice, 22.0% reported sometimes or frequently distrusting their child's provider. This is consistent with other literature that demonstrates prevalent distrust between parents and providers particularly within the food allergy community. This is likely due to the uncertainties and anxieties associated with childhood allergies as well as variation in treatment plans among healthcare providers (Hu et al., 2008). This prevalent distrust parents and caregivers have of their child's healthcare practitioners can place parents and caregivers at an even greater risk of developing a calcium deficiency as they may not be receiving sufficient information or education

on the diverse impact of food allergies. While the results of this study show that 17.1% of participants feel that they have not received adequate information from their child's provider on their allergy, 34.2% do not receive ongoing education about their child's allergy. Ongoing education and learning is critical for parents and caregivers to be aware of potential deficiencies for themselves and their child, learn how to effectively manage their child's food allergy, as well as achieve a better quality of life (Vargas et al., 2011)

2.5.4 Implications for Research and Practice

The findings of this study suggest that the quality of healthcare can be improved by highlighting the nutritional risks of parents and caregivers of children with food allergies. While previous research has been conducted on the nutritional concerns of children diagnosed with food allergies, there is a significant gap in the literature on the implications a child's food allergy has on the diet of their parents or caregivers (Fukuda et al., 2020; Mehta et al., 2013; Meyer, 2018).

This research study addresses this gap in literature and contributes to the understanding of the dietary connection between children and their parents or caregivers from the parent/caregiver perspective, the nutritional implications of eliminating milk/milk-containing products from an individual's diet, as well as factors that contribute to a decreased consumption of dietary calcium. Notable and significant findings include: a child's milk allergy impacts the dietary calcium intake of their parents or caregivers and milk/milk-containing products contribute to a greater intake of calcium. Furthermore, this study emphasizes the importance of nutritional monitoring and ongoing education for parents and caregivers of food allergies.

2.5.5 Limitations

The primary limitation of this study is the recruitment method, which may contribute to a risk of bias in the study and limits generalizability. While recruiting participants through social media was an efficient method to capture demographically diverse participants, the study's reach was limited to nine Facebook special interest groups for the experimental and control groups. An additional limitation of this study related to the investigation of multivitamin and calcium supplementation use; control group multivitamin and calcium supplementation were not investigated.

2.6 Conclusion

The study observed a lower dietary calcium intake in parents and caregivers of children with a milk allergy than in parents and caregivers of children without a milk allergy. Implications of this research can support nutrition education for parents and caregivers of children with food allergies, particularly as it pertains to closely evaluating their micronutrient consumption as well as identifying any dietary restrictions due to their child's allergy.

2.7 Tables and Figures

Table 1. Demographics of experimental and control group participants

	Control (n=16)		Experimental (n=41)		*P*
	n	%	n	%	
Gender					
Female	15	93.75%	41	100%	
Male	1	6.25%	0	0.00%	
Marital Status					
Single	1	6.25%	3	7.32%	
Married	13	81.25%	36	87.80%	
Divorced	1	6.25%	1	2.43%	
Separated	0	0.00%	1	2.43%	
Widowed	1	6.25%	0	0.00%	
Race/Ethnicity					
Asian	4	25.00%	0	0.00%	
Black or African American	1	6.25%	1	2.43%	0.009
Latinx	0	0.00%	2	4.88%	
White	11	68.75%	38	92.68%	
Highest Level of Education					
Less than High School	0	0.00%	0	0.00%	
High School Graduate	0	0.00%	2	4.88%	
Some College	0	0.00%	8	19.51%	
2-Year Degree	0	0.00%	3	7.32%	
4-Year Degree	1	6.25%	4	9.76%	0.001
Professional Degree	1	6.25%	1	2.43%	
Bachelor's Degree	2	12.50%	5	12.20%	
Master's Degree	9	56.25%	14	34.15%	
Doctorate	3	18.75%	2	4.88%	
Employment Status					
Employed Full-Time	11	68.75%	14	34.15%	
Employed Part-Time	2	12.50%	11	26.83%	0.552
Unemployed	3	18.75%	16	39.02%	
Household Income					
Less than $10,000	0	0.00%	2	4.88%	
$10,000 - $19,999	0	0.00%	0	0.00%	
$20,000 - $29,999	1	6.25%	0	0.00%	
$30,000 - $39,999	0	0.00%	1	2.43%	
$40,000 - $49,999	0	0.00%	4	9.76%	
$50,000 - $59,999	0	0.00%	3	7.32%	
$60,000 - $69,999	0	0.00%	2	4.88%	
$70,000 - $79,999	0	0.00%	5	12.20%	
$80,000 - $89,999	0	0.00%	3	7.32%	
$90,000 - $99,999	0	0.00%	2	4.88%	
$100,000 - $149,999	1	6.25%	7	17.07%	
More than $150,000	13	81.25%	11	26.83%	
<no response>	1	6.25%	1	2.43%	

Table 2. Results of the child allergy status screening question.

Child Allergy Status	Mean	
No	519.63	A
No, however, my child has a milk intolerance or suspected allergy	239.00	AB
Yes, one child with a milk allergy	281.22	B
Yes, two children with a milk allergy	180.67	AB

Mean values identified without the same letter are significantly different (p=0.022). Significance was determined utilizing one-way ANOVA.

Figure 1. Survey design of experimental group and control group surveys

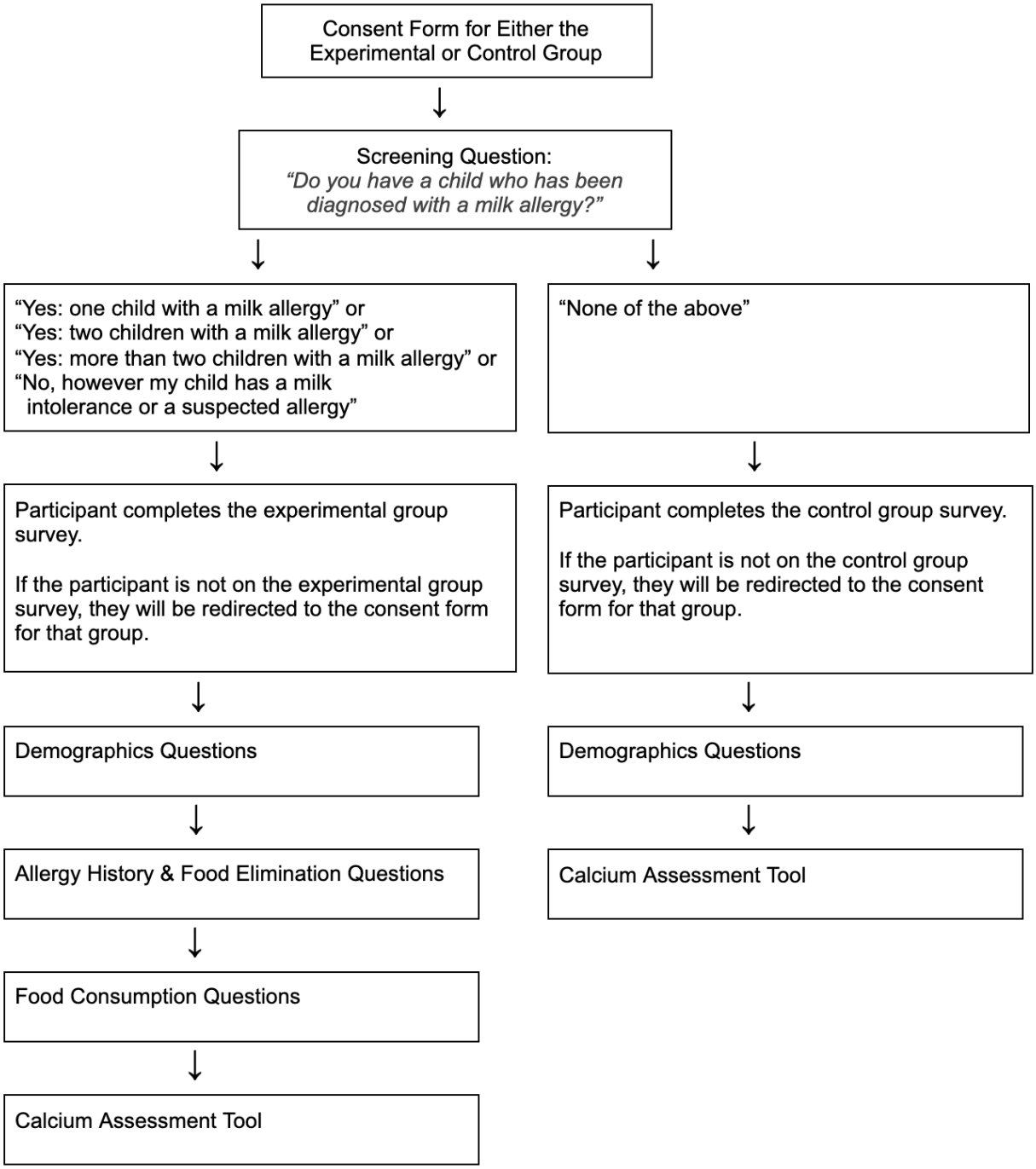
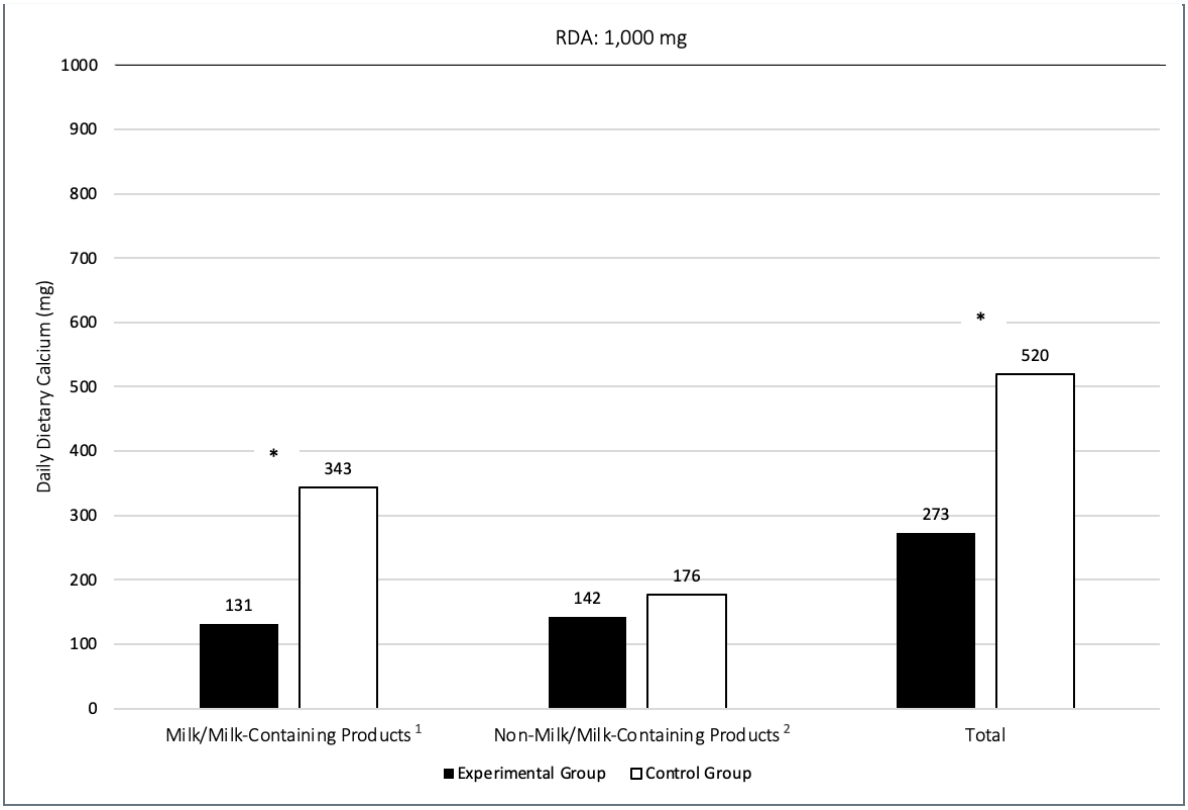


Figure 2. CAT results, comparing daily calcium intake by categorized food items (milk/milk-containing products; non-milk/milk-containing products)

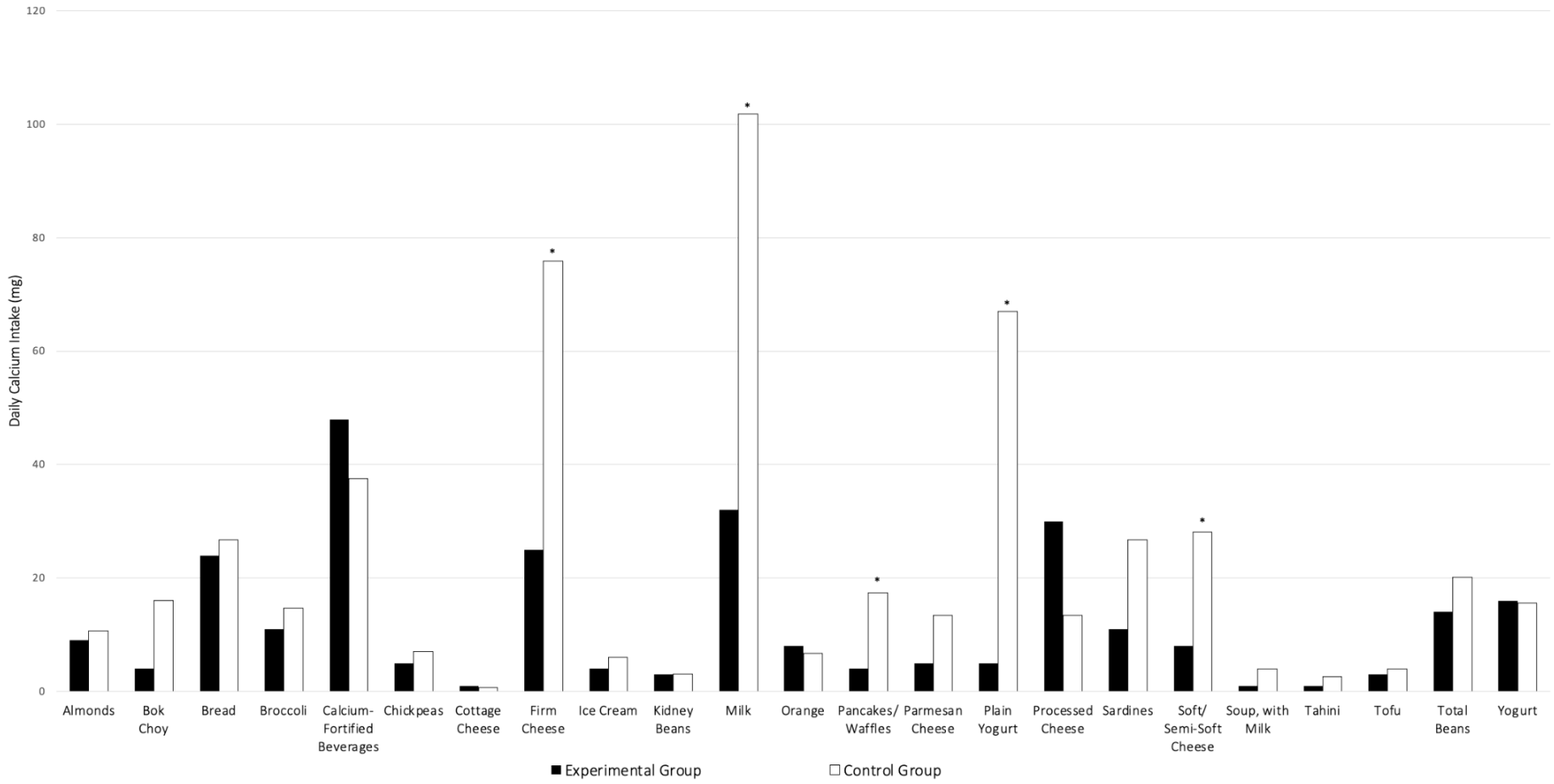


*Indicates statistically significant results: Milk/Milk-Containing Products (p=0.009); Total Calcium Intake (p=0.002)

[1] Milk/milk-containing products include: cottage cheese, firm cheese, ice cream, milk, pancakes/waffles, parmesan cheese, plain yogurt, processed cheese, soft/semi-soft cheese, soup, and yogurt

[2] Non-milk/milk-containing products include: almonds, bok choy, bread, broccoli, calcium-fortified beverages, chick peas, kidney beans, orange, sardines, tahini, tofu, and total beans

Figure 3. CAT results: mean daily calcium intake (mg) by food item



*Indicates statistically significant results: Firm Cheese (p=0.003); Milk (p=0.043); Pancakes/Waffles (p=0.024); Plain Yogurt (p=0.013); Soft/Semi-Soft Cheese (p=0.021). Consumption of the assessed CAT food items were compared among all participants using an Independent Samples T-Test.

2.8 References

Abrams, E. M., & Sicherer, S. H. (2016). Diagnosis and management of food allergy. *CMAJ : Canadian Medical Association Journal*, *188*(15), 1087–1093. https://doi.org/10.1503/cmaj.160124

Anagnostou, A. (2021). Weighing the benefits and risks of oral immunotherapy in clinical practice. *Allergy and Asthma Proceedings*, *42*(2), 118–123. https://doi.org/10.2500/aap.2021.42.200107

Anvari, S., & Anagnostou, K. (2018). The Nuts and Bolts of Food Immunotherapy: The Future of Food Allergy. *Children*, *5*(4). https://doi.org/10.3390/children5040047

BC Dairy Association. (n.d.). *Calcium Calculator*. Calcium Calculator. Retrieved February 28, 2021, from https://bcdairy.ca/nutritioneducation/calciumcalculator/

Begin, P., et al. (2014). Oral immunotherapy for the treatment of food allergy. *Human Vaccines & Immunotherapeutics*, *10*(8), 2295–2302. https://doi.org/10.4161/hv.29233

Black, M. M. (2003). Micronutrient deficiencies and cognitive functioning. *The Journal of Nutrition*, *133*(11 Suppl 2), 3927S-3931S. https://doi.org/10.1093/jn/133.11.3927S

Bouziani, A., et al. (2018). Dietary Calcium Intake in Sample of School Age Children in City of Rabat, Morocco. *Journal of Nutrition and Metabolism*, *2018*. https://doi.org/10.1155/2018/8084623

Boyce, J. A., et al. (2011). Guidelines for the diagnosis and management of food allergy in the United States: Summary of the NIAID-Sponsored Expert Panel Report. *Nutrition*, *27*(2), 253–267. https://doi.org/10.1016/j.nut.2010.12.001

Brożek, J. L., et al. (2012). Oral immunotherapy for IgE-mediated cow's milk allergy: A systematic review and meta-analysis. *Clinical and Experimental Allergy: Journal of the*

British Society for Allergy and Clinical Immunology, *42*(3), 363–374. https://doi.org/10.1111/j.1365-2222.2011.03948.x

Burt, L. A., et al. (2019). Effect of High-Dose Vitamin D Supplementation on Volumetric Bone Density and Bone Strength: A Randomized Clinical Trial. *JAMA*, *322*(8), 736–745. https://doi.org/10.1001/jama.2019.11889

Calcium: Fact Sheet for Health Professionals. (2021, August 17). National Institutes of Health Office of Dietary Supplements. https://ods.od.nih.gov/factsheets/Calcium-HealthProfessional/

Cannon, H. E. (2018). The Economic Impact of Peanut Allergies. *AJMC*, *24*(19). https://www.ajmc.com/view/the-economic-impact-of-peanut-allergies

CDC. (2020). *Food Allergies, Healthy Schools*. https://www.cdc.gov/healthyschools/foodallergies/index.htm

Chad, Z. (2001). Allergies in children. *Paediatrics & Child Health*, *6*(8), 555–566. https://doi.org/10.1093/pch/6.8.555

Chafen, J. J. S., et al. (2010). Diagnosing and Managing Common Food Allergies: A Systematic Review. *JAMA*, *303*(18), 1848–1856. https://doi.org/10.1001/jama.2010.582

Chen, M., & Land, M. (2017). The current state of food allergy therapeutics. *Human Vaccines & Immunotherapeutics*, *13*(10), 2434–2442. https://doi.org/10.1080/21645515.2017.1359363

Cormick, G., & Belizán, J. M. (2019). Calcium Intake and Health. *Nutrients*, *11*(7), 1606. https://doi.org/10.3390/nu11071606

Flom, J. D., & Sicherer, S. H. (2019). Epidemiology of Cow's Milk Allergy. *Nutrients*, *11*(5). https://doi.org/10.3390/nu11051051

Food Allergies. (2021, February 8). Food and Drug Administration; FDA. https://www.fda.gov/food/food-labeling-nutrition/food-allergies

Food Allergy Research & Education. (n.d.). Retrieved February 28, 2021, from https://www.foodallergy.org/

Fukuda, Y., et al. (2020). A study on the effect of nutrient intake on the body mass index of mothers of children with food allergies. *Asian Pacific Journal of Allergy and Immunology*, *38*(4), 264–270. https://doi.org/10.12932/AP-260718-0377

Gore, C., et al. (2016). New patient-reported experience measure for children with allergic disease: Development, validation and results from integrated care. *Archives of Disease in Childhood*, *101*(10), 935–943. https://doi.org/10.1136/archdischild-2015-309598

Groetch, M. E., et al. (2010). Food Allergy Educational Needs of Pediatric Dietitians: A survey by the Consortium of Food Allergy Research. *Journal of Nutrition Education and Behavior*, *42*(4), 259–264. https://doi.org/10.1016/j.jneb.2009.06.003

Hadley, C. (2006). Food allergies on the rise? Determining the prevalence of food allergies, and how quickly it is increasing, is the first step in tackling the problem. *EMBO Reports*, *7*(11), 1080–1083. https://doi.org/10.1038/sj.embor.7400846

Harvard T.H. Chan School of Public Health. (n.d.). *The Nutritional Source: Calcium*. The Nutrition Source. Retrieved December 9, 2021, from https://www.hsph.harvard.edu/nutritionsource/calcium/

Heine, R. G. (2018). Food Allergy Prevention and Treatment by Targeted Nutrition. *Annals of Nutrition and Metabolism*, *72*(3), 33–45. https://doi.org/10.1159/000487380

Hodges, J. K., et al. (2019). Lactose Intolerance and Bone Health: The Challenge of Ensuring Adequate Calcium Intake. *Nutrients*, *11*(4). https://doi.org/10.3390/nu11040718

Hoy, K. M., & Goldman, J. (2014, October 28). *Calcium intake of the U.S. population, What We Eat in America, NHANES 2009-2010*. https://www.ars.usda.gov/research/publications/publication/?seqNo115=309598

Hu, W., et al. (2008). When doctors disagree: A qualitative study of doctors' and parents' views on the risks of childhood food allergy. *Health Expectations : An International Journal of Public Participation in Health Care and Health Policy*, *11*(3), 208–219. https://doi.org/10.1111/j.1369-7625.2008.00506.x

Hung, A., et al. (2011). Validation of a calcium assessment tool in postmenopausal Canadian women. *Maturitas*, *69*(2), 168–172. https://doi.org/10.1016/j.maturitas.2011.02.016

Jackson, K., et al. (2013). Trends in allergic conditions among children: United States, 1997-2011. *NCHS Data Brief*, *121*, 1–8.

Jin, J. (2017). Treatments for Food Allergies. *JAMA*, *318*(19), 1945. https://doi.org/10.1001/jama.2017.17306

Koplin, J. J., et al. (2013). The Impact of Family History of Allergy on Risk of Food Allergy: A Population-Based Study of Infants. *International Journal of Environmental Research and Public Health*, *10*(11), 5364–5377. https://doi.org/10.3390/ijerph10115364

Lau, G.Y., et al. (2014). Anxiety and stress in mothers of food-allergic children. *Pediatric Allergy and Immunology: Official Publication of the European Society of Pediatric Allergy and Immunology*, *25*(3), 236–242. https://doi.org/10.1111/pai.12233

Lifschitz, C., & Szajewska, H. (2015). Cow's milk allergy: Evidence-based diagnosis and management for the practitioner. *European Journal of Pediatrics*, *174*(2), 141–150. https://doi.org/10.1007/s00431-014-2422-3

Lim, H.S., et al. (2018). Food Elimination Diet and Nutritional Deficiency in Patients with

Inflammatory Bowel Disease. *Clinical Nutrition Research*, *7*(1), 48–55. https://doi.org/10.7762/cnr.2018.7.1.48

Loh, W., & Tang, M. L. K. (2018). The Epidemiology of Food Allergy in the Global Context. *International Journal of Environmental Research and Public Health*, *15*(9). https://doi.org/10.3390/ijerph15092043

Mehta, H., et al. (2013). Growth and Nutritional Concerns in Children with Food Allergy. *Current Opinion in Allergy and Clinical Immunology*, *13*(3), 275–279. https://doi.org/10.1097/ACI.0b013e328360949d

Messina, M., & Venter, C. (2020). Recent Surveys on Food Allergy Prevalence. *Nutrition Today*, *55*(1), 22–29. https://doi.org/10.1097/NT.0000000000000389

Meyer, R. (2018). Nutritional disorders resulting from food allergy in children. *Pediatric Allergy and Immunology : Official Publication of the European Society of Pediatric Allergy and Immunology*, *29*(7), 689–704. https://doi.org/10.1111/pai.12960

Mofidi, S. (2003). Nutritional management of pediatric food hypersensitivity. *Pediatrics*, *111*(6 Pt 3), 1645–1653.

Mowszet, K., et al. (2005). Causes of malnutrition in children under the age of 5 years in own material. *Advances in Clinical and Experimental Medicine*, *14*, 315–322.

Nakamura, T., & Murata, T. (2018). Regulation of vascular permeability in anaphylaxis. *British Journal of Pharmacology*, *175*(13), 2538–2542. https://doi.org/10.1111/bph.14332

National Institutes of Health, Office of Dietary Supplements. (n.d.). *Calcium Fact Sheet for Consumers*. Retrieved December 9, 2021, from https://ods.od.nih.gov/factsheets/Calcium-Consumer/

Pastorello, E. A., et al. (1995). Studies on the relationship between the level of specific IgE

antibodies and the clinical expression of allergy: I. Definition of levels distinguishing patients with symptomatic from patients with asymptomatic allergy to common aeroallergens. *Journal of Allergy and Clinical Immunology*, *96*(5), 580–587. https://doi.org/10.1016/S0091-6749(95)70255-5

Polloni, L., et al. (2013). Nutritional behavior and attitudes in food allergic children and their mothers. *Clinical and Translational Allergy*, *3*(1), 41. https://doi.org/10.1186/2045-7022-3-41

Roberts, K., et al. (2021). Parental Anxiety and Posttraumatic Stress Symptoms in Pediatric Food Allergy. *Journal of Pediatric Psychology*, *jsab012*. https://doi.org/10.1093/jpepsy/jsab012

Ross, A. C., et al. (2011). Dietary Reference Intakes for Adequacy: Calcium and Vitamin D. In *Dietary Reference Intakes for Calcium and Vitamin D*. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK56056/

Rozenberg, S., et al. (2016). Effects of Dairy Products Consumption on Health: Benefits and Beliefs—A Commentary from the Belgian Bone Club and the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases. *Calcified Tissue International*, *98*, 1–17. https://doi.org/10.1007/s00223-015-0062-x

S.578—117th Congress: FASTER Act of 2021 (2021/2022). (2021, April 23). [Legislation]. https://www.congress.gov/bill/117th-congress/senate-bill/578

Sicherer, S. H., et al. (2010). US prevalence of self-reported peanut, tree nut, and sesame allergy: 11-year follow-up. *Journal of Allergy and Clinical Immunology*, *125*(6), 1322–1326. https://doi.org/10.1016/j.jaci.2010.03.029

Sözen, T., et al. (2017). An overview and management of osteoporosis. *European Journal of Rheumatology*, *4*(1), 46–56. https://doi.org/10.5152/eurjrheum.2016.048

Story, M., et al. (2008). Creating healthy food and eating environments: Policy and environmental approaches. *Annual Review of Public Health*, *29*, 253–272. https://doi.org/10.1146/annurev.publhealth.29.020907.090926

Turner, P. J., et al. (2017). Fatal Anaphylaxis: Mortality Rate and Risk Factors. *The Journal of Allergy and Clinical Immunology. in Practice*, *5*(5), 1169–1178. https://doi.org/10.1016/j.jaip.2017.06.031

Van Den Heuvel, E. G. H. M., & Steijns, J. M. J. M. (2018). Dairy products and bone health: How strong is the scientific evidence? *Nutrition Research Reviews*, *31*(2), 164–178. https://doi.org/10.1017/S095442241800001X

Vargas, P. A., et al. (2011). Developing A Food Allergy Curriculum for Parents. *Pediatric Allergy and Immunology : Official Publication of the European Society of Pediatric Allergy and Immunology*, *22*(6), 575–582. https://doi.org/10.1111/j.1399-3038.2011.01152.x

Warren, C. M., et al. (2019). Prevalence and Severity of Sesame Allergy in the United States. *JAMA Network Open*, *2*(8), e199144. https://doi.org/10.1001/jamanetworkopen.2019.9144

Woods, R. K., et al. (2002). Reported adverse food reactions overestimate true food allergy in the community. *European Journal of Clinical Nutrition*, *56*(1), 31–36. https://doi.org/10.1038/sj.ejcn.1601306

3. Manuscript II

Parental and Child Stress, Anxiety, and Calcium Intake

3.1 Abstract

Parents and caregivers of children with food allergies are at a greater risk of developing adverse psychological and psychosocial impacts, such as increased anxiety, stress, and worry. These concerns can impact a parent's or caregiver's overall quality of life, such as comfortability in dining at restaurants, as well as attending social events or other gatherings. This study investigates whether quality of life variables influence dietary calcium intake among parents and caregivers of a child with a milk allergy. The results of this study demonstrated a lack of significance across all variables investigated when comparing mean calcium intake among participants who agreed or did not agree with the factors evaluated. Further analysis showed that nearly half of participants (48.8%) reported not feeling comfortable dining outside of the home with their milk-allergic child and 39.0% are not comfortable attending social events with their child. This study addresses a significant gap in literature on the dietary impact a child's food allergy has on their parent or caregiver's diet.

3.2 Introduction

Many parents and caregivers of at least one child with a food allergy experience negative psychological and psychosocial impacts due to heightened stress, worry, and anxiety (Roberts et al., 2021). Research has shown that parents and caregivers of children who are either at-risk of anaphylaxis or have a history of anaphylaxis are more likely to develop anxiety and posttraumatic stress. Using the Penn State Worry Questionnaire (PSWQ), a validated 16-item tool to measure levels of worry, Roberts and others (2021) evaluated worry levels among parents of children with food allergies. On a scale from 16 to 80, from lower to greater levels of worry, researchers reported a mean score of 56.77 and found that 85 participants (81.0%) scored over the cut-off of 45, indicating some level of an anxiety disorder, and 37 participants (35.2%) demonstrated a score above 64, indicating the presence of generalized anxiety disorder.

This study also utilized the Depression Anxiety Stress Scales 21 (DASS), a validated tool to assess anxiety levels in the generalized population, and the results demonstrated that 46.7% of participants experienced “normal” anxiety levels, 28.6% experienced “mild” to “moderate” anxiety, 8.0% “severe” anxiety, and 16.2% “extremely severe” anxiety (Roberts et al., 2021). The results also showed a correlation between parent anxiety levels and the severity of their children’s food allergy, measured by the frequency of prior anaphylactic reactions and/or severe allergic symptoms. Additionally, higher levels of uncertainty and lower degrees of self-efficacy were both associated with more significant parental anxiety, worry, and posttraumatic stress.

The correlation between a child’s allergies and parent and/or caregiver behaviors extends beyond psychological and psychosocial factors. The relationship between parental dietary habits and patterns, and the influence parents have on the diets of their children has been well-researched, particularly among children between the ages of one to 12 years (Lazarou et al.,

2008; Savage et al., 2007; Yee et al., 2017). The home food environment, including the availability and accessibility of food, snacking habits, as well as parental diets, are primary factors that influence the eating habits and behaviors of children (Mahmood et al., 2021). In addition, parental food preferences and household rules, such as how much and what food items a child may eat, also influence the diets of children (Scaglioni et al., 2011; Russell et al., 2018). A recent study evaluated the dietary connection in parent-child dyads, comparing children with and without neurodevelopmental disorders, and identified that fussy eating among parents was a strong determinant in a child's eating behavior (Thorsteinsdottir et al., 2021).

Another research study conducted in Dunedin, New Zealand explored the correlation between parental diet quality and child dietary patterns by analyzing intake holistically, rather than a single nutrient (Davison et al., 2017). This cross-sectional study reviewed 401 child-parent pairs; the children were aged nine to 12 years old. Basic demographic information was collected from the children and parents separately, along with their food and drink intake. The Physical Activity, Exercise, Diet and Lifestyle Study (PEDALS) food frequency questionnaire was used to gather data on the children's typical intake, using a seven-point Likert scale. Parents utilized the Dietary Habits Questionnaire (DHQ), using a five-point Likert scale. The results of this study demonstrated that the children's snack consumption and patterns negatively affected parents' diet quality. For instance, an increase in a child consumDavisoning less healthy snack foods led to their parents having a poorer quality diet.

The influence that a child's diet may have on their parent or caregiver, however, has been under-researched, particularly as it pertains to food allergies (Polloni et al., 2013). One study conducted in Northeastern Italy evaluates the impact a child's allergy may have on members within the same household (Polloni et al., 2013). This study's objective was to identify the

impact food allergies may have on attitudes toward food among family members, particularly as it relates to social life. The sample population included 124 mother-child pairs; the children were of preschool-age and were diagnosed with at least one food allergy. The specific allergens in the inclusion criteria consisted of milk, egg, wheat, and nuts. The results of this study demonstrated that 9.8% (n=13) of respondents excluded food allergens from their home due to the child's allergy, with the objective of establishing a safe home environment, free of allergens, while 15.3% (n=19) did not share their food with any members of their family. Polloni and others (2013) concluded that food allergies impact the psychological status, quality of life, and nutritional status of members of the same household, yet recognize that this topic is under-explored.

Prior studies have been conducted that analyze the nutritional implications of children that have been diagnosed with a food allergy, as well as the influence parents and caregivers have on the diet of their child(ren) (Christie et al., 2002; Hildebrand et al., 2019). The influence that a child's allergy has on the diet of their parent or caregiver, however, has not been well-studied. One recent study reports that no prior studies have investigated the impact a child's allergy has on the mother's diet and body mass index (BMI) (Fukuda et al., 2020). The results of this study demonstrate that the BMI of mothers who strictly follow the diet of their child with the food allergy is significantly lower than mothers in the non-food allergy group. An additional study assesses the correlation between the parent and child diets, including the BMI of mothers, and showed that the meal contents between children who had food allergies and their mothers were significantly higher than the control group (Fukuda & Kameda, 2019).

There is current literature on maternal elimination diets due to breastfeeding infant allergies; researchers suggest that allergenic proteins in breast milk may elicit an allergic

response in infants (Rajani et al., 2020). This research balances the benefits of breastfeeding with the potential risks of allergy-related symptoms, such as gastrointestinal symptoms, atopic dermatitis, and potential anaphylaxis. However, there is a gap in research that examines maternal or parental elimination diets once their child stops breastfeeding, particularly as it pertains to childhood food allergies. Furthermore, to the researchers' knowledge, there have been no prior studies that investigate dietary calcium implications on parents and caregivers of milk-allergic children. This research study addresses this gap in literature and knowledge as well as investigates if quality of life variables influence the dietary calcium intake among parents and caregivers of a child with a milk allergy.

3.3 Materials and Methods

Panelists were recruited and evaluated for calcium intake as described in Chapter 1 of this thesis. Participants of this study included experimental group participants from Chapter 1: parents and caregivers of a child with a milk allergy. A self-reported food frequency questionnaire (FFQ) was utilized to assess estimated calcium intake. The validated Calcium Assessment Tool (CAT) (see Appendix) obtained dietary consumption patterns by assessing an individual's weekly intake of 26 different calcium-rich food and beverage items. Participants recorded the number of servings consumed in a typical week over the past month.

Five variables were assessed to determine participants' level of stress, anxiety, and comfort in caring for their child with the food allergy. The 'quality of life' variables investigated included stress in managing their child's milk allergy, comfort in managing their child's allergy, comfort in dining at a restaurant with their milk-allergic child, comfort in attending social events with their milk-allergic child, and whether they limit gatherings or social interactions with their milk-allergic child. Each variable was assessed on a five-point Likert scale, from 'strongly

disagree' to 'strongly agree.' Assessment scale variables were condensed into two groups for the data analysis: 'do not agree' which included neutral/disagree/strongly disagree responses and 'agree' which included agree and strongly agree responses. One-way ANOVA was utilized to determine if there were any significant differences among the variables compared to daily calcium intake.

3.4 Results

In response to 'quality of life' questions investigated, 48.8% (n=20) of participants disagree or strongly disagree with the statement, 'I feel comfortable dining at a restaurant with my child,' and 39.0% (n=16) disagree or strongly disagree with the statement: 'I feel comfortable attending social events with my child.'A lack of significance was identified among the five variables that assessed differences among participants when comparing to dietary intake: stress in managing their child's milk allergy (p=0.660), comfort in managing their child's allergy (p=0.480), comfort in dining at a restaurant with their milk-allergic child (p=0.610), comfort in attending social events with their milk-allergic child (p=0.780), and whether they limit gatherings or social interactions with their milk-allergic child (p=0.890) (see Figure 1).

3.5 Discussion

The results of the assessment of participants' levels of stress, anxiety, and comfort in caring for their child with the food allergy, it was evident that these factors are not predictive of calcium intake, as evidenced by a lack of significance among all quality of life variables. Moreover, there was a similarity in results among mean calcium intake when comparing participants who agreed or did not agree with the factors evaluated. However, when evaluating mean calcium intake, it is evident that participants are consuming insufficient calcium and are at significant risk of developing a calcium deficiency.

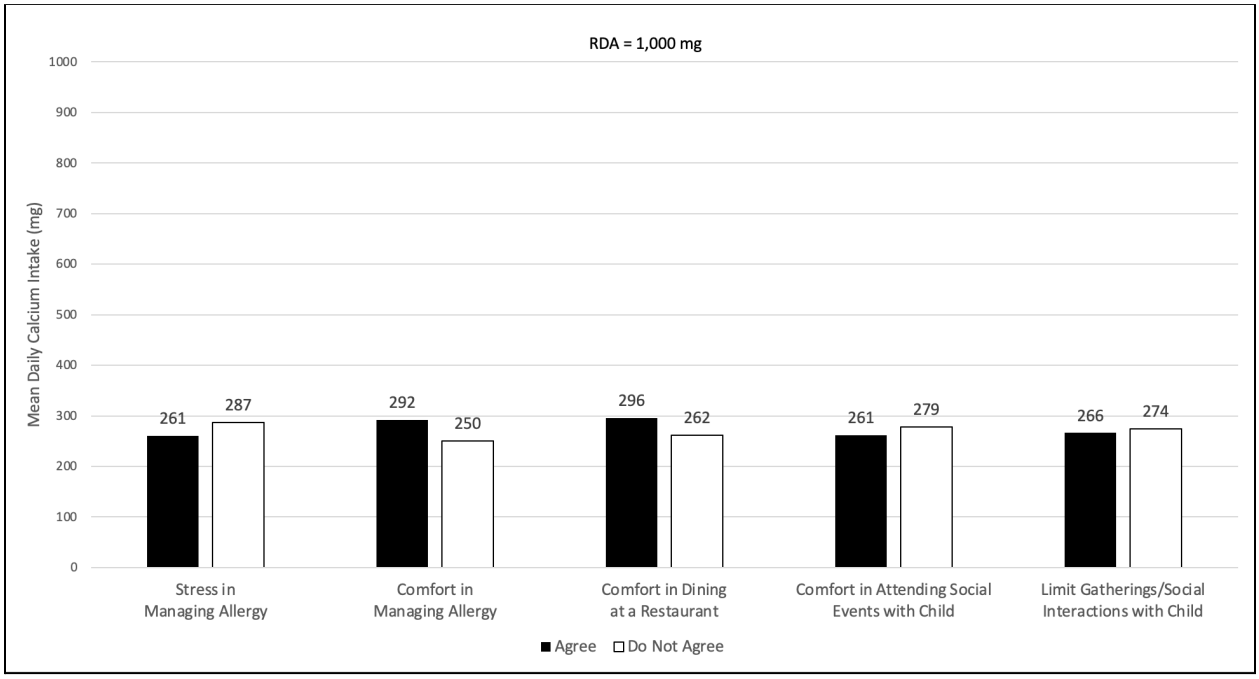
Roberts and others (2021) report that high levels of uncertainty and worry contribute to parental anxiety and stress. Other researchers have investigated parental anxiety, worry, and stress in managing their child's allergy, and report that mothers, in particular, are at a greater risk of developing stress and anxiety compared to mothers of children who do not have a chronic illness (Lau et al., 2014). Another recent study, which evaluated quality of life measures and stress among parents of children with a medically diagnosed food allergy compared to parents of children without a food allergy, reported no significant differences in quality of life, however significantly higher anxiety and stress levels in parents of allergic children, compared to the control group (Birdi et al., 2016). This level of elevated stress and anxiety may be correlated with a parent's or caregiver's decision and comfort in dining out at a restaurant as well as comfort in attending social gatherings, however, this study demonstrates that these factors are not predictive of calcium intake.

3.6 Conclusion

Childhood food allergies contribute to a greater level of worry, anxiety, and stress on parents and caregivers. While the results of this study show that nearly half of parents and caregivers of children with milk allergies limit experiences due to their child's allergy (e.g. dining at a restaurant or attending social events), these factors are not predictive of dietary calcium intake.

3.7 Tables and Figures

Figure 1. Likert scale assessment of parental comfort and stress among experimental group participants.



Participants rated each statement on a scale from 'Strongly Disagree' to 'Strongly Agree.' Significance values investigated for each assessment: Stress in Managing [Child's] Allergy (p=0.660); Comfort in Managing [Child's] Allergy (p=0.480); Comfort in Dining at a Restaurant (p=0.610); Comfort in Attending Social Events with Child (p=0.780); Limit Gatherings/Social Interactions with Child (p=0.890)

3.8 References

Birdi, G., et al. (2016). Quality of Life, Stress, and Mental Health in Parents of Children with Parentally Diagnosed Food Allergy Compared to Medically Diagnosed and Healthy Controls. *Journal of Allergy*, *2016*, e1497375. https://doi.org/10.1155/2016/1497375

Christie, L., et al. (2002). Food Allergies in Children Affect Nutrient Intake and Growth. *Journal of the American Dietetic Association*, *102*(11), 1648–1651. https://doi.org/10.1016/S0002-8223(02)90351-2

Davison, B., et al. (2017). The Association between Parent Diet Quality and Child Dietary Patterns in Nine- to Eleven-Year-Old Children from Dunedin, New Zealand. *Nutrients*, *9*(5). https://doi.org/10.3390/nu9050483

Fukuda, Y., & Kameda, M. (2019). Assessment of the Correlation Between Mother and Child Body Mass Index and Mother and Child Diet in Children With Food Allergies. *Journal of Clinical Medicine Research*, *11*(10), 703–710. https://doi.org/10.14740/jocmr.v11i10.3959

Fukuda, Y., et al. (2020). A study on the effect of nutrient intake on the body mass index of mothers of children with food allergies. *Asian Pacific Journal of Allergy and Immunology*, *38*(4), 264–270. https://doi.org/10.12932/AP-260718-0377

Hildebrand, H., et al. (2019). Calcium Intake in Children with Eczema and/or Food Allergy: A Prospective Cohort Study. *Nutrients*, *11*(12), 3039. https://doi.org/10.3390/nu11123039

Lau, G.Y., et al. (2014). Anxiety and stress in mothers of food-allergic children. *Pediatric Allergy and Immunology: Official Publication of the European Society of Pediatric Allergy and Immunology*, *25*(3), 236–242. https://doi.org/10.1111/pai.12233

Lazarou, C., et al. (2008). The influence of parents' dietary beliefs and behaviours on children's

dietary beliefs and behaviours. The CYKIDS study. *Appetite*, *51*, 690–696. https://doi.org/10.1016/j.appet.2008.06.006

Mahmood, L., et al. (2021). The Influence of Parental Dietary Behaviors and Practices on Children's Eating Habits. *Nutrients*, *13*(4), 1138. https://doi.org/10.3390/nu13041138

Polloni, L., et al. (2013). Nutritional behavior and attitudes in food allergic children and their mothers. *Clinical and Translational Allergy*, *3*(1), 41. https://doi.org/10.1186/2045-7022-3-41

Rajani, P. S., et al. (2020). Presentation and Management of Food Allergy in Breastfed Infants and Risks of Maternal Elimination Diets. *The Journal of Allergy and Clinical Immunology: In Practice*, *8*(1), 52–67. https://doi.org/10.1016/j.jaip.2019.11.007

Roberts, K., et al. (2021). Parental Anxiety and Posttraumatic Stress Symptoms in Pediatric Food Allergy. *Journal of Pediatric Psychology*, *jsab012*. https://doi.org/10.1093/jpepsy/jsab012

Russell, C. G., et al. (2018). Parental feeding practices associated with children's eating and weight: What are parents of toddlers and preschool children doing? *Appetite*, *128*, 120–128. https://doi.org/10.1016/j.appet.2018.05.145

Savage, et al. (2007). Parental influence on eating behavior: Conception to adolescence. *The Journal of Law, Medicine & Ethics: A Journal of the American Society of Law, Medicine & Ethics*, *35*(1), 22–34. https://doi.org/10.1111/j.1748-720X.2007.00111.x

Scaglioni, S., et al. (2011). Determinants of children's eating behavior. *The American Journal of Clinical Nutrition*, *94*(6 Suppl), 2006S-2011S. https://doi.org/10.3945/ajcn.110.001685

Thorsteinsdottir, S., et al. (2021). Fussy Eating among Children and Their Parents: Associations in Parent-Child Dyads, in a Sample of Children with and without Neurodevelopmental

Disorders. *Nutrients*, *13*(7), 2196. https://doi.org/10.3390/nu13072196

Yee, A. Z. H., et al. (2017). The influence of parental practices on child promotive and preventive food consumption behaviors: A systematic review and meta-analysis. International Journal of Behavioral Nutrition and Physical Activity, 14(1), 47. https://doi.org/10.1186/s12966-017-0501-3

4. Conclusion

The study observed a lower dietary calcium intake in parents and caregivers of children with a milk allergy than in parents and caregivers of children without a milk allergy. While prior literature shows that a child's food allergy negatively impacts their parent's or caregiver's state of worry, anxiety, and stress, this study showed that these factors are not predictive of dietary calcium intake.

Implications of this research can support nutrition education for parents and caregivers of children with food allergies, particularly as it pertains to closely evaluating their micronutrient consumption as well as identifying any dietary restrictions due to their child's allergy.

Future studies can explore the implications other childhood allergens may have on parents or caregivers, such as eggs, peanuts or tree nuts, fish, wheat, or soy. In addition, future studies could reproduce this research by evaluating vitamin D consumption, and investigating the impact on calcium absorption.

5. References

Abrams, E. M., & Sicherer, S. H. (2016). Diagnosis and management of food allergy. *CMAJ : Canadian Medical Association Journal*, *188*(15), 1087–1093. https://doi.org/10.1503/cmaj.160124

Anagnostou, A. (2021). Weighing the benefits and risks of oral immunotherapy in clinical practice. *Allergy and Asthma Proceedings*, *42*(2), 118–123. https://doi.org/10.2500/aap.2021.42.200107

Anvari, S., & Anagnostou, K. (2018). The Nuts and Bolts of Food Immunotherapy: The Future of Food Allergy. *Children*, *5*(4). https://doi.org/10.3390/children5040047

BC Dairy Association. (n.d.). *Calcium Calculator*. Calcium Calculator. Retrieved February 28, 2021, from https://bcdairy.ca/nutritioneducation/calciumcalculator/

Begin, P., et al. (2014). Oral immunotherapy for the treatment of food allergy. *Human Vaccines & Immunotherapeutics*, *10*(8), 2295–2302. https://doi.org/10.4161/hv.29233

Birdi, G., et al. (2016). Quality of Life, Stress, and Mental Health in Parents of Children with Parentally Diagnosed Food Allergy Compared to Medically Diagnosed and Healthy Controls. *Journal of Allergy*, *2016*, e1497375. https://doi.org/10.1155/2016/1497375

Black, M. M. (2003). Micronutrient deficiencies and cognitive functioning. *The Journal of Nutrition*, *133*(11 Suppl 2), 3927S-3931S. https://doi.org/10.1093/jn/133.11.3927S

Bouziani, A., et al. (2018). Dietary Calcium Intake in Sample of School Age Children in City of Rabat, Morocco. *Journal of Nutrition and Metabolism*, *2018*. https://doi.org/10.1155/2018/8084623

Boyce, J. A., et al. (2011). Guidelines for the diagnosis and management of food allergy in the United States: Summary of the NIAID-Sponsored Expert Panel Report. *Nutrition*, *27*(2),

253–267. https://doi.org/10.1016/j.nut.2010.12.001

Brożek, J. L., et al. (2012). Oral immunotherapy for IgE-mediated cow's milk allergy: A systematic review and meta-analysis. *Clinical and Experimental Allergy: Journal of the British Society for Allergy and Clinical Immunology*, *42*(3), 363–374. https://doi.org/10.1111/j.1365-2222.2011.03948.x

Burt, L. A., et al. (2019). Effect of High-Dose Vitamin D Supplementation on Volumetric Bone Density and Bone Strength: A Randomized Clinical Trial. *JAMA*, *322*(8), 736–745. https://doi.org/10.1001/jama.2019.11889

Calcium: Fact Sheet for Health Professionals. (2021, August 17). National Institutes of Health Office of Dietary Supplements. https://ods.od.nih.gov/factsheets/Calcium-HealthProfessional/

Cannon, H. E. (2018). The Economic Impact of Peanut Allergies. *AJMC*, *24*(19). https://www.ajmc.com/view/the-economic-impact-of-peanut-allergies

CDC. (2020). *Food Allergies, Healthy Schools*. https://www.cdc.gov/healthyschools/foodallergies/index.htm

Chad, Z. (2001). Allergies in children. *Paediatrics & Child Health*, *6*(8), 555–566. https://doi.org/10.1093/pch/6.8.555

Chafen, J. J. S., et al. (2010). Diagnosing and Managing Common Food Allergies: A Systematic Review. *JAMA*, *303*(18), 1848–1856. https://doi.org/10.1001/jama.2010.582

Chen, M., & Land, M. (2017). The current state of food allergy therapeutics. *Human Vaccines & Immunotherapeutics*, *13*(10), 2434–2442. https://doi.org/10.1080/21645515.2017.1359363

Christie, L., et al. (2002). Food Allergies in Children Affect Nutrient Intake and Growth. *Journal*

of the American Dietetic Association, *102*(11), 1648–1651. https://doi.org/10.1016/S0002-8223(02)90351-2

Cormick, G., & Belizán, J. M. (2019). Calcium Intake and Health. *Nutrients*, *11*(7), 1606. https://doi.org/10.3390/nu11071606

Davison, B., et al. (2017). The Association between Parent Diet Quality and Child Dietary Patterns in Nine- to Eleven-Year-Old Children from Dunedin, New Zealand. *Nutrients*, *9*(5). https://doi.org/10.3390/nu9050483

Flom, J. D., & Sicherer, S. H. (2019). Epidemiology of Cow's Milk Allergy. *Nutrients*, *11*(5). https://doi.org/10.3390/nu11051051

Food Allergies. (2021, February 8). Food and Drug Administration; FDA. https://www.fda.gov/food/food-labeling-nutrition/food-allergies

Food Allergy Research & Education. (n.d.). Retrieved February 28, 2021, from https://www.foodallergy.org/

Fukuda, Y., & Kameda, M. (2019). Assessment of the Correlation Between Mother and Child Body Mass Index and Mother and Child Diet in Children With Food Allergies. *Journal of Clinical Medicine Research*, *11*(10), 703–710. https://doi.org/10.14740/jocmr.v11i10.3959

Fukuda, Y., et al. (2020). A study on the effect of nutrient intake on the body mass index of mothers of children with food allergies. *Asian Pacific Journal of Allergy and Immunology*, *38*(4), 264–270. https://doi.org/10.12932/AP-260718-0377

Gore, C., et al. (2016). New patient-reported experience measure for children with allergic disease: Development, validation and results from integrated care. *Archives of Disease in Childhood*, *101*(10), 935–943. https://doi.org/10.1136/archdischild-2015-309598

Groetch, M. E., et al. (2010). Food Allergy Educational Needs of Pediatric Dietitians: A survey by the Consortium of Food Allergy Research. *Journal of Nutrition Education and Behavior*, *42*(4), 259–264. https://doi.org/10.1016/j.jneb.2009.06.003

Hadley, C. (2006). Food allergies on the rise? Determining the prevalence of food allergies, and how quickly it is increasing, is the first step in tackling the problem. *EMBO Reports*, *7*(11), 1080–1083. https://doi.org/10.1038/sj.embor.7400846

Harvard T.H. Chan School of Public Health. (n.d.). *The Nutritional Source: Calcium*. The Nutrition Source. Retrieved December 9, 2021, from https://www.hsph.harvard.edu/nutritionsource/calcium/

Heine, R. G. (2018). Food Allergy Prevention and Treatment by Targeted Nutrition. *Annals of Nutrition and Metabolism*, *72*(3), 33–45. https://doi.org/10.1159/000487380

Hildebrand, H., et al. (2019). Calcium Intake in Children with Eczema and/or Food Allergy: A Prospective Cohort Study. *Nutrients*, *11*(12), 3039. https://doi.org/10.3390/nu11123039

Hodges, J. K., et al. (2019). Lactose Intolerance and Bone Health: The Challenge of Ensuring Adequate Calcium Intake. *Nutrients*, *11*(4). https://doi.org/10.3390/nu11040718

Hoy, K. M., & Goldman, J. (2014, October 28). *Calcium intake of the U.S. population, What We Eat in America, NHANES 2009-2010*. https://www.ars.usda.gov/research/publications/publication/?seqNo115=309598

Hu, W., et al. (2008). When doctors disagree: A qualitative study of doctors' and parents' views on the risks of childhood food allergy. *Health Expectations : An International Journal of Public Participation in Health Care and Health Policy*, *11*(3), 208–219. https://doi.org/10.1111/j.1369-7625.2008.00506.x

Hung, A., et al. (2011). Validation of a calcium assessment tool in postmenopausal Canadian

women. *Maturitas*, *69*(2), 168–172. https://doi.org/10.1016/j.maturitas.2011.02.016

Jackson, K., et al. (2013). Trends in allergic conditions among children: United States, 1997-2011. *NCHS Data Brief*, *121*, 1–8.

Jin, J. (2017). Treatments for Food Allergies. *JAMA*, *318*(19), 1945. https://doi.org/10.1001/jama.2017.17306

Koplin, J. J., et al. (2013). The Impact of Family History of Allergy on Risk of Food Allergy: A Population-Based Study of Infants. *International Journal of Environmental Research and Public Health*, *10*(11), 5364–5377. https://doi.org/10.3390/ijerph10115364

Lau, G.Y., et al. (2014). Anxiety and stress in mothers of food-allergic children. *Pediatric Allergy and Immunology: Official Publication of the European Society of Pediatric Allergy and Immunology*, *25*(3), 236–242. https://doi.org/10.1111/pai.12233

Lazarou, C., et al. (2008). The influence of parents' dietary beliefs and behaviours on children's dietary beliefs and behaviours. The CYKIDS study. *Appetite*, *51*, 690–696. https://doi.org/10.1016/j.appet.2008.06.006

Lifschitz, C., & Szajewska, H. (2015). Cow's milk allergy: Evidence-based diagnosis and management for the practitioner. *European Journal of Pediatrics*, *174*(2), 141–150. https://doi.org/10.1007/s00431-014-2422-3

Lim, H.S., et al. (2018). Food Elimination Diet and Nutritional Deficiency in Patients with Inflammatory Bowel Disease. *Clinical Nutrition Research*, *7*(1), 48–55. https://doi.org/10.7762/cnr.2018.7.1.48

Loh, W., & Tang, M. L. K. (2018). The Epidemiology of Food Allergy in the Global Context. *International Journal of Environmental Research and Public Health*, *15*(9). https://doi.org/10.3390/ijerph15092043

Mahmood, L., et al. (2021). The Influence of Parental Dietary Behaviors and Practices on Children's Eating Habits. *Nutrients*, *13*(4), 1138. https://doi.org/10.3390/nu13041138

Mehta, H., et al. (2013). Growth and Nutritional Concerns in Children with Food Allergy. *Current Opinion in Allergy and Clinical Immunology*, *13*(3), 275–279. https://doi.org/10.1097/ACI.0b013e328360949d

Messina, M., & Venter, C. (2020). Recent Surveys on Food Allergy Prevalence. *Nutrition Today*, *55*(1), 22–29. https://doi.org/10.1097/NT.0000000000000389

Meyer, R. (2018). Nutritional disorders resulting from food allergy in children. *Pediatric Allergy and Immunology : Official Publication of the European Society of Pediatric Allergy and Immunology*, *29*(7), 689–704. https://doi.org/10.1111/pai.12960

Mofidi, S. (2003). Nutritional management of pediatric food hypersensitivity. *Pediatrics*, *111*(6 Pt 3), 1645–1653.

Mowszet, K., et al. (2005). Causes of malnutrition in children under the age of 5 years in own material. *Advances in Clinical and Experimental Medicine*, *14*, 315–322.

Nakamura, T., & Murata, T. (2018). Regulation of vascular permeability in anaphylaxis. *British Journal of Pharmacology*, *175*(13), 2538–2542. https://doi.org/10.1111/bph.14332

National Institutes of Health, Office of Dietary Supplements. (n.d.). *Calcium Fact Sheet for Consumers*. Retrieved December 9, 2021, from https://ods.od.nih.gov/factsheets/Calcium-Consumer/

Pastorello, E. A., et al. (1995). Studies on the relationship between the level of specific IgE antibodies and the clinical expression of allergy: I. Definition of levels distinguishing patients with symptomatic from patients with asymptomatic allergy to common aeroallergens. *Journal of Allergy and Clinical Immunology*, *96*(5), 580–587.

https://doi.org/10.1016/S0091-6749(95)70255-5

Polloni, L., et al. (2013). Nutritional behavior and attitudes in food allergic children and their mothers. *Clinical and Translational Allergy*, *3*(1), 41. https://doi.org/10.1186/2045-7022-3-41

Rajani, P. S., et al. (2020). Presentation and Management of Food Allergy in Breastfed Infants and Risks of Maternal Elimination Diets. *The Journal of Allergy and Clinical Immunology: In Practice*, *8*(1), 52–67. https://doi.org/10.1016/j.jaip.2019.11.007

Roberts, K., et al. (2021). Parental Anxiety and Posttraumatic Stress Symptoms in Pediatric Food Allergy. *Journal of Pediatric Psychology*, *jsab012*. https://doi.org/10.1093/jpepsy/jsab012

Ross, A. C., et al. (2011). Dietary Reference Intakes for Adequacy: Calcium and Vitamin D. In *Dietary Reference Intakes for Calcium and Vitamin D*. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK56056/

Rozenberg, S., et al. (2016). Effects of Dairy Products Consumption on Health: Benefits and Beliefs—A Commentary from the Belgian Bone Club and the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases. *Calcified Tissue International*, *98*, 1–17. https://doi.org/10.1007/s00223-015-0062-x

Russell, C. G., et al. (2018). Parental feeding practices associated with children's eating and weight: What are parents of toddlers and preschool children doing? *Appetite*, *128*, 120–128. https://doi.org/10.1016/j.appet.2018.05.145

S.578—117th Congress: FASTER Act of 2021 (2021/2022). (2021, April 23). [Legislation]. https://www.congress.gov/bill/117th-congress/senate-bill/578

Savage, J. S., et al. (2007). Parental influence on eating behavior: Conception to adolescence. *The Journal of Law, Medicine & Ethics: A Journal of the American Society of Law, Medicine & Ethics*, *35*(1), 22–34. https://doi.org/10.1111/j.1748-720X.2007.00111.x

Scaglioni, S., et al. (2011). Determinants of children's eating behavior. *The American Journal of Clinical Nutrition*, *94*(6 Suppl), 2006S-2011S. https://doi.org/10.3945/ajcn.110.001685

Sicherer, S. H., et al. (2010). US prevalence of self-reported peanut, tree nut, and sesame allergy: 11-year follow-up. *Journal of Allergy and Clinical Immunology*, *125*(6), 1322–1326. https://doi.org/10.1016/j.jaci.2010.03.029

Sözen, T., et al. (2017). An overview and management of osteoporosis. *European Journal of Rheumatology*, *4*(1), 46–56. https://doi.org/10.5152/eurjrheum.2016.048

Story, M., et al. (2008). Creating healthy food and eating environments: Policy and environmental approaches. *Annual Review of Public Health*, *29*, 253–272. https://doi.org/10.1146/annurev.publhealth.29.020907.090926

Thorsteinsdottir, S., et al. (2021). Fussy Eating among Children and Their Parents: Associations in Parent-Child Dyads, in a Sample of Children with and without Neurodevelopmental Disorders. *Nutrients*, *13*(7), 2196. https://doi.org/10.3390/nu13072196

Turner, P. J., et al. (2017). Fatal Anaphylaxis: Mortality Rate and Risk Factors. *The Journal of Allergy and Clinical Immunology. in Practice*, *5*(5), 1169–1178. https://doi.org/10.1016/j.jaip.2017.06.031

Van Den Heuvel, E. G. H. M., & Steijns, J. M. J. M. (2018). Dairy products and bone health: How strong is the scientific evidence? *Nutrition Research Reviews*, *31*(2), 164–178. https://doi.org/10.1017/S095442241800001X

Vargas, P. A., et al. (2011). Developing A Food Allergy Curriculum for Parents. *Pediatric*

Allergy and Immunology : Official Publication of the European Society of Pediatric Allergy and Immunology, *22*(6), 575–582. https://doi.org/10.1111/j.1399-3038.2011.01152.x

Warren, C. M., et al. (2019). Prevalence and Severity of Sesame Allergy in the United States. *JAMA Network Open*, *2*(8), e199144. https://doi.org/10.1001/jamanetworkopen.2019.9144

Woods, R. K., et al. (2002). Reported adverse food reactions overestimate true food allergy in the community. *European Journal of Clinical Nutrition*, *56*(1), 31–36. https://doi.org/10.1038/sj.ejcn.1601306

Yee, A. Z. H., et al. (2017). The influence of parental practices on child promotive and preventive food consumption behaviors: A systematic review and meta-analysis. International Journal of Behavioral Nutrition and Physical Activity, 14(1), 47. https://doi.org/10.1186/s12966-017-0501-3

6. Appendix

A. Calcium Assessment Tool (CAT)

Calcium Assessment Tool (CAT)

UHN Toronto General Toronto Western Princess Margaret Toronto Rehab

The CAT is a modified version of the Calcium Calculator™ and is used to measure calcium intake from food.

For each food item in the table below, consider if you eat the item on a ***weekly basis,*** and if so, how many portions you have had in a ***typical week in the past month.*** Portion sizes are noted beside each food item. If you eat a certain food regularly, ***but less than once a week,*** record 0 servings for that food item. Once you have finished entering the number of servings of all food items, you can calculate your total calcium intake.

Calcium-rich foods	Portion size	# portions in a typical week	Calcium intake
Foods with 50 mg calcium per serving			
Bread (bagels, buns & pita bread count as 2 slices)	2 slices	_____	**Total Servings:** _____ x 50mg calcium/serving = _____ **mg calcium**
Broccoli, cooked	¾ cup	_____	
Kidney beans, lima beans, lentils	1 cup	_____	
Orange (fruit, not juice)	1 medium	_____	
Tahini (sesame seed paste)	2 tbsp	_____	
Foods with 75 mg calcium per serving			
Bok choy or kale, cooked	½ cup	_____	**Total Servings:** _____ x 75mg calcium/serving = _____ **mg calcium**
Chickpeas	1 cup	_____	
Cottage cheese (regular, low fat, or fat free)	½ cup	_____	
Ice cream	½ cup	_____	
Parmesan cheese	1 tbsp	_____	
Almonds	¼ cup (20-25)	_____	
Foods with 150 mg calcium per serving			
Baked beans, soybeans, white beans	1 cup	_____	**Total Servings:** _____ x 150mg calcium/ serving = _____ **mg calcium**
Ice milk (gelato), frozen yogurt (regular, low fat, or fat free)	½ cup	_____	
Pancakes or waffles, made with milk	3 medium	_____	
Pudding, made with milk	½ cup	_____	
Soft and semi-soft cheese (not cream cheese) such as feta, mozzarella, Camembert (regular, low fat, or fat free)	1¼" cube	_____	
Soup, made with milk	1 cup	_____	
Tofu, made with calcium (if not made with calcium, use half the amount of calcium per serving, i.e. 75 mg)	3 oz.	_____	

Calcium-rich foods	Portion size	# portions in a typical week	Calcium intake
Foods with 250 mg calcium per serving			
Firm cheese such as cheddar, Swiss, Gouda (regular, low fat, or fat free)	1¼" cube	_____	**Total Servings:** _____ x 250mg calcium/ serving **= _____ mg calcium**
Processed cheese slices (regular, low fat, or fat free)	2 slices	_____	
Salmon or sardines, canned with bones	½ can	_____	
Yogurt, fruit-flavored (regular, low fat, or fat free)	¾ cup	_____	
Foods with 300 mg calcium per serving			
Milk (skim, 1%, 2%, whole, buttermilk, or chocolate)	1 cup	_____	**Total Servings:** _____ x 300mg calcium/ serving **= _____ mg calcium**
Calcium-fortified beverages (e.g. soy, orange juice, rice)	1 cup	_____	
Skim milk powder	⅓ cup	_____	
Yogurt, plain (regular, low fat, or fat free)	¾ cup	_____	
Total calcium intake			
Total calcium in a **typical week** from all foods			= _____ mg/week
Total calcium **per day** from all foods (divide by 7)			**= _____ mg/day**
Calcium supplements and/or calcium from multivitamin & mineral supplements			_____ mg/day
Total calcium per day from all sources			**= _____ mg/day**

Are you getting enough calcium?

Osteoporosis Canada recommends **1,000 mg** of calcium per day for adults 19-50 years of age and **1,200 mg** of calcium per day for adults over 50 years of age.

<500 mg calcium per day → **Talk to your doctor about taking calcium supplements.** Also increase your calcium intake by adding calcium-rich foods (from the list above) into your diet.

500-1000 mg calcium per day → **Try to increase your calcium intake through your diet.** Taking into account your family history of kidney stones and heart disease, your doctor can do a risk/ benefit analysis and may recommend calcium supplements.

>1000 mg calcium per day → **It is unlikely that you need calcium supplements.** Continue to meet your calcium requirements through your diet.

OsteoConnections.com facebook.com/OsteoporosisUHN twitter.com/OsteoUHN youtube.com/OsteoUHN

B. Experimental Group and Control Group Surveys

Start of Block: Screening Question (Experimental and Control Groups)

Q1.1 Do you have a child who has been diagnosed with a milk allergy?

- o Yes: one child with a milk allergy
- o Yes: two children with a milk allergy
- o Yes: more than two children with a milk allergy
- o No, however my child has a milk intolerance or a suspected allergy
- o None of the above

Skip To: Q59
If Do you have a child who has been diagnosed with a milk allergy? = None of the above

Display This Question:
If Do you have a child who has been diagnosed with a milk allergy? = None of the above

Q59 Please refer to this survey for parents and caregivers of a child without a milk allergy. Click here to be directed to the secondary survey.

Skip To: End of Survey If Please refer to this survey for parents and caregivers of a child without a milk allergy. Click h... Is Displayed

End of Block: Screening Question

Start of Block: Demographics (Experimental and Control Groups)

Q1 How would you describe your gender?

- o Male (including transgender men)
- o Female (including transgender women)
- o Prefer to self describe as _____ (non-binary, gender-fluid, agender)
- o Prefer not to say

Q2 What is your marital status?

- Single
- Married
- Divorced
- Widowed
- Other, please specify _____

Q3 Who are the members of your household, as they relate to you? (Please include "1" for yourself and number all that apply.)

	Quantity
Yourself	
Spouse or Partner	
Child(ren)	
Sibling(s)	
Parent	
Grandparent	

Other #1, please specify	
Other #2, please specify	
Total	

Q4 How many children do you have under the age of 18 in your household?

- 0
- 1
- 2
- 3
- 4
- 5 or more

Skip To: End of Survey If How many children do you have under the age of 18 in your household? = 0

Q5 How old are your children?

- Child 1: Age _____
- Child 2: Age _____
- Child 3: Age _____
- Child 4: Age _____
- Child 5: Age _____

Q6 In what state do you live? _____

Q7 What is your employment status?

- Employed; Full-Time (30 hours or more)

- Employed; Part-Time (< 30 hours)
- Not Employed

Q8 What was your 2020 total household income?

- Less than $10,000
- $10,000 - $19,999
- $20,000 - $29,999
- $30,000 - $39,999
- $40,000 - $49,999
- $50,000 - $59,999
- $60,000 - $69,999
- $70,000 - $79,999
- $80,000 - $89,999
- $90,000 - $99,999
- $100,000 - $149,999
- More than $150,000

Q9 What is your race?

- White
- Black or African American
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Pacific Islander
- Latinx
- Other, please specify: _____

Q10 What is the highest level of education you have received?

- Less than High School
- High School Graduate
- Some College
- 2-Year Degree

- 4-Year Degree
- Professional Degree
- Bachelor's Degree
- Master's Degree
- Doctorate

End of Block: Demographics

Start of Block: Calcium Assessment Tool (CAT) **(Experimental and Control Groups)**

Q58 How did you hear about this study?

- Apex/Cary Moms
- Ask the Village
- Deliciously Dairy Free
- Living with Food Allergies in SOMA
- Maplewood Moms
- Milk Allergy Mommies
- Moms of Kids With Milk Allergy and Food Allergies
- NC FACES
- SOMA Lounge NJ
- Other, please specify: _____

End of Block: Calcium Assessment Tool (CAT)

Start of Block: Allergy History & Food Elimination (Experimental Group, Only)

Q11 What household role best describes you?

- Mother
- Father
- Caregiver
- Other, please specify _____

Q12 How often do you and your family members prepare meals for your child who has a milk allergy?

	0 times daily	1-2 times daily	3-4 times daily
Yourself	o	o	o
Spouse or Partner	o	o	o
Your Child with the Milk Allergy	o	o	o
Other Children	o	o	o
Other Caregiver, please specify	o	o	o

Q14 How long have you been aware of your child's milk allergy?

- o Less than one year
- o 1-5 years
- o 5 years or more

Q15 What other food allergies does your child with the milk allergy have? (If none, then skip.)

- o Eggs
- o Fish
- o Shellfish
- o Tree Nuts
- o Peanuts
- o Wheat
- o Soy
- o Other, please specify: _____

Q26 Does anyone else in your household have a food allergy? Select all that apply.)

- ▢ Myself
- ▢ My spouse or partner
- ▢ Other children

- ▢ Other, please specify: _____

Q16 What other food allergies are in your household, other than your child with the milk allergy? (If none, then skip.)

- ▢ Eggs
- ▢ Fish
- ▢ Shellfish
- ▢ Tree Nuts
- ▢ Peanuts
- ▢ Wheat
- ▢ Soy
- ▢ Other, please specify: _____

Q58 Which of the below statements best describes your child's allergy? (Select all that apply.)

- ▢ My child consumes small amounts of milk products.
- ▢ My child consumes only baked milk products.
- ▢ My child is highly sensitive to milk products.
- ▢ My child does not consume dairy and we avoid being near milk products.
- ▢ I have a milk-free household; cross-contamination poses a significant danger.

Q18 When thinking about your child's milk allergy, which statement(s) apply to your family?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
My child does not consume any foods that have a known cross-reactivity to their allergens.	o	o	o	o	o
My child's allergy prevents my family from eating in restaurants.	o	o	o	o	o
My child's allergy causes me to restrict my own milk intake.	o	o	o	o	o

I limit travel and family vacations due to my child's allergy.	o	o	o	o	o
I do not have any milk products in my home due to my child's allergy.	o	o	o	o	o
I limit social gatherings and social interactions with my family due to my child's allergy.	o	o	o	o	o
Living within close proximity to a hospital is important due to my child's allergy.	o	o	o	o	o
Cross-contamination of allergens poses a danger to my child.	o	o	o	o	o

Q19 Please indicate the type of healthcare provider(s) you have seen for your child's milk allergy and for how long you have seen the provider(s)?

	Less than 1 year	1-2 years	2-3 years	3-4 years	More than 4 years
Nurse Practitioner	o	o	o	o	o
Pediatrician	o	o	o	o	o
Family Allergist / Immunologist	o	o	o	o	o
Pediatric Allergist / Immunologist	o	o	o	o	o
Pulmonologist	o	o	o	o	o
Dietitian or Nutritionist	o	o	o	o	o
Other provider or specialist, please specify: _____	o	o	o	o	o

Q54 How do you feel about the amount of information you have received from your child's healthcare provider(s) regarding your child's allergy?

- o Very Satisfied
- o Satisfied
- o Neutral
- o Unsatisfied
- o Very Unsatisfied

Q21 Which statements apply regarding your trust in your child's provider who manages your child's allergy? Select all that apply.)

- ▢ I frequently distrust my child's provider's opinion and seek a second one.
- ▢ I sometimes distrust my child's provider's opinion but do not seek a second one.
- ▢ I always trust my child's provider's opinion.
- ▢ If my child's provider tells me something, then it must be true.
- ▢ I trust my child's provider's judgments about my child's medical care.

Q22 Please rate your opinion on the below statements.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I feel that I have received adequate information about my child's allergy.	o	o	o	o	o
I receive ongoing allergy information from my child's provider(s).	o	o	o	o	o
I feel stressed managing my child's allergy.	o	o	o	o	o
I am comfortable managing my child's allergy.	o	o	o	o	o
I feel comfortable dining at a restaurant with my child.	o	o	o	o	o

I feel comfortable attending social events with my child.	o	o	o	o	o

Q23 Do you eliminate any food items from your household?

- o Yes
- o No

Skip To: Q25 If Do you eliminate any food items from your household? = No

Q24 What food items do you eliminate from your household? _____

Q25 Have any of your children experienced anaphylaxis?

- o Yes, my child with the milk allergy
- o Yes, another one of my children
- o No

Skip To: Q26 If Have any of your children experienced anaphylaxis? = No

Q25 Has your child's anaphylactic reaction changed the way you shop or cook?

- ▢ Yes, we now eliminate food items from our household.
- ▢ Yes, we now keep allergens in a separate area of the house.
- ▢ Yes, we now do not to purchase allergenic foods.
- ▢ No, we always eliminated food items from our household.
- ▢ No, we always kept allergens in a separate area of the house.
- ▢ No, we always did not purchase allergenic foods.
- ▢ Other, please specify: _____

End of Block: Allergy History & Food Elimination

Start of Block: Food Consumption (Experimental Group, Only)

Q27 The next few questions relate to the milk consumption patterns in your household. “Milk products" refer to butter, cheese, yogurt, milk, ice cream, etc. made with cow's milk. Do you consume milk or milk products?

- o Yes
- o No

Q29 Please select the purchasing decisions you make for your household. (Select all that apply.)

- ▢ I only purchase items that are from allergen-free facilities.
- ▢ I only purchase items that do not contain milk.
- ▢ I try to purchase whole foods as much as possible.
- ▢ I limit purchasing processed foods.
- ▢ I am wary of food manufacturers.
- ▢ I find dairy-free products expensive.

Q30 Please identify any specialty diets that you and your household members follow.

	Yourself	Child with milk allergy	Other household members
Vegan	▢	▢	▢
Vegetarian	▢	▢	▢
Gluten-Free	▢	▢	▢
Paleo	▢	▢	▢
Kosher	▢	▢	▢
Dairy-Free	▢	▢	▢
Plant-Based	▢	▢	▢
Other, please specify: _____	▢	▢	▢

Q56 Are you and/or your child with the milk allergy taking any multivitamins or calcium supplements?

	Yourself	Child with milk allergy
Multivitamins	▢	▢
Calcium Supplements	▢	▢

Q31 Do you purchase any milk alternatives for your family?

- o Yes
- o No

Skip To: Q35 If Do you purchase any milk alternatives for your family? = No

Q32 What type of milk alternatives do you purchase for your family? *(Please select all that apply.)*

- ▢ Oat Milk
- ▢ Coconut Milk
- ▢ Almond Milk
- ▢ Soy Milk
- ▢ Flax Milk
- ▢ Rice Milk
- ▢ Pea Milk
- ▢ Hemp Milk
- ▢ Cashew Milk
- ▢ Other, please specify: _____

Q33 Do you purchase fortified milk alternatives?

- o Yes
- o No
- o Not sure

Q34 What do you typically use milk alternatives for? *(Select all that apply.)*

- Coffee
- Cereal
- Standalone Beverage
- Smoothies or Shakes
- Recipes
- Other, please specify: _____

Q35 How confident are you that you are meeting your family's nutrient needs? *(1=not confident at all; 5=extremely confident)*

- 1
- 2
- 3
- 4
- 5

Q36 How would you rate the challenge of ensuring nutrient requirements of <u>your child</u> with the milk allergy are met? *(1=not challenging at all; 5=extremely challenging)*

- 1
- 2
- 3
- 4
- 5

Q37 How would you rate the challenge of ensuring <u>your</u> nutrient requirements are met? (1=not challenging at all; 5=extremely challenging)

- 1
- 2
- 3
- 4
- 5

End of Block: Food Consumption

Start of Block: Closing

Q38 Thank you for your willingness to participate in this study. At this time, we are seeking parents or guardians with at least one child with a milk allergy. Thank you for your time.

End of Block: Closing