ASSESSING WILLINGNESS TO TRY NOVEL AND FAMILIAR FOODS IN BRITISH COLUMBIA SCHOOL CHILDREN: IMPACT OF FOOD EXPLORERS, A CLASSROOM-BASED FOOD EXPERIENCE PROGRAM

by

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Abstract

Background:

The Food Explorers (FE) program was designed and developed for use with kindergarten and grade 1 children. Offered within the classroom setting, the program aims to encourage children to identify and experience a wide variety of foods. The objective of this study was to examine the impact of the program on children’s willingness to try new and familiar foods.

Methods:

A quasi-experimental pre-post design was employed to evaluate the impact of the program on children’s familiarity and willingness to try novel and familiar test foods. Children in the FE group participated in food-related classroom activities led by teachers, over 5 months and the control group were taught the standard curriculum. Assessments of familiarity and willingness to try foods was completed at baseline and after 5 months in both groups. Parent-perceived food neophobia was also assessed using a validated scale at both times. Open-ended questions were used to assess parent and teacher experience with the program.

Results:

Analyses were conducted with 194 children (FE group, n=102 and control group, n=92). Knowledge of familiar foods increased over time in both groups and a significant group by time interaction was observed with 2 test foods (out of 10) at follow-up, indicating increased knowledge in the FE group, compared to the control group. Willingness to try the test foods, measured as food preference scores significantly increased for five novel foods in the FE group compared to the control group. No significant difference was observed in parent-perceived food neophobia scores between groups. Parents indicated positive experiences with respect to their children’s willingness to try new foods at home. Positive experiences were also noted by the teachers.
Conclusion:

While there is some evidence to suggest that the FE program may positively impact food knowledge and willingness to try new foods in kindergarten and grade 1 children, limitations of the study and implementation of the FE program warrant consideration when considering the impact of the program. The findings of the study provide valuable information on barriers for implementation of the FE program in classrooms and will inform future evaluations of the program.
Lay Summary

Food neophobia (reluctance to try new and/or unfamiliar foods) and food pickiness (unwillingness to eat familiar foods) have been identified as significant barriers to intake of adequate healthy foods, including fruits and vegetables in children. School-based food/nutrition programs offer one of the most promising means to expose children to “healthy” foods at an early age. The goal of this study was to explore the impact of a classroom-based food experience program (Food Explorers- FE) on willingness to try familiar and new foods in children. The study used a comprehensive approach to evaluate the impact of the program on students, teachers and parents. The outcome of this research has the potential to help encourage educators to deliver nutrition education in classrooms across BC that may enhance childrens’ knowledge of healthy food and thereby, change eating behaviour.
Preface

This thesis is original work by the author, Gayathri Murthy, under the supervision and guidance of Dr. Rachel Murphy, and supervisory committee members Dr. Louise Mâsse and Dr. Jennifer Black, except the construction of the facial hedonistic scale. Figure 2.1 that presented the scale used to rate childrens’ food preferences has been published in Soltero EG, Ledoux T, Lee RE. Feasibility and acceptability of adapting the eating in the absence of hunger assessment for preschoolers in the classroom setting. Eat Behav. 2015; 19:68-71. The study was designed by Dr. Murphy and Dr. Mâsse to investigate the impact of Food Explorers, a classroom-based food experience program on willingness to try familiar and novel foods in children. I collaborated with Drs. Murphy and Mâsse to assist with development of survey and data collection tools, to recruit participants and to independently collect the data. Data analysis and thesis writing were independently conducted by me under the supervision of the committee. The Behavioural Research Ethics Board of the University of British Columbia approved procedures for the Food Explorers study, ethics certificate number (H16-01931). The Vancouver School Board and the Surrey School District provided permission for UBC researchers to contact the school administrators, teachers, parents and students to participate in this study.
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List of Abbreviations

BC: British Columbia

BCDA: British Columbia Dairy Association

CCHS: Canadian Community Health Survey

CFNS: Child Food Neophobia Scale

C-HEI: Canadian Healthy Eating Index

CI: Confidence Interval

FNS: Food Neophobia Scale

HEI: Healthy Eating Index

HZ: Heterozygotic

KG/Gr 1: Kindergarten/Grade 1

MZ: Monozygotic

MG: Motivation Generation

OR: Odds Ratio

PHSA: Provincial Health Services Authority

RCT: Randomized Controlled Trial

SCT: Social Cognitive Theory

SD: Standard Deviation

SE: Standard Error

UK: United Kingdom

US: United States

WHO: World Health Organization
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Dedication

To my Grandmother

who passed away at the ‘young’ age of 99 during the course of my graduate school- Thank you for believing in me and supporting all my decisions in life.
Chapter 1: Introduction

1.1 Background

Food preference (likes and dislikes) is an important determinant of food choices and acceptance in children and is linked to overall diet patterns (1). Children’s taste and preferences for foods change with age and stage of development. Early childhood – 3 to 6 years of age is a particularly critical time for development of eating behaviour, as eating patterns are established during this period. Children’s food experiences play an important role in shaping preferences for certain foods (1,2,3). However, encouraging children to try new foods to promote diet diversity and meet dietary recommendations is often challenging. During these years, behaviours such as food neophobia and food pickiness emerge and are predictors of future healthful eating habits (4). It is well established that eating behaviour in children is a complex process that involves an interplay of biological, personal, social, parental, environmental and cultural factors (5).

However, food neophobia has been recognized as a significant barrier to increasing variety in children’s diet (4,5).

Food neophobia is defined as “reluctance to eat and/or avoidance to eat novel foods” (4). Although used interchangeably, food pickiness refers to rejection of a substantial amount of familiar foods and unfamiliar foods, including specific food textures (4,6). Food neophobia and pickiness are common traits in children but may also track into adulthood (7) and have been shown to hinder development of varied food preferences (8). Both behaviours limit childrens’ dietary intake in terms of variety and quality, in particular, decreased intake of fruits and vegetables. Food neophobia is also associated with unhealthy body weight (4,9). While some studies suggest that “picky/fussy” eaters have lower body weight (10,11,12, 13), other studies suggest that picky eaters may compensate with intake with sweetened foods, and hence risk
over-consumption of calories and excessive weight gain (14,15). However, more recently, a systematic review that included 41 studies published between 1990 and 2015 showed no association between childhood weight status and food neophobia, and inconclusive results for picky eating (16). Nevertheless, early years is a key period to encourage positive food experience and food acceptance in children through appropriate behaviour techniques such as repeated exposure and other hands-on activities, and thereby reduce food neophobia (17).

Food/nutrition education is an evidence-based, cost effective strategy to positively influence food preference and foster healthy eating habits in young children (23). Traditionally, interventions aiming to enhance children’s food experience have focused on increasing childrens’ knowledge base. In Canada, such programs are composed of introduction to Eating well with Canada’s Food Guide, description of foods (healthy vs unhealthy) and identification of food groups. However, in recent years, there has been a shift towards theory-driven interventions which are complemented with more engaging, hands-on, experiential activities that are age/developmentally appropriate such as food exposure, food preparation and increased direct contact with foods (18,19,20). Research suggests that repeated exposure to an unfamiliar food positively influences eating behaviours (21).

Although food/nutrition education can be beneficial throughout the lifespan, young children have the greatest potential for change because of the impact of early nutrition on health. Young children are curious, eager to learn and quick to accumulate, and process information from others (22). Kindergarten children (5 to 6 years of age) enter the school system with a wide range of exposures to food and so this stage offers a unique opportunity to discover and taste new foods in a secure and stimulating environment. Therefore, schools have been recognized as an ideal social environment to promote healthful behaviours such as healthy eating. According to the Comprehensive School Health Framework, school environment (including policy,
partnerships, programs, teachers and peers) can support health related behaviours in children and youth (23, 24).

School-based programs offer an opportunity to reach a large number of children from all socio-economic and ethnic backgrounds (19). In the absence of a national school food program in Canada and nation-wide curricula for nutrition education in schools, provincial/territorial and local governments have taken the constitutional responsibility to provide education, introduce population-based programs to support healthy eating /nutrition education, and develop and implement school food policies to increase access to healthy foods and beverages (25, 26).

Numerous not-for-profit health organizations in Canada have also identified healthy eating in children as a public health priority. Several organizations have developed school-based food literacy/ nutrition programs to provide children with hands-on experience with food, with the goal of improving dietary intake. To name a few, the Heart and Stroke Foundation (27) in an effort to promote the health of young Canadians, has committed to supporting programs such as FoodShare (improves access to healthy foods) in Ontario, HeartSmartKids in BC and Manitoba’s Kids in the Kitchen (after school program that teaches cooking and nutrition to kids). Despite the perceived food/nutrition related benefits of school-based programs, there is a scarcity of evaluations of such programs in academic literature.

In British Columbia, the British Columbia Dairy Association (BCDA), (28) a not-for-profit society, also supports school-based nutrition education programs that align with curriculum established by the Ministry of Education, Province of British Columbia, for all (K-12) grade levels. One such program is the Food Explorers (FE), which is a school-based food experience program delivered by teachers in kindergarten and grade 1 classrooms (KG/Gr 1). The program is designed to expose KG/Gr 1 children to a wide variety of foods within the classroom-setting through tasting, cooking and other extension activities. Although the FE
program has been implemented in a number of BC schools over the years, and has anecdotal evidence of being effective, the program has not been formally evaluated.

This thesis provides a comprehensive evaluation of the impact of the FE program. One of the primary outcomes of the program and hence this evaluation is children’s appreciation of a wide range of foods, indicated by increased willingness to try new and familiar foods. Research has shown that increased familiarity with foods improves diet quality and variety in children (29, 30). A combination of quantitative and open-ended measures was used in this study to provide unique and comprehensive evidence on the impact of the FE program from the perspectives of children, parents and teachers.
1.2 Review of Literature

The purpose of this literature review is to summarize existing research that examines the relationship between food neophobia in children and willingness to try new foods. The literature review will begin by discussing the importance of healthy dietary habits in childhood. Food preferences and determinants of dietary intake are then discussed followed by food neophobia and factors influencing food neophobia. Lastly, strategies to overcome food neophobia including school and classroom-based food exposure and education are considered.

Childhood is a period of rapid growth and development and nutrition in the early years is an important phase for acquiring healthy dietary habits for life (31). The importance of early nutrition has been recognized for more than 2 decades now (32). Healthy dietary patterns among children include eating a variety of foods (diet diversity) such as whole grains, fruits and vegetables, lean protein and dairy that help to ensure adequate intake of nutrients (33). A healthy and balanced diet in early childhood may also protect against development of nutrition-related chronic disease, obesity and associated co-morbidities such cardiovascular disease, later in life (32). However, from a public health standpoint, children’s dietary intake has become a concern in the recent years. There is a lack of diversity in children’s diet and food preferences in children are not consistent with a healthy diet pattern. Eating patterns have deteriorated to be characterized by high-fat, high-sugar and salty foods (34). Greater availability of energy dense foods and changing lifestyles have also led to an increasing prevalence of childhood overweight and obesity (35).

1.2.1 Eating behaviour in children

Eating behaviour in children has received a great amount of attention in the recent years, due to the rise in childhood obesity and consequences for long term health. Early experience with
foods has long-lasting effects on individuals’ food habits as this is a critical period of development and experiential learning (36). Research has shown that establishing healthy eating habits in early childhood may decrease the risk for obesity and chronic disease and improve overall health later in life (37). There are also clear links between healthy eating and academic performance, where children who adopt healthy eating habits have demonstrated increased problem-solving skills and creative abilities (27).

In most developed countries, children’s nutritional status is measured through adherence to national dietary guidelines. In Canada, Eating Well with Canada’s Food Guide is used to provide guidelines for healthy eating patterns (33). The food guide outlines the type (eg. four food groups, including Grains and grain products, Milk and Alternatives, Meat and Alternatives and Vegetables and Fruits) and amount (servings) of food to meet nutrient needs across all ages and attain optimal health. However, many children in Canada, like other developed countries, have unhealthy eating habits putting them at risk for overweight, obesity as well as related comorbidities such as diabetes and cardiovascular disease. Data from the Canadian Community Health Survey (CCHS, 2004) shows that one in five children have energy intakes that exceed their needs (38). Seven out of 10 children aged 4 to 8 in Canada eat well below the recommended intake of 5 fruits and vegetables and up to 37% of Canadian children between the ages of 4 and 9 did not meet recommended intake of 2-4 servings of milk and alternatives (38). More recently, a study that compared dietary quality in Canadian children using the 2015 CCHS survey showed a modest improvement compared to 2004 (39, unpublished data from PhD dissertation). The study used an adaptation of the Canadian Healthy Eating Index (C-HEI) to demonstrate diet quality. The total HEI scores increased by approximately 6 points (out of a possible 100 points) from 2004 to 2015, however, average intakes of the four food groups were
still far below the recommended intakes. Similar data have also emerged from the US and UK (40,41).

Approximately, 30% of Canadian children also consume soft drinks one or more time per day. A population-based study of sugar consumption from nationally represented dietary surveys from across the world showed that intake of added sugars was the highest in school age children and adolescents, contributing to 19% of total energy (42). The same study also reported that total sugar intake (expressed as a percentage of total energy) in children 4-10 y of age ranged from 17% to 38% across the world, with intakes in Canadian children (4-8 years) contributing to 26% of total energy per day. To put this in perspective, the WHO recommends that no more than 10% of total energy should come from sugars (43). A 2014 review of dietary intakes of school children and adolescents in developing countries also showed lack of diversity in childrens’ diet including minimal consumption of fruits and vegetables (44).

1.2.2 Food Preferences and determinants of dietary intake

While adults consider nutritional value, cost, time and food preparation, children tend to eat what they ‘like’. Dietary intake in children is largely determined by food preferences and taste (10). Indicators from available evidence suggests that the preference for salty (e.g. pizza, French fries) and sweet foods (e.g. cake, chocolate) are highest in the early years and declines with age (31). Similarly, preference for vegetables is highest during early infancy with a downward trend through pre-school years and thereafter (36).

A combination of biological (genetic) and environmental factors determine food preferences and thereby directly influence food intake in children (45).
1.2.2.1 Genetic factors

Taste sensitivity and heritability are the two most prominent genetic factors that influence food intake. For the most part, food preferences are inherited. Heritability of food preferences was demonstrated in a study conducted in 2006 (46) using a large sample size of twins aged 4 to 5 years. The sample included monozygotic (MZ) twins, who were genetically identical and heterozygotic (HZ) twins, who were similar to siblings. When foods were grouped into desserts, fruits, vegetables and protein foods, the MZ twins showed stronger correlations than HZ twins to almost all foods in the four groups.

Taste perception also influences food preference, in particular, for fruits and vegetables. Some children are highly sensitive to specific bitter compounds present in vegetables and are called “super tasters”. A trait that is genetically determined, children who had high ‘taste sensitivity’ perceived cruciferous vegetables such as broccoli and spinach as ‘bitter-tasting’ and demonstrated low acceptance (45).

Flavour perception has also been found to influence food preference in children and can be explained by both prenatal and postnatal exposure to flavours. Evidence suggest that development of food preferences and thereby eating patterns begin before birth. Infants and children exposed in utero to certain flavours via mother’s diet showed a greater acceptance to those flavours upon introduction to solid foods (47). Similarly, food choices made by the mother altered flavours in breastmilk, which in turn altered flavour acceptance in their children (48). Breast fed children are exposed to a wide range of flavours through breastmilk and are more likely to have high acceptance for a wide variety of foods. Recently, a large study of four birth cohorts revealed that regular breastfeeding predicts greater variety of healthy food in preschool children (49).
1.2.2.2 Parental influence

Initially, in the toddler and preschool years, eating habits are influenced by the family. Parental practices and feeding styles play an important role in the development of healthy eating behaviours (50). Authoritative parenting style (vs authoritarian- parents who strongly controlled eating through restriction and/or force feeding), where parents provided a wide variety of healthy foods to their children and allowed children to make choices has been found to be positively associated with healthful eating habits in children, including greater fruits and vegetables. Parental eating habits have also been shown to influence childrens’ dietary intakes, where parents who ate diets high in fat and sugar had children with similarly high intakes of fat and sugar. Parents, caregivers and siblings can also influence food preferences by acting as role models. Models have the crucial role of encouraging or discouraging food intake (50).

While the biological determinants of food preference cannot be modified, food preference can be altered through learning and experience. Environmental factors such as family, culture, food familiarity and food neophobia are known to influence food preference in children (45).

1.2.2.3 Cultural factors

Parents create a food environment for childrens’ early food experience and such an environment is influenced by parental beliefs and perceptions, culture and family traditions. The type of food and the timing of introduction of foods are determined by cultural beliefs and practices. Some foods that are commonly disliked are more accepted by children who grow up in cultures that widely use that food (45). For example, children in Mexico are exposed to spicy (chili peppers) food early on as part of a process of socialization (51). Environmental factors such as food availability and accessibility also influence children’s preferences for some foods.
Greater availability and accessibility of fruits and vegetables have been correlated with greater consumption in children (52, 53).

1.2.2.4 Social context/environment

In young children, eating is typically considered a ‘social phenomenon’. Outside the home environment where parents and caregivers influence food preferences, during school age, extra-familial influences such as friends and peers play a vital role due to the social environment (54). School-age children show more independence, including learning to make their own food decisions from parents and caregivers and develop confidence in all areas of life. Peers, teachers and caregivers outside the home environment can have powerful effects on food selection and choice (54). Studies have shown that young children aged 2 to 5 learn to accept foods by observing others. The acceptance is high when the person seen as a ‘model’ is familiar to the children, such as parents or teachers (55).

1.2.3 Food Neophobia

Food neophobia is a significant barrier to food preferences and the development of healthy eating habits, in particular, to the intake of fruits and vegetables (45). Neophobia is defined as a restrictive eating concept that could contribute to a child rejecting a wide variety of foods (4). Biologically, young children tend to reject novel or unfamiliar foods. The rejection of foods happens within the visual domain so foods that do not “look right” are most likely the ones to be rejected (8). Food fussiness/ picky eating, on the other hand, is defined as inadequate variety of foods due to rejection of familiar foods (4). The rejection of foods happens within the flavor and/or taste domain due to displeasing textures, taste and smell. The novelty of the food presented differentiates the two common traits among children.
1.2.3.1 Prevalence and measurement of food neophobia

Estimates of the prevalence of food neophobia in children varies from study to study. A large population-based cohort (Generation R) estimated the prevalence to be 27% in toddlers who were 18 months old that dropped to 13% at 6 years (56). However, a North American study reported that the prevalence of picky eaters was 50% in 2-year-old children (57). A study from China in 7-12-year-old children reported a prevalence of 59%. However, the study included children who were ‘always picky and ‘somewhat picky’ and hence the prevalence was likely inflated (58).

The inconsistency in estimates of prevalence could be attributed to lack of a distinct definition of food neophobia and food pickiness, and absence of a reliable tool to measure it. While a majority of studies have used the Pliner’s Food Neophobia Scale (FNS) to measure food neophobia, the Food Fussiness Scale, established from the Child Eating Behaviour Questionnaire has been used to measure food pickiness (4). A more recent review (59) that looked into the 13 existing instruments for measuring food neophobia suggested that choice of instrument is outcome-dependent. Although not one instrument could be used to measure all aspects of food neophobia, the FNS, developed by Pliner and Hobden was found to be the most widely used, valid and reliable tool. The FNS consists of 10 statements concerning food neophobic behaviour to which subjects indicate agreement/disagreement. Originally developed for adults, the FNS was then adapted to measure child food neophobia (CFNS) (45, 60).

1.2.3.2 Factors influencing food neophobia

The degree to which food neophobia is prevalent in children may be determined by a combination of factors such as age, parental attitudes, personality traits, previous experience with the food or familiarity and overall willingness to try new foods.
Research suggest that food neophobia might be an age-dependent stage in childhood. Most researchers agree that there is a steep increase in prevalence of food neophobia and/or food fussiness in the second year of life, reaching a peak between 2 to 6 years of age and declining after (57,61,67). This trait decreases as children age as their experiences with food are more frequent and varied, and fewer foods are new to them (8).

Although some researchers believe that food neophobia is a genetic trait as demonstrated by the twins’ study (46), others argue that it is a personality trait. Anxiety, emotionality and shyness are all associated with food neophobia (17). In terms of gender differences and food neophobia, findings have been mixed. A cohort study conducted by Lytle et al, showed that developmental trends and eating patterns were similar in boys and girls (62). Few gender differences have been reported in another study in 2 to 4-year-old Spanish children (63). Le Bigot Macaux and colleagues have shown that boys’ preferences for fruits is lower than girls (64), while Cooke and Wardle (65), in a study with children 4-16 years of age, have shown that while girls preferred more fruit, boys preferred fatty foods, processed meat and eggs.

1.2.3.3 Consequences of food neophobia

The health implications of food neophobia are both immediate and long term. Food preferences and eating patterns fluctuate throughout life. However, for young children, lack of a varied diet with healthy choices could prove detrimental. Nutrient deficiencies may be common in children who avoid nutrient-rich foods such as lean meat and fruits and vegetables. Consumption of energy-dense choices (sweet or fatty foods) may lead to adiposity and associated health consequences (4,66).

The most common consequence of food neophobia is low intake of fruits and vegetables. A study conducted in a group of overweight 4-8-year old children in New Zealand showed that
children who were picky had significantly lower intakes of fruits and vegetables compared to those who were not classified as picky (68). More recently, the Generation R study (56) showed that in children who were classified as picky at the age of 14 months had significantly lower intakes of whole grains, fruits and vegetables when assessed at the age of 4. Picky eaters were also found to have lower energy intake (69). Picky eaters were reported to be shorter and underweight in a longitudinal study (67). However, there is conflicting evidence of food neophobia and its relation to obesity as another longitudinal study found that fussy eating may reduce the risk of obesity (67).

1.2.4 Strategies to improve food neophobia in children

While some factors influencing food neophobia are genetic/biological, food preferences are malleable. Negative food preferences, such as preference for salty and sweet foods that tend to be energy dense (e.g. cakes, cookies, and chips) and, refusal of vegetables and fruits may be modified through experience and time (31,47).

1.2.4.1 Taste Exposure

Children can be encouraged to develop healthy food preferences by increasing their willingness to try new foods. Providing children with frequent opportunities to try a wide variety of foods, has been shown to increase familiarity and thereby acceptance. A growing body of evidence suggests that food acceptance is high when a new/unfamiliar food is offered repeatedly and frequently for up to 15 occasions, a phenomenon that is termed “Mere-Exposure”. A randomized control trial looking at vegetable acceptance in children through parent-led exposure revealed increased intake after 14 daily exposures (70). Children’s reflexive resistance, which is a biological trait, can be overcome by repeated exposure to new foods (71). School-based taste
exposure programs have shown to increase liking and consumption of vegetables in elementary school children (72). This suggests that during early childhood, childrens’ food preference development is linked with familiarity with foods- the more familiar they are, the more it is liked (4). A positive experience is also shown to lower reluctance to try new foods. It has been shown that repeated exposure in a non-coercive manner increases acceptance to new foods (73). However, a negative environment may hinder acceptance to new foods (4). Excessive control, pressure to eat foods that are perceived as “healthy” and restricting children’s access to highly palatable foods (high in sugar, salt and fat) have shown to decrease children’s preference and intake of new foods (74).

1.2.4.2 Visual Exposure

Another key concept that influences children’s decision to try a novel food and improve acceptance to new foods is ‘visual familiarity’ or foods they see more frequently in their environment. Studies have shown that children who had lower food neophobia were more familiar with a wide range of foods (75). Results from early research led by Birch et al concluded that visual exposure alone may be sufficient to change preference for a food in young children (76). There is also evidence that visual familiarity- where children are exposed to new foods through pictures and books have increased acceptance when offered the ‘real’ food (77,78). Visual exposure through books and pictures is also a means to reduce the number of ‘mere exposure’ needed to increase willingness to try new foods (79). However, translating visual familiarity to actually tasting the food may require more time and its translation to the home environment is still under study (79).
1.2.4.3 Reward

Exposure as a strategy to increase willingness to try new foods is successful based on the degree of neophobia. A small number of children are extremely fussy/food neophobic and for these children, the promise of an incentive/reward is the most common strategy used at home (45). Rewards have been seen as a necessary step on the road to improving dietary intakes in children who are food neophobic. However, research findings in this area are controversial. While some researchers believe that rewards can be effective in altering eating behaviour in children, others believe that rewards undermine the individual’s intrinsic motivation to succeed (45). Nevertheless, rewards have been used in a number of home-based and school-based interventions. In particular, ‘exposure plus reward’ was more successful than ‘exposure’ alone in increasing acceptance to vegetables in a school-based intervention (80).

Literature suggests that in order for rewards to be effective, they need to be desirable to children (81). Rewards can take many forms such as stickers, pencils and erasers and have been successful in improving dietary consumption of fruits and vegetables (82).

1.2.4.4 Modelling

The effect of modelling on dietary intake is well documented (45). Modelling is a social influence that can reduce or reverse food neophobia. Children are more likely to model an adult behaviour. However, it is also suggested that ‘enthusiastic’ modelling has better outcomes of food acceptance than ‘silent’ modelling. Similarly, familiar (such siblings, parents and teachers) models are more likely to alter eating behaviours positively in children (83). A Flemish study in children and adolescents showed a significant and positive association between peer modelling and daily fruit intake (84).
The degree of neophobia in role models (peers, parents, teachers) also affects children’s acceptance of new foods (85).

1.2.5  **School-based nutrition education**

**The school as setting to impact food preferences in children**

Schools have been recognized as an ideal setting to offer nutrition education and promote healthy eating in children, as children spend a substantial amount of time per day (50% of waking hours) at school. Furthermore, school provides a stimulating learning environment where children acquire knowledge and skills from peers and teachers (85). While many classroom-based healthy eating interventions have been implemented within Canadian schools, there is little independent evaluation of such programs.

1.2.5.1  **Teachers as role models**

Teachers can serve as an important influence on children and help with behaviour change. Research shows that children’s acceptance of new foods is high when the foods are offered by a familiar person. Parents can be this person in a home setting, while teachers are models in a school-setting (83). As an example, teachers are familiar with learning challenges of specific students and may be able to offer nutrition education and adapt activities based on their learning needs (above or below grade levels). Evidence suggests promising results when using teachers as vehicles to offer nutrition education. An intervention study where teachers offered education and offered a weekly fruit snack to students and consumed the snack with the students showed significance increase in student fruit consumption (86). Similar results were shown in a recent review (87) that providing nutrition education and exposing children to preparation of foods/tasting of foods in classrooms help children make healthier choices. Despite barriers such
as limited class time and knowledge in subject matter, teachers are believed to be role models and motivators when it comes to nutrition education (83).

1.2.5.2 Activities and approaches

School based nutrition interventions have different approaches, aims, and activities to intervene in children’s eating behaviour. Nutrition education provided as part of the curriculum have been useful in increasing knowledge, attitude, and skills towards healthy and conscious eating behavior (19).

More recently, a review on methods and teaching strategies to improve eating behaviour in primary school children revealed that theory-based education complemented with game-based activities, rewards, incentives, experiential activities such as cooking, gardening and tasting were the most beneficial to students, in terms of reducing intake of energy-dense foods, increasing fruit and vegetable consumption, reducing sugar consumption and increasing nutrition knowledge. Other beneficial strategies include parental involvement (active or passive), however, there is controversy over how to maximize parent involvement. While some studies have suggested that counselling parents is the most effective to improve childrens’ dietary behaviour, others argue that sending home materials is effective as well (88). With limited time, sending home materials is also the most feasible in school settings (87).

1.2.5.3 Facilitators and Barriers

The outcomes of a school-based intervention such as an increase in knowledge of foods or change in eating behaviour depend in part on the schools and teachers themselves. Teacher’s time, school environment, space, budget, student-teacher relationship, teacher knowledge,
perceived relevance and student-related factors such as receptiveness, motivation and enthusiasm are all factors that influence outcome of the program (87).

The effectiveness of nutrition education programs can be enhanced when school-based programs not only provide healthy eating information but also add opportunities for cooking and tasting (89). Studies also suggest that education in schools should focus on exposing students to a wide variety of foods and encourage tasting unfamiliar foods (90).

Despite evidence around the benefits of school-based food interventions, there is a lack of rigorous evaluations of existing programs in academic literature. Evaluations can provide critical information on strengths and barriers of programs that can be used to improve the program and inform development of new programs. The FE program is readily available to all schools and teachers in BC. It is therefore important to assess the effectiveness of the program on children's knowledge and willingness to try novel and familiar foods.

An overview of the FE program followed by the research purpose and objectives are discussed below.

1.3 Food Explorers Program

1.3.1 Program Objectives:

FE is a comprehensive early childhood nutrition education program designed to fit within the provincial (BC) physical and health education curriculum, with many activities that integrate other subject matter such as Language, Arts, Mathematics, Education, Science and Social Studies. Developed by Registered Dietitians/nutrition educators at the BCDA, the program was designed specifically for KG/Gr1 classrooms, across BC. Offered by teachers, the overall objective of the program is to encourage children to identify and experience a wide variety of
foods. The goal is to help children develop a positive self-concept which in turn enhances the child’s interest and motivation to participate in the food-related activity.

1.3.2 Theoretical Framework

A variety of conceptual models and theories have been applied to understand healthy eating behaviours and have informed a multitude of school-based nutrition education programs. At the time of development, in the late 80’s, the FE program was built on the work by Leanne Birch and Ellyn Satter, presented at the National Conference on Nutrition Education Research. Birch’s work on “The Role of Experience in Children’s Food Acceptance Patterns” (91) formed the genesis for the different components of the program such as sensory exploration, discussion, use of books and songs, and cooking. The program also draws upon concepts outlined in the ‘Motivation Generating’ (MG) model. Developed by an education consultant at the Dairy Council of California (92), the premise of MG model is that motivation to complete a task comes from success, and by building food-related activities where children can experience trying new foods successfully, they would become motivated to do this again.

The FE program also draws upon aspects of Albert Bandura’s Social Cognitive Theory (SCT) which is one of the most cited theories for school-based nutrition education programs (93,94). At the population level, particularly in school children, the SCT provides a framework for conceptualizing the dynamic interactions between personal factors (perceptions and beliefs), behavioural (nutrition knowledge and skills, food acceptance and choice) and, social and environmental factors (home, parents, peers, school setting) that influence health behaviour. Apart from behavioural capability (knowledge and skills), other key concepts of the SCT also
include self-efficacy (confidence to change behaviour), similar to the motivation aspect of the MG model.

1.3.3 Learning outcomes

At the end of the FE program it is expected that students will have the following learning outcomes:

a. Identify a variety of foods
b. Demonstrate willingness to try new foods
c. Use goal-setting as an approach to continue to try new foods
d. Demonstrate an understanding of the importance of eating a wide variety of foods.

The activities in the FE program encourage tasting, reading related books, discussion and journal keeping that will allow the children to express their feelings about the new concept and food introduced. Evidence from early learning and child development research suggests that children in elementary grades (5 to 6 y) are able to use complex vocabulary and make mental representations such as relationship between food choices and health, when new concepts are introduced with the aid of “real-life references and materials” (95).

The FE program provides teachers with a great amount of flexibility in terms of offering the lessons. Teachers may choose to offer lessons plans and introduce one food at a time, on a regular basis throughout the school year or combine units to offer nutrition education and introduce foods all within a few weeks (e.g. 1 food per month, 2 foods per week, or 8 foods in a month). The activities build upon each other and can be repeated as often as needed.
1.3.4 **Program activities**

Recognizing the active learning phase of KG/Gr 1 children (5 to 6 years), the program aims to provide students with first-hand, real life, structured, yet fun experience with food, focusing on colors, tastes and textures of food. Program activities include discussion, cooking, tasting and keeping journals on the activities that help children express and reflect on their feelings related to food introduced. It is well established that familiarity and knowledge about a variety of foods is a factor in making healthier food choices (96). The teachers who choose to offer the FE program in their classroom are required to complete an in-service workshop. The workshop is offered for free by the nutrition educators/dietitians at the BCDA, however, teachers acquire the standardized materials/ resources needed to teach the program for a subsidized fee ($20 CAD). Parents have to provide a signed consent for their children to participate in the FE program.

A total of sixteen foods are presented in the FE program as Package A or Package B; teachers choose which Package to deliver in their classroom. Each of the packages contains 2 foods from each food group. The foods are chosen for their variety, availability and economy. Furthermore, these foods are also basic to many cultures that are representative of children in BC schools.
Introduction of a minimum of eight foods (out of 16 foods) is recommended in order to meet the learning outcomes of the FE program.

1.3.5 Core components of FE

1.3.5.1 Mystery box- Food Introduction:

A food is introduced through a mystery box activity passed around to each student in class where children describe the food through sensory (smell, sound and touch) exploration. Alternatively, the food is kept out of sight and children play a “Who am I?” activity. The teacher encourages the children to ask questions pertaining to the food to try and identify the food. Foods are also introduced with an art activity, song or poem, followed by tasting.
1.3.5.2 Cooking and tasting opportunities:

The teacher guide includes recipe suggestions from ‘easy’ to more ‘challenging’. Each food within the teacher guide has 3 to 4 recipe suggestions, so the teachers can choose to use one or more of them to follow in the cooking component. Children are involved in the cooking process and take responsibility to complete one or more cooking related activity. Cooking activities are designed to align with the curriculum such as measuring (mathematics), physical change (science), following recipes (temporal sequence, reading) and mixing, washing (physical development- gross and fine motor skills).

1.3.5.3 Journal (“Foods we explored/New foods I want to try”):

Children are encouraged to record their feelings and emotions after tasting the ‘newly’ introduced food by drawing and/or printing. This gives an opportunity to look back at the journal and recall the food-related experience during repeated exposures. Motivation to try the food again or try another new food comes from the success/sense of achievement of completing one journal record. Students are given stickers to celebrate the success of trying a new food and are encouraged to bring home the journal, stickers and the recipe cards to share with their parents.

1.3.5.4 Extension activities/Discussion

Teachers are provided with related books and resources to encourage ‘visual familiarity’ that may be completed as additional activities. Field trips are also encouraged to reinforce learning.

A sample of activities under each of the components for one of the eight foods introduced as part of the program is depicted in Figure 1.1. Not all resources and activities are listed in the figure.
Figure 1.1 Sample activities for apple (food in package A) in the FE program
1.4 Purpose of the research

The FE program is being offered in over a hundred schools in BC, however, the effectiveness has not been independently evaluated. Evaluating the effectiveness of already existing school-based nutrition education programs can provide valuable information to stakeholders to help understand strengths and weaknesses of the program and thereby increase positive eating behaviours in children.

Therefore, the current study was designed to evaluate the effectiveness nutrition education lessons from the FE program. This study aims to

1. assess the impact of the FE program on knowledge and willingness to try new and familiar foods in KG/Gr1 children
2. assess the impact of the FE program on willingness to try new and familiar foods in KG/Gr1 children
3. Assess impact of the FE program on parent-perceived food neophobia in children
4. outline facilitators and barriers for implementing the program from the teachers’ perspective

1.5 Research Hypotheses

The hypotheses for the current study are

a) The FE program increases knowledge about new and familiar foods in KG/Gr1 children

b) The FE program affect food preferences (willingness to try) in KG/Gr1 children

c) The FE program is effective in reducing food neophobia in KG/Gr1 children

d) School level barriers exist that affect implementation of the FE program
Chapter 2: Methods

2.1 Study design:

A non-randomized (quasi-experimental), pre-post comparison study design with an intervention group and control group was used to evaluate the impact of the FE. Data was collected from teachers, children and their parents during the school year 2016-17 and 2017-18. A quantitative component provided information on willingness to try new and familiar foods in the children as reported by the children and their parents, while open-ended questions provided an understanding of the experience and impact of the program, from both teachers’ and parents’ perspective. Participants were evaluated at baseline and at 5 months post-intervention. Five months was chosen as the evaluation period as teachers indicated this was the most common timeframe for delivering the program in the classroom.

2.2 School Selection:

Although the FE program is offered in schools all across BC, this evaluation study was restricted to classrooms located within 100km from the University of British Columbia to ensure feasibility and minimize travel costs around data collection. Schools within 2 school districts in BC, Vancouver School Board (SD#39) and Surrey School District (SD#36) were approached to participate in this study and consented to participation. Ethics approval for the study was obtained from the University of British Columbia Behavioural Research Ethics Board (H16-01931). Vancouver School Board and Surrey School District, Research & Evaluation. Initial contact with intervention classrooms was established based upon existing teachers who had registered to receive training and materials to teach the FE program during the evaluation period.

To further expand the recruitment of intervention classrooms, schools that had offered the FE program at least once in the past 3 years were also contacted. An information letter was
mailed out to Principals of those schools about the evaluation study. Control classrooms were those who did not offer the FE program during the evaluation period and were matched to the intervention classrooms within a school when possible or were otherwise matched based on classrooms (KG/Gr 1) and school characteristics including neighbourhood characteristics and school district by directly surveying schools in the area.

2.3 Sample selection and recruitment:

The sample of interest for the evaluation of the FE program included all teachers, children in KG/Gr 1 classrooms and their parents. The evaluation methodology and instruments for the children’s assessments were pilot tested on two different occasions in a sample of six children each (n=12). The aim of the pilot study was to

(a) determine the foods that were novel and familiar to be included in the study
(b) test the suitability of the photographs and
(c) determine the feasibility of the testing protocol

The findings highlighted the need to change some foods, use alternate photographs and simplify some of the questions in child assessments. The list of 20 foods, photographs and testing protocol used in the evaluation reflect the changes made after the pilot study.

Initial contact was established with 2 school districts in the Lower Mainland for the intervention group. Recruitment letters were sent out by staff at the BCDA on behalf of the investigators to teachers who had registered to receive training and material to teach the FE program (Appendix A.1). In total, 32 KG/Gr1 teachers from 25 schools were sent the recruitment letters and information package about the evaluation study. Sixteen teachers from 11 schools (50% response rate) who were planning to offer the FE program during the evaluation period expressed interest to participate in the study. However, only 11 teachers from 8 schools
(35% participation rate) provided written consent (Appendix B.1) to participate in the study. For the control group, initial contact (Appendix A.2) was established with classrooms (KG/Gr 1) within the same schools where possible or within the same catchment as the intervention group. Administrators of 22 schools were mailed an information letter to request permission to contact their KG/Gr 1 teachers. Teachers were eligible to participate if they were not offering the FE program during the evaluation period. Fourteen teachers from 6 schools expressed interest in participating in the study as a control group. However, 11 teachers from four schools (50% participation rate) provided written consent (Appendix B.1)

Upon receiving consent and completion of a demographic survey (Appendix D.1) teachers were sent information packages including parent recruitment letter, eligibility screener and consent forms to be sent home with the children (Appendix B.2, B.3, B.4). Only those children who had signed consent to participate in the FE program were invited to participate in the evaluation study. The eligibility screener included questions on ongoing enrollment with the school (till the end of the school year) and details on any health condition that affects diet (e.g. Celiac disease).

Inclusion criteria for the study included

- Children to be enrolled in KG/Gr 1 in the current school year
- Parents and children to be proficient in English
- Meets criteria in the Eligibility screener (continued enrolment and no health condition)

Two hundred and twenty four packages (1 package per child) were mailed out to teachers in the FE group and 214 parent information packages were mailed out to control teachers. Parents were requested to return the completed forms to the teacher for the researchers to collect. Written consent was obtained from 133 parents in the FE group (66% recruitment) and 111 parents in the control group (52% recruitment). Once consent from teachers and parents were
obtained, in-class assessments were scheduled in coordination with teachers and took place from January 2017 (baseline) to June 2017 (follow-up) in year 1 and November 2017 (baseline) to May 2018 (follow-up) in year 2. **Figure 2.1** depicts the recruitment and data collection procedures for the FE evaluation study.
Figure 2.1 Flow diagram of recruitment and data collection procedures for the FE evaluation

**Intervention group (2016-2018)**

- **Enrolment**
  - Initial contact
    - Schools n=25
    - Teachers (K/1) n=32
  - 16 teachers from 11 schools expressed interest in the evaluation study
  - 11 teachers consented from 8 schools
  - 224 parental consents/study information mailed out to teachers to be sent home with children
  - Consent obtained from 133 parents

- **Recruitment and Baseline**
  - Baseline data collected from 114 children and 78 parents
    - (Participation rate: child 85.7%, parent 58.6%)
  - Follow-up data was collected from 103 children and 68 parents
    - (Retention rate: child 90%, parent 87%)
  - Children lost to follow-up
    - (n=11) as they no longer attend school or absent from school on the day of interview
  - Parents lost to follow-up
    - (n=10) due to no response and children no longer attend school

- **Analysis**
  - Child assessment:
    - Data from 102 children (pre-post) were analyzed for child measures of food knowledge and preference

- **Parent assessment**
  - Data from 49 parents (pre-post) were analyzed for parent perception of food neophobia in children

**Control group (2016-2018)**

- **Enrolment**
  - Initial contact (letters to school Principals)
    - Schools n=22
  - 14 teachers expressed interest in participating in the control group
  - 11 teachers consented from 4 schools
  - 214 parental consents/study information mailed out to teachers to be sent home with children
  - Consent obtained from 111 parents

- **Recruitment and Baseline**
  - Baseline data collected from 102 children and 83 parents
    - (Participation rate: child 92%, parent 76.6%)
  - Follow-up data was collected from 98 children and 75 parents
    - (Retention rate: child 96%, parent 90.3%)
  - Children lost to follow-up
    - (n=4) as they no longer attend school or absent from school on the day of interview
  - Parents lost to follow-up
    - (n=8) due to no response and children no longer attend school

- **Analysis**
  - Child assessment:
    - Data from 92 children (pre-post) were analyzed for child measures of food knowledge and preference

- **Parent assessment**
  - Data from 65 parents (pre-post) were analyzed for parent perception of food neophobia in children
2.4 Data collection methods:

2.4.1 Quantitative data collection

Quantitative data included both in-class assessments in children and parent questionnaires, at baseline and follow-up in both intervention and control groups. While assessments in children provided child-reported measures of food knowledge and food preference, parent questionnaires provided information on parent-perceived neophobia and pickiness in their children. Child-driven measures of food knowledge and preference were measured using a pre-existing validated method that are age/developmentally appropriate (60). This method has shown to be internally consistent with Cronbach’s alpha ranging from 0.83 to 0.92 (60).

2.4.1.1 Baseline measurements in children

The in-class baseline assessments of food neophobia and pickiness in children were completed in both the intervention and control groups. The assessments of children followed a 2-step process. Each child was individually interviewed by a researcher to assess their food preferences. Interviews lasted 10-12 minutes per child. A verbal assent was obtained from all children after a brief explanation of the purpose of the study and the task required to complete.

Step-1:

The food set presented to the children consisted of twenty foods (ten familiar foods and ten novel foods) representing the four food groups. High quality photographs of the twenty foods were shown one at a time in the same order for each child. A complete list of the ten familiar foods and ten novel foods can be found in Table 2-1.
Table 2.1 Familiar and novel foods shown to children as photographs to assess familiarity and preference

<table>
<thead>
<tr>
<th>Familiar foods</th>
<th>Novel foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato (white)</td>
<td>Pumpernickel bread</td>
</tr>
<tr>
<td>Kiwi</td>
<td>Swiss cheese</td>
</tr>
<tr>
<td>Cereal (Shreddies)</td>
<td>Shrimp</td>
</tr>
<tr>
<td>Oatmeal</td>
<td>Potato (red)</td>
</tr>
<tr>
<td>Milk</td>
<td>Cream of Broccoli soup</td>
</tr>
<tr>
<td>Cheddar cheese</td>
<td>Cauliflower</td>
</tr>
<tr>
<td>Egg</td>
<td>Wild rice</td>
</tr>
<tr>
<td>Tuna</td>
<td>Kefir</td>
</tr>
<tr>
<td>Pizza</td>
<td>Chickpeas</td>
</tr>
<tr>
<td>Chicken</td>
<td>Falafel</td>
</tr>
</tbody>
</table>

For each food photograph presented, the children were told “I want you to tell me what this food is”. If the child provided generic answers, for example, “cheese” instead of cheddar cheese, the researcher probed by asking “What type of cheese is it?” If the child was unable to name the food, the researcher provided the name (Appendix C).

After each photograph was shown and named, the children were asked “Have you tasted _____ (name of food)?” one by one. The answers were recorded as ‘yes’ or ‘no’. If the child was unsure, children were prompted with the name of the food again and the question was
repeated. The answers were recorded as ‘N/A’ if children were still unsure or refused to answer. The process was repeated until all twenty photographs of foods were shown or until saturation ¹

**Step 2**

Following step 1, the children used a three point ‘facial’ hedonistic scale to rate their preference (liking) of the twenty foods ([Fig 2.2](#)) (97). The reliability of this method has also been demonstrated in other studies with test-retest correlations ranging from 0.70 to 0.89 in five-year-old children (97, 98, 99,100). The researcher showed each child the faces (happy, neutral and sad in conjunction with yummy, ok and yucky respectively) and provided a detailed explanation. Children’s understanding of the scale was tested at random, prior to and during the assessment. For the ‘yummy’ face, child was told “this is the face you might make when you taste something really nice and delicious; it’s a yummy face”. Similarly, for the ‘yucky face’, “this is the face you might make when you taste something you really don’t like; it’s a yucky face”. For the ‘just okay’ face the child was told “this is the face that you make when you eat something that doesn't taste really yummy, but that doesn't taste really yucky; it just tastes okay”. The same 20 foods from step 1 were used and shown in the same order as in step 1. After each photograph was shown, the children were asked “point to the face you would make when eating this food”. The process was repeated until all twenty food photographs were shown or until saturation¹. The facial hedonistic scale was used to ensure that children easily understood taste perception of each of the food presented.

¹ Saturation is defined as the child refusing to answer (non-responsive) for 3 non-consecutive (or consecutive) photographs.
Food preference scores were calculated based on the responses. The food preferences were coded three for ‘yummy’, two for ‘just okay’ and one for ‘yucky’, with total scores ranging from 20 to 60 with higher values corresponding to a higher preference for these foods. Average scores for the ten familiar foods and ten novel foods were calculated and the final scores ranged from 1-3.

2.4.1.2 Baseline measurements in parents

Upon consent, parents were requested to complete a survey either online or paper-based (based on preference) that included basic demographic (Appendix D.2) details such as parent age, gender, child age, ethnic background, parent education and household income. A second 9-item questionnaire on parent perception of their child’s food neophobia and pickiness was also completed at baseline (Appendix D.3). The parent questions were based on previously validated CFNS (60). The CFNS proposed by Pliner is completed by parents and consists of items from the original FNS in terms of the child’s behaviour. It is a widely used tool to measure food neophobia among children (60). The original scale to measure food neophobia has shown to be internally consistent with a Cronbach’s alpha of 0.88 with test-retest correlations ranging from
Responses were measured using a 5-point Likert scale, ranging from “strongly disagree” to “strongly agree”. The items can be found in Table 2-2. Individual scores were obtained by summing the values for each of the scale item, corresponding to the values of 1-5 and totaling 9 to 45 points. The scores on two items (Item 4 and 6) were reverse coded since these items correspond to ‘food neophilia’ rather than neophobia. Higher scores indicated greater parent perception of food neophobia or reluctance to try new foods. Similar to previous studies (101,102), a cut-off score of 35 was used to indicate food neophobia.

Table 2.2 Child food neophobia scale (parent -perceived measure)

| “My child does not trust new foods” |
| “If my child doesn’t know what’s in a food, he/she won’t try it” |
| “My child is afraid to eat things she/he has never had before” |
| “My child will eat almost everything” |
| “My child is very particular about the foods she/he will eat” |
| “My child is constantly sampling new and different foods” |
| “My child’s diet consists only of a few foods” |
| “My child is unwilling to eat many of the foods that our family eats at mealtime” |
| “My child is fussy or picky about what she/he eats” |

2.4.1.3 Follow-up measurements in children and parents

In-classroom assessment of child-driven measures of food familiarity and neophobia in control and FE groups were repeated using the same protocol as baseline. Parent questionnaires
on their perception of their child’s food neophobia was also repeated (Appendix D.3) at follow-up. All follow-up measurements were completed 5 months after the baseline assessments.

2.4.2 Open-ended questions

Teachers who offered the FE program in class and parents of children who participated in the FE program were invited to complete an open-ended online questionnaire that outlined their experience with the program (Appendix E.1). While teachers were asked to comment on the program content and delivery such as most/least helpful activities, frequency of program delivery (once a week, once in two weeks etc.), facilitators and barriers to offering the program; parents were asked to comment on changes, if any in their child’s food preferences over the time that FE was taught in the classroom (Appendix E.2).

As an incentive to participate in the study, teachers from the control groups received a $100 CAD cash remuneration to spend on classroom resources. The teachers in the FE group received the mini-grant ($100 CAD) to run the program. Children/parents who completed all assessments and questionnaires received a $25 CAD cash remuneration as a token of appreciation. Parents and teachers were contacted up to 6 times to encourage completion of study measures at each time point.
2.5 Data analysis

All continuous variables were visually examined with histograms and categorical variables with mosaic charts to examine distribution (a graphical display to examine cell frequencies of a contingency table, where the area of the boxes are proportional to the cell frequencies). Univariate analysis (age, gender, grade) was conducted and a comparison of the descriptive statistics for the FE and the control group indicated that the samples were well matched with respect to demographics of children and parents.

2.5.1 Descriptive statistics

Descriptive statistics were used to report the distribution of demographic characteristics for parents, children and teachers as well as outcomes in the entire sample, such as food preference scores, food neophobia scores and as FE and control groups separately. Continuous variables are reported as mean ± standard deviation (SD) and categorical variables as counts and percentages.

Bivariate comparisons were performed using t-tests for continuous variables and χ² test for categorical variables.

2.5.2 Generalized mixed effect models

To understand the associations between the group and familiarity of the foods measured by children’s knowledge (yes/no) of foods, regression analyses using a generalized mixed logistic model for repeated measures was conducted. Logistic regression was used to evaluate the change in knowledge (no or yes) and taste of food (no or yes) at baseline and follow-up. The parameter estimates of the model was presented as odds ratios (OR) and 95% confidence intervals (95% CIs). Food preference scores and food neophobia scores at follow-up were
analyzed using generalized mixed linear regression models. The parameter estimates of models are presented as β-coefficients and 95% CIs.

All models included the main effects of “group” and “time” as fixed effects and “participants” as the random effect. A group by time interaction was included in the model to evaluate the effect of differences between the groups at baseline and follow-up and within-group differences over time. The analyses were based on two time points of assessment (i.e. baseline and follow-up at 5 months). Data analyses were based on participants with data at baseline and follow-up. Participants with missing data were excluded in the analyses and sample size varies for each group/outcome based on availability of matched data.

All tests were two-sided and considered statistically significant at the p<0.05 level. All data and statistical analysis were analysed in SAS 9.4 (SAS Inc, Cary, NC) (103).

2.5.3 Open-ended questionnaires

Each of the responses from the open-ended questionnaires were read in detail following which data was categorized. The open-ended responses were separated as positive, negative and neutral. Once the data was studied, the information was summarized using descriptive text incorporating quotes directly from the respondents.
Chapter 3: Results

Eleven FE classrooms and eleven control classrooms participated in the study. A total of 194 children completed assessments at both time points (pre and post), with n=102 in the FE group and n=92 in the control group.

3.1 Demographic characteristics of study sample- Children

Table 3.1 presents the demographic characteristics of the children in the study sample. Gender was evenly distributed, with 51% female in the FE group and 55% in the control group. Most of the children were in kindergarten, 87% in the FE group and 77% in the control group. Children’s age was assessed via parent questionnaires. Overall, at pre-test the mean (±SD) age of children in the FE group (n=78) was 5.45 (± 0.75) years. In the control group (n=84), the mean (±SD) of children was 5.32 (±0.6) years. Children did not significantly differ in age between the two groups.
Table 3.1 Demographic characteristics of participating children

<table>
<thead>
<tr>
<th></th>
<th>Food Explorers (n=102)</th>
<th>Control (n=92)</th>
<th>p-value $^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>% / Mean (SD)</td>
<td>n</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50</td>
<td>49.0</td>
<td>41</td>
</tr>
<tr>
<td>Female</td>
<td>52</td>
<td>51.0</td>
<td>51</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KG</td>
<td>89</td>
<td>87.3</td>
<td>71</td>
</tr>
<tr>
<td>Grade 1</td>
<td>13</td>
<td>12.7</td>
<td>21</td>
</tr>
<tr>
<td><strong>Age (in years)</strong></td>
<td>78</td>
<td>5.45 (0.75)</td>
<td>84</td>
</tr>
</tbody>
</table>

$^1$p-value for Pearson’s χ² test and independent 2-sample t-test compares the difference in the distribution of the study population and mean age, respectively; $\alpha=0.05$; parent reported age of children is reported, the number varies due to missing data.

3.2 Demographic characteristics - Parents

Table 3.2 shows the distribution of gender, age, education, marital status, ethnicity, household income and family size as determined from parental pre-questionnaires. Questionnaires were completed by parents of both the FE (n=78) and control groups (n=84). A majority of parents who completed the questionnaires were female in both the FE and control group, 78% and 86% respectively. Approximately, one-third of the parents reported to have completed a bachelor’s degree and above in both groups. In the intervention group, 2 parents did not report their ethnicity. Among the remaining 76 parents, 26% reported as being ‘White’. Among the control group, of the 84 parents who responded to the question about ethnicity, approximately one-third reported being ‘South Asian’. Half of the families in both groups who participated in the study were 2 children households. Chi-square analysis of the demographic variables (Table 3.2) showed no significant differences between groups in the distribution of
parent gender, education status, age, household income and number of adults/children in the family. The only demographic variable where a significant difference was seen between the two study groups was ethnicity ($p=0.003$), which represents a higher proportion of “South Asians” in the control group.
Table 3.2 Demographic characteristics of participating parents

<table>
<thead>
<tr>
<th></th>
<th>Food Explorers</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
<td>21.7</td>
</tr>
<tr>
<td>Female</td>
<td>61</td>
<td>78.2</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 to 30</td>
<td>12</td>
<td>15.6</td>
</tr>
<tr>
<td>31 to 40</td>
<td>46</td>
<td>59.7</td>
</tr>
<tr>
<td>41 and above</td>
<td>19</td>
<td>24.7</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below high school/high school completion/trade</td>
<td>27</td>
<td>35.0</td>
</tr>
<tr>
<td>College/university certificate</td>
<td>24</td>
<td>31.1</td>
</tr>
<tr>
<td>Bachelor’s and above</td>
<td>26</td>
<td>33.8</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>20</td>
<td>26.3</td>
</tr>
<tr>
<td>South Asian</td>
<td>13</td>
<td>17.1</td>
</tr>
<tr>
<td>Asian</td>
<td>14</td>
<td>18.4</td>
</tr>
<tr>
<td>South East Asian</td>
<td>11</td>
<td>14.5</td>
</tr>
<tr>
<td>Other*</td>
<td>18</td>
<td>23.7</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/common law</td>
<td>67</td>
<td>85.9</td>
</tr>
<tr>
<td>Never married/divorced/separated</td>
<td>11</td>
<td>14.1</td>
</tr>
<tr>
<td><strong>Household income (CAD)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than $50,000</td>
<td>28</td>
<td>38.9</td>
</tr>
<tr>
<td>$50,000 to $100,000</td>
<td>27</td>
<td>37.5</td>
</tr>
<tr>
<td>$100,000 to $150,000</td>
<td>6</td>
<td>8.3</td>
</tr>
<tr>
<td>$150,000 and above</td>
<td>11</td>
<td>15.3</td>
</tr>
<tr>
<td><strong>Adults in household</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 to 2 adults in household</td>
<td>52</td>
<td>66.6</td>
</tr>
<tr>
<td>3 or more adults in household</td>
<td>26</td>
<td>33.3</td>
</tr>
<tr>
<td><strong>Children in household</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single child household</td>
<td>16</td>
<td>21.0</td>
</tr>
<tr>
<td>2 children household</td>
<td>38</td>
<td>50.0</td>
</tr>
<tr>
<td>3 or more children household</td>
<td>22</td>
<td>28.9</td>
</tr>
</tbody>
</table>

Number varies as indicated due to missing data. * Significant difference between the two study groups with chi square (p=0.003). * Latin American, Arab, West Asian, Mixed race, Indigenous
Table 3.3 Demographic characteristics of participating teachers (n=17*)

<table>
<thead>
<tr>
<th></th>
<th>Food Explorers</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>100</td>
</tr>
<tr>
<td><strong>Teacher Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 to 35</td>
<td>3</td>
<td>33.3</td>
</tr>
<tr>
<td>36 to 45</td>
<td>3</td>
<td>33.3</td>
</tr>
<tr>
<td>46 and above</td>
<td>3</td>
<td>33.3</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>4</td>
<td>44.4</td>
</tr>
<tr>
<td>South Asian</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Asian</td>
<td>4</td>
<td>44.4</td>
</tr>
<tr>
<td>South East Asian</td>
<td>1</td>
<td>11.1</td>
</tr>
<tr>
<td>Others (Indigenous)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Teaching experience (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-5</td>
<td>1</td>
<td>11.1</td>
</tr>
<tr>
<td>6-10</td>
<td>2</td>
<td>22.2</td>
</tr>
<tr>
<td>11-15</td>
<td>3</td>
<td>33.3</td>
</tr>
<tr>
<td>&gt;15</td>
<td>3</td>
<td>33.3</td>
</tr>
<tr>
<td><strong>Teach healthy eating programs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>apart from FE, yes</td>
<td>7</td>
<td>78</td>
</tr>
</tbody>
</table>

*Data is shown for the 17 teachers (out of 22) who completed the baseline survey. Data is shown for descriptive purposes and were not statistically compared.

3.3 Demographic characteristics- Teachers

Table 3.3 shows the sample characteristics of the participating teachers. While a total of twenty-two teachers (FE and control group) participated in the study, only seventeen teachers completed the baseline survey relating to teacher gender, age, ethnicity and years of teaching experience. For the question “Besides the Food Explorers program, do you teach nutrition in your classroom?”, seven out of nine teachers in the FE group and six out of eight in the control
group responded ‘yes’. Data in Table 3.3 is shown for descriptive purposes only and were not statistically compared.

3.4 Familiarity/Knowledge of foods

Table 3.4 shows the proportion of children with knowledge of familiar foods at baseline and follow-up, modeling the probability of children responding ‘yes’ to knowledge of foods by group (FE and control) and time (baseline/follow-up). Results from the generalized mixed effects model showed a significant main effect for time for four out of the ten familiar foods that included white potato, kiwi, oatmeal and tuna where familiarity of foods increased over time. The prevalence of children (in both groups) who were able to identify the name of the above foods at follow-up was higher. A significant group by time interaction was observed for two of the ten familiar foods; knowledge of cereal and cheddar cheese increased in the FE group at follow-up [OR (95%CI) of 3.05 (1.28, 7.26) and 4.44 (1.55, 12.73), respectively] while knowledge in the control group did not change.

Table 3.5 shows the proportion of children with knowledge of novel foods at baseline and follow-up, modeling the probability of responding ‘yes’ to knowledge of foods by group and time. With respect to the novel foods, a significant main effect for time was observed for shrimp and cream of broccoli soup (p=0.05 and p<0.0001) respectively, where familiarity of these foods increased over time. No significant group by time interaction was observed for any of the ten novel foods. No associations were tested for four novel foods (pumpernickel bread, wild rice, kefir and falafel) due to an insufficient number of children (n=0 to 5) familiar with the foods at baseline and follow-up.
Table 3.4 Associations between group and knowledge (yes/no) of the name of familiar foods (FE, N=102 and control, N=92)

<table>
<thead>
<tr>
<th></th>
<th>Baseline yes, %</th>
<th>Follow-up yes, %</th>
<th>Group effect OR (95%CI)</th>
<th>Time effect OR (95% CI)</th>
<th>P-value group</th>
<th>P-value time</th>
<th>Group x Time effect OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Potato, white</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>66</td>
<td>86</td>
<td>1.05 (0.55, 2.01)</td>
<td>3.25 (1.91, 5.51)</td>
<td>0.80</td>
<td>0.007</td>
<td>1.34 (0.46, 3.86)</td>
</tr>
<tr>
<td>Control</td>
<td>67</td>
<td>84</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Kiwi</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>53</td>
<td>74</td>
<td>1.29 (0.71, 2.33)</td>
<td>2.67 (1.68, 4.22)</td>
<td>0.61</td>
<td>0.006</td>
<td>1.15 (0.46, 2.88)</td>
</tr>
<tr>
<td>Control</td>
<td>49</td>
<td>67</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cereal (Shreddies)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>38</td>
<td>64</td>
<td>0.97 (0.56, 1.68)</td>
<td>1.83 (1.19, 2.83)</td>
<td>0.09</td>
<td>0.87</td>
<td>3.05 (1.28, 7.26)*</td>
</tr>
<tr>
<td>Control</td>
<td>51</td>
<td>52</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oatmeal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>9</td>
<td>22</td>
<td>1.42 (0.70, 2.90)</td>
<td>2.97 (1.54, 5.73)</td>
<td>0.58</td>
<td>0.04</td>
<td>1.09 (0.29, 4.07)</td>
</tr>
<tr>
<td>Control</td>
<td>7</td>
<td>16</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Milk</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>97</td>
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<td>98</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Cheddar cheese</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>17</td>
<td>42</td>
<td>2.14 (1.21, 3.78)</td>
<td>1.77 (1.05, 3.00)</td>
<td>0.97</td>
<td>0.68</td>
<td>4.44 (1.55, 12.73)*</td>
</tr>
<tr>
<td>Control</td>
<td>16</td>
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<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Egg</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>96</td>
<td>99</td>
<td>2.36 (0.61, 9.13)</td>
<td>2.93 (0.78, 11.0)</td>
<td>0.44</td>
<td>0.31</td>
<td>1.98 (0.14, 27.9)</td>
</tr>
<tr>
<td>Control</td>
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<td>97</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tuna</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>4</td>
<td>16</td>
<td>1.77 (0.62, 5.06)</td>
<td>4.98 (2.86, 13.34)</td>
<td>0.51</td>
<td>0.04</td>
<td>0.95 (0.13, 6.80)</td>
</tr>
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<tr>
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</tr>
<tr>
<td>FE</td>
<td>100</td>
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Associations tested with generalized mixed effects model (repeated measures outcome, yes to knowledge of foods) with interactions for group and time; OR - odds ratio; CI - confidence interval; p value significant at <0.05; * significant group by time interaction effect. No associations were tested for two familiar foods (pizza and milk) due to an insufficient number of children (n=0 to 3) unfamiliar with the foods at baseline and follow-up.
Table 3.5 Associations between group and knowledge (yes/no) of the name of novel foods  
(FE, N=102 and control, N=92)

<table>
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<tr>
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<th>Baseline yes, %</th>
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<th>Time effect OR (95%CI)</th>
<th>P-value group</th>
<th>P-value time</th>
<th>Group x Time effect OR (95% CI)</th>
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Associations tested with generalized mixed effects model (repeated measures outcome, yes to knowledge of foods) with interactions for group and time; OR-odds ratio; CI-confidence interval; p value significant at <0.05; No associations were tested for four novel foods (pumpernickel bread, wild rice, kefir and falafel) due to an insufficient number of children (n=0 to 5) familiar with the foods at baseline and follow-up.
Table 3.6 Associations between group and taste (yes/no) of familiar foods (FE, N=102 and control, N=92)

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<th>Baseline yes, %</th>
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<th>Group effect OR (95%CI)</th>
<th>Time effect OR (95%CI)</th>
<th>P-value group</th>
<th>P-value time</th>
<th>GroupxTime effect OR (95% CI)</th>
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Associations tested with generalized mixed effects model (repeated measures outcome, yes to having tasted the foods) with interactions for group and time; OR-odds ratio; CI-confidence interval; p value significant at <0.05; * significant group by time interaction effect.
### Table 3.7 Associations between group and taste (yes/no) of novel foods (FE, N=102 and control, N=92)

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<th>Food</th>
<th>Baseline yes, %</th>
<th>Follow-up yes, %</th>
<th>Group effect OR (95%CI)</th>
<th>Time effect OR (95%CI)</th>
<th>P-value group</th>
<th>P-value time</th>
<th>Group x Time effect OR (95% CI)</th>
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<td>Control</td>
<td>1</td>
<td>1</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Kefir</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>13</td>
<td>6</td>
<td>2.43 (1.14,10.23)</td>
<td>0.52 (0.18,1.50)</td>
<td>0.03</td>
<td>0.65</td>
<td>2.89 (0.07,5.21)</td>
</tr>
<tr>
<td>Control</td>
<td>3</td>
<td>2</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chickpeas</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>35</td>
<td>51</td>
<td>1.12 (0.67,1.86)</td>
<td>1.34 (0.88,2.05)</td>
<td>0.41</td>
<td>0.76</td>
<td>2.19 (0.94,5.12)</td>
</tr>
<tr>
<td>Control</td>
<td>42</td>
<td>40</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Falafel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>19</td>
<td>24</td>
<td>1.68 (0.91,3.10)</td>
<td>1.02 (0.59,1.77)</td>
<td>0.45</td>
<td>0.67</td>
<td>1.53 (0.51,4.55)</td>
</tr>
<tr>
<td>Control</td>
<td>15</td>
<td>13</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Associations tested with generalized mixed effects model (repeated measures outcome, yes to taste of foods) with interactions for group and time; OR-odds ratio; CI-confidence interval; p value significant at <0.05; * significant group by time interaction effect.
3.5 Taste of foods

Table 3.6 shows the proportion of children who have tasted the familiar foods at baseline and follow-up, modeling the probability of responding ‘yes’ to having tasted the foods by group and time. Generalized mixed effects model for familiar foods revealed a significant main effect for time for kiwi (p=0.009), indicating an increase in prevalence of tasting over time. A significant group by time interaction [OR (95%CI) of 4.59 (1.26, 13.09)] was observed for eggs whereby more children in the FE group were likely to have tasted eggs over time while the children who reported to have tasted eggs in the control group at follow-up remained the same.

With respect to novel foods, the proportion of children who have tasted novel foods at baseline and follow-up, modeling the probability of responding ‘yes’ to having tasted the foods by group and time is shown in Table 3.7.

A significant group by time interaction was observed for swiss cheese [OR (95%CI) of 0.48 (0.27, 0.86)], which indicates that the change in the prevalence of children who had tasted swiss cheese over time significantly differed between the two groups. Fewer children in the FE group reported to have tasted swiss cheese at follow-up, while the prevalence of tasting swiss cheese was similar to baseline in the control group.
3.6 Food preference

Table 3.8 shows the mean food preference scores for children’s willingness to try familiar and novel foods at baseline and follow-up. For all foods combined, the mean (±SD) food preference score in the FE group was 2.13 (±0.34) at baseline and 2.25 (±0.34) at follow-up. In the control group, the mean (±SD) food preference score was 2.25 (±0.34) at baseline and 2.20 (±0.31) at follow-up.

Associations between the group and food preference scores are shown in Table 3.9. The mean (±SE) score for the control group at baseline was 2.25 (±0.03) out of a score of 3, for all twenty foods combined. Significant group differences were observed in food preference scores between the FE group and control group at baseline for all foods combined (p=0.007). Food preference scores were significantly lower in the FE group at baseline. The group by time interaction was significant (p=0.0003). Food preference scores increased in the FE group from baseline to follow-up in the FE group while it decreased in the control group. The mean (±SE) food preference scores for all foods combined in the FE group was 2.13 (±0.04) at baseline and 2.25 (±0.04) at follow-up. While a statistically significant increase in scores was observed in the FE group from baseline to follow-up, the magnitude of this increase was relatively small (5.6% relative difference).
Table 3.8 Mean food preference scores in children for all, familiar and novel foods

<table>
<thead>
<tr>
<th></th>
<th>Baseline Mean ± SD</th>
<th>Follow-up Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All foods</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE group</td>
<td>2.13±0.34</td>
<td>2.25±0.32</td>
</tr>
<tr>
<td>Control group</td>
<td>2.25±0.34</td>
<td>2.20±0.31</td>
</tr>
<tr>
<td><strong>Familiar foods</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE group</td>
<td>2.37±0.34</td>
<td>2.45±0.32</td>
</tr>
<tr>
<td>Control group</td>
<td>2.45±0.33</td>
<td>2.43±0.34</td>
</tr>
<tr>
<td><strong>Novel foods</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FE group</td>
<td>1.89±0.41</td>
<td>2.05±0.39</td>
</tr>
<tr>
<td>Control group</td>
<td>2.07±0.42</td>
<td>1.97±0.37</td>
</tr>
</tbody>
</table>

Mean scores presented for descriptive purposes only; Food preferences were scored on a three-point scale with 1=yucky, 2=just okay, 3=yummy, a higher score indicative of greater liking for a food. Scores for the three individual categories were obtained by summing the single food preference score for each food item within the category and dividing the sum by the total number of foods (20 food items in total with 10 familiar and 10 novel food items).
Table 3.9 Associations between group and food preference scores in children  
(Fe, N=102 and control, N=92)

<table>
<thead>
<tr>
<th></th>
<th>Standardized coefficients (β)</th>
<th>SE</th>
<th>95% CI</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All foods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>2.20</td>
<td>0.02</td>
<td>(2.17, 2.25)</td>
<td>107.93</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Group</td>
<td>-1.26</td>
<td>0.46</td>
<td>(-2.18, -0.34)</td>
<td>-2.71</td>
<td>0.007</td>
</tr>
<tr>
<td>Time</td>
<td>-0.55</td>
<td>0.34</td>
<td>(-1.22, 0.11)</td>
<td>-1.64</td>
<td>0.103</td>
</tr>
<tr>
<td>Group x Time</td>
<td>1.54</td>
<td>0.41</td>
<td>(0.72, 2.35)</td>
<td>3.73</td>
<td>0.0003</td>
</tr>
<tr>
<td><strong>Familiar foods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>2.42</td>
<td>0.02</td>
<td>(2.38, 2.46)</td>
<td>117.47</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Group</td>
<td>-0.75</td>
<td>0.47</td>
<td>(-1.68, 0.19)</td>
<td>-1.57</td>
<td>0.11</td>
</tr>
<tr>
<td>Time</td>
<td>-0.07</td>
<td>0.35</td>
<td>(-0.78, 0.63)</td>
<td>-0.21</td>
<td>0.83</td>
</tr>
<tr>
<td>Group x Time</td>
<td>0.78</td>
<td>0.43</td>
<td>(-0.07, 1.63)</td>
<td>1.79</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Novel foods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>1.99</td>
<td>0.02</td>
<td>(1.95, 2.04)</td>
<td>49.51</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Group</td>
<td>-1.77</td>
<td>0.56</td>
<td>(-2.89, -0.65)</td>
<td>-3.13</td>
<td>0.002</td>
</tr>
<tr>
<td>Time</td>
<td>-1.03</td>
<td>0.44</td>
<td>(-1.91, -0.16)</td>
<td>-2.34</td>
<td>0.02</td>
</tr>
<tr>
<td>Group x Time</td>
<td>2.29</td>
<td>0.53</td>
<td>(1.23, 3.36)</td>
<td>4.27</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Generalized mixed effect linear regression model with group time interaction; p value significant at <0.05;  
CI- confidence interval; SE- standard error  
Food preferences were scored on a three-point scale with 1=yucky, 2=just okay, 3=yummy, a higher score indicative of greater liking for a food. Scores for the three individual categories were obtained by summing the single food preference score for each food item within the category and dividing the sum by the total number of foods (20 food items in total with 10 familiar and 10 novel food items)
When the ten familiar foods were analyzed collectively, no significant group by time interaction (p=0.07) was observed. When the food preference scores were assessed for each of the individual familiar foods, a significant group by time interaction effect (p=0.03) was seen for cheddar cheese whereby preference scores increased in the FE group and decreased in the control group (Appendix F, Fig.1) A group by time interaction was also observed for chicken (p=0.004), reflecting the increase in food preference scores for chicken increased in the FE group and decreased in the control group (Appendix F, Fig.2).

When novel foods were analyzed collectively, a significant group by time interaction (p<0.0001) showed that the food preference scores significantly differed between the groups at follow-up, whereby food preference scores increased in the FE group and decreased in the control group. A comparison of baseline and follow-up scores in the FE group, for all novel foods combined, showed an 8.6% increase in scores at follow-up. When each of the novel test foods were analyzed individually, a group by time interaction was seen for swiss cheese (p=<0.0001), red potato (p=0.01), kefir (p=0.01), chickpeas (p=0.002) and falafel (p=0.04), indicating that the increase in food preference scores over time differed between the two groups. A significant increase in food preference scores was observed for the above foods in the FE group while the scores decreased in the control group, at follow-up. Interaction plots are presented in Appendix F (Fig.3, Fig.4, Fig.5, Fig.6, Fig.7).
3.7 Child Food Neophobia scores (parent-perceived)

At baseline, the prevalence of food neophobia (FNS score ≥ 35) was 22% in the FE group and 27% in the control group. At follow-up, the prevalence decreased to 14% in the FE group and remained at 25% in the control group. Parent-perceived child food neophobia scores are presented in Table 3.10. Associations between the group and food neophobia scores were assessed using mixed linear regression models and the standardized beta coefficients are shown in Table 3.11. The control group at baseline was the reference category. No group differences in mean scores were observed at baseline but lower mean (±SD) scores [26.9 ±(7.8)] over time were seen in the FE group. No significant group by time interaction was observed. While there was a decrease in the absolute mean scores for food neophobia [28.7 (±8.7) at baseline and 26.9 (±7.8) at follow-up] in the FE group (6.2% relative change in scores), this decrease was not significant compared to the control group (p=0.18).
### Table 3.10 Child food neophobia scores (CFNS-parent perceived)
(Fe, N=49 and control, N=65)

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline Mean ± SD</th>
<th>Follow-up Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>FE group</td>
<td>28.7 ± 8.7</td>
<td>26.9 ± 7.8</td>
</tr>
<tr>
<td>Control group</td>
<td>29.2 ± 8.0</td>
<td>28.9 ± 7.3</td>
</tr>
</tbody>
</table>

Mean scores presented for descriptive purposes only

### Table 3.11 Associations between group and child food neophobia scores
(Fe, N=49 and control, N=65)

<table>
<thead>
<tr>
<th></th>
<th>Standardized coefficients (β)</th>
<th>SE</th>
<th>95% CI</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>28.4</td>
<td>0.68</td>
<td>(27.1, 29.8)</td>
<td>41.47</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Group</td>
<td>-3.43</td>
<td>11.2</td>
<td>(-25.6, 18.7)</td>
<td>-0.31</td>
<td>0.76</td>
</tr>
<tr>
<td>Time</td>
<td>-2.09</td>
<td>5.66</td>
<td>(-13.3, 9.1)</td>
<td>-0.37</td>
<td>0.71</td>
</tr>
<tr>
<td>Group x Time</td>
<td>-9.42</td>
<td>7.09</td>
<td>(-23.4, 4.63)</td>
<td>-1.33</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Generalized mixed effect linear regression model with group time interaction; p value significant at <0.05; CI- confidence interval; SE-standard error
3.8 Teacher surveys

Nine teacher surveys were received from the FE group, yielding an 81% response rate. Eight teachers taught foods listed in package A, while three taught a combination of foods in package A and B. A list of foods introduced during the period of evaluation is provided in Table 3.12. Seven out of the nine teachers taught the program once a week using more than one recipe for each of the food introduced in the package. Two teachers taught the program once every two weeks. Teachers responded positively to the impact of the FE program on childrens’ willingness and interest to participate in the FE program, ease and clarity of instructions provided in the FE package, and confidence teaching the program were positive. A majority of the teachers strongly agreed that they would teach the program again and recommend the program to other teachers. Responses are depicted in Figure 3.1.
Table 3.12 Foods/recipes introduced to children who participated in the FE program

<table>
<thead>
<tr>
<th>Teacher (package)</th>
<th>Foods introduced in class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (A)</td>
<td>Apple, potato, bread, milk, cheese and eggs</td>
</tr>
<tr>
<td>2 (A+B)</td>
<td>Berries, potato, milk, pasta, bread, apple</td>
</tr>
<tr>
<td>3 (A)</td>
<td>Apple (apple cake), potato (baked fries), bread (bannock), milk (smoothie), cheese, egg (French toast), meat alternative (hummus)</td>
</tr>
<tr>
<td>4 (A)</td>
<td>Apple, potato, bread, pasta, cheese, eggs, milk, meat alternative (beans)</td>
</tr>
<tr>
<td>5 (A)</td>
<td>Apple, potato, bread, milk, cheese, eggs</td>
</tr>
<tr>
<td>6 (A +B)</td>
<td>Potato, bread (naan pizza), apple (apple sauce), cheese (quesadillas), milk (ice cream in a bag), berries (fruit salad)</td>
</tr>
<tr>
<td>7 (A+B)</td>
<td>Squash (pumpkin pie), apple (apple sauce), berries (blueberry tart), eggs (mayonnaise), milk (banana ice cream)</td>
</tr>
<tr>
<td>8 (A)</td>
<td>Apple, potato, bread, pasta, eggs, milk, meat alternative (beans)</td>
</tr>
<tr>
<td>9 (A)</td>
<td>Apple, potato, bread, meat alternative (beans), cheese</td>
</tr>
</tbody>
</table>
Overall, teachers responded positively about the program activities and individual components. All teachers found the mystery can activity the most helpful for introducing the foods. Six out of nine teachers (67%) provided positive feedback about the use of books and poems and songs to introduce the foods, while seven out of nine teachers found the cooking and tasting activities very enjoyable. Teachers found the extension activities (such as visit to a grocery store/farm) least helpful due to insufficient time for field trips during school year and the lack of parent volunteers to accompany children on field trips. One teacher also commented about the lack of availability of literary resources suggested by the program for each food. Parent link activities such as collector cards with recipes were identified as least helpful by one teacher, specifically, in classrooms where children had English as Second Language (ESL). All teachers were appreciative of the mini-grant available ($100) through the BCDA that helped offset the cost of procuring supplies and food to run the program.
When queried about the challenges in teaching the program, all teachers responded lack of time as one of their top challenge. Other challenges include lack of infrastructure (sufficient cooking facilities) within the school and volunteers to assist with running the activities. When asked about what would make the program better, five out of nine teachers suggested the need for

(a) updated manuals with newer recipes,
(b) online links to all materials and access to e-books
(c) associated videos for recipes
(d) addition of new book titles for introduction of foods

Teachers also responded positively when asked about childrens’ willingness to try new or familiar foods over the time the FE program was taught. Specific feedback is summarized in Table 3.13
“Children’s’ willingness to try new foods got better.”

“The last food we made was pasta- spaghetti with tomato sauce and all of the children in class tried it”.

“Most children were ‘eaters’ and a few were not, and it stayed that way throughout the program”.

“They were very excited to cook and try everything”.

“Most of the class was willing to try new foods, except for the exceptionally picky ones”.

“I think students who were a little hesitant to try became more open to trying new foods especially when they saw their peers trying new foods”.

“Willingness increased during the course of the program”.

“The foods weren’t weird or unusual and so it wasn’t scary for them to try”.

Table 3.13 Select responses of teachers to an open-ended question about children’s willingness to try novel or familiar foods over the time FE was taught
Teacher responses on the most significant changes noticed in children over the time FE program was taught are summarized in Table 3.14.

**Table 3.14 Teacher responses to an open-ended question about the most significant change in the children over the time FE was taught**

<table>
<thead>
<tr>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Learning new foods and food-based vocabulary.”</td>
</tr>
<tr>
<td>“Excitement about cooking and tasting”.</td>
</tr>
<tr>
<td>“Sharing about the different foods eaten in the family”.</td>
</tr>
<tr>
<td>“Enjoyment in preparing food and tasting increased every time”.</td>
</tr>
<tr>
<td>“How surprised they were when they actually enjoyed something that they didn’t like before”.</td>
</tr>
<tr>
<td>“They reported back to the class and talked about food when they made a recipe from the program at home”.</td>
</tr>
<tr>
<td>“The excitement knowing that we are going to cook that day”.</td>
</tr>
<tr>
<td>“Most students were already very willing and not sure if I saw any major change”.</td>
</tr>
</tbody>
</table>

**3.9 Parent surveys**

A subsample of sixty parents of children who had completed the FE group were randomly selected to complete an open-ended questionnaire about their experience and perspective of the program. Forty-one parent questionnaires were received from the FE group at the end of the program, of which 28 were complete. A majority (N=20, 73%) of parents responded that their children had shared the recipes and the food cards with the family and were excited to try new recipes at home.
When asked about their children’s willingness to try new or familiar foods over the time the FE program was taught, more than half of the parents (N=16, 57%) responded positively, while the remaining suggested no changes in willingness to try foods. Select parent responses, positive and negative are summarized in Table 3.15 below. However, when queried about changes in children’s diet over the time the program was taught, only 8 out of 28 parents reported positive changes to diet while 72% of parents reported no significant changes to their child’s diet. Select positive responses regarding change in diet are summarized in Table 3.16.
Table 3.15 Select parent responses to an open-ended question about the children’s willingness to try new or familiar foods over the time FE program was taught

<table>
<thead>
<tr>
<th>“More open to new foods.”</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Will try atleast one bite before dismissing it”.</td>
</tr>
<tr>
<td>“Sharing about the different foods eaten in the family”.</td>
</tr>
<tr>
<td>“More willing to try new foods, may be after seeing all his classmates trying”.</td>
</tr>
<tr>
<td>“I have definitely noticed a change. She is talking about wanting to try new things often since the start of the program”.</td>
</tr>
<tr>
<td>“He has indicated a positive attitude towards trying foods, but this has not translated to actually eating them”.</td>
</tr>
<tr>
<td>”Excited to make the recipes at home and liked almost all the recipes”.</td>
</tr>
<tr>
<td>“No changes really”</td>
</tr>
<tr>
<td>“No noticeable changes”</td>
</tr>
<tr>
<td>“My kids asks for new things when we go shopping, for example grape tomatoes. Before it was hard to get him to eat anything at all”.</td>
</tr>
<tr>
<td>“I am not sure the program introduced anything new (foods) that we hadn’t had before”</td>
</tr>
</tbody>
</table>
Table 3.16 Parent responses to an open-ended question on changes to diet in the children over the time FE was taught

<table>
<thead>
<tr>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>“She has eaten some things that I had never imagined she would, like homemade salsa”.</td>
</tr>
<tr>
<td>“He is more willing to try some fruits which he would never before, when I asked him to try. He would never give a chance but now it’s changed”.</td>
</tr>
<tr>
<td>“Showing interests in family food and different food groups”.</td>
</tr>
<tr>
<td>“Asked to eat an apple and has never liked them”.</td>
</tr>
</tbody>
</table>

When asked about the most significant change in the child over the time FE program was taught, a majority of parents (N=16, 57%) responded positively; increased willingness to try new foods was the most common response. Responses from select parents is highlighted below.

“*I think the biggest change is her being more open to trying new foods, like she suddenly realized there may be other foods out there that she might like and the only way to find out is to try it. It’s an obvious concept that we have been trying to teach her forever, but suddenly it clicked*”.

“She was very excited about most of the recipes in the program, even when it was Cheese, she like the marble cheese, which we never bought at home, I believe seeing her peers enjoy them really opened her up as well*.”
Three parents responded with additional comments about the FE program. Responses include

“I’m super glad we participated in the program. Sometimes kids need to hear it from others than just Mom and Dad. We try to eat healthy and balanced diets but with kids it’s such a struggle. So, I really appreciated all the things she picked up. Thanks for doing this”.

“Thanks for giving my child and myself a chance to participate in the program, because my child has a different approach to food ever since he started the program”.

“She has a baby brother who eats everything. She would never eat avocados before and they are her favorite food”.

3.10 Summary of results with reference to research hypotheses

Familiarity of novel or familiar foods

The results suggest that there is an increase in knowledge of foods over time in both groups. Knowledge of two test foods (cheddar cheese, cereal) increased in the FE group at follow-up, when compared to the control group.

Willingness to try foods (food preference scores)

Willingness to try (food preference) significantly increased for all foods combined in the FE group compared to the control group. Food preference scores for two familiar foods and five novel foods, significantly increased in the FE group compared to the control group, when analyzed individually. Food preference scores were higher in the FE group for cheddar cheese and chicken in the familiar foods’ category and for swiss cheese, red potato, kefir, chickpeas and falafel in the novel foods’ category.

Food neophobia scores

Parent-perceived food neophobia scores did not significantly change following the program in the FE group, compared to the control group. However, parents responded positively about changes observed in children with respect to willingness to try a variety of foods.

Parent and teacher experience with the program

Parents and teachers responded positively with respect to childrens’ willingness to participate in the program and try new and familiar foods within the school environment and at home. Less than one-third of parents reported positive changes to children’s diet suggesting that
willingness to try foods does not necessarily equate to changes in diet in this subsample.

**Barriers to teaching the program**

A majority of teachers found all the activities in FE program helpful and easy to implement. However, lack of ‘time’ and ‘volunteers’ were top barriers to offering the program on a yearly basis.
Chapter 4: Discussion

FE is a multi-component food experience program aimed to expose KG/Gr 1 children to a variety of familiar and novel foods within a classroom setting. Food preference has been consistently identified as one of the key determinants of healthy eating in young children (54, 104).

The current study investigated whether and how the program influenced familiarity, taste and willingness to taste such foods, in addition to food neophobia in KG/Gr 1 children. The study also explored experiences of teachers and parents with the program and changes observed with respect to children’s willingness to try new and familiar foods. The main findings of the study were that the FE program increased knowledge of two out of the twenty foods tested; cheddar cheese and cereal. Willingness to try familiar and new foods as measured by food preference scores increased in children in the FE group for seven of the twenty foods tested in this study. A decrease in the absolute mean food neophobia score was also observed in the FE group, however, this decrease was not significant when compared to the control group.

For the purpose of discussion, the main findings of the study in children will be commented on first, followed by a discussion on parent and teacher experiences of the program.

With respect to the demographic information collected as part of the parent questionnaires, there were no striking differences between the FE group and the control group, suggesting our efforts for matching the groups were effective. Similar parent and child characteristics were observed except for ethnicity as reported by parents. A significantly higher proportion of children in the control group reported to be from a ‘South Asian’ background. It is well known that ethnicity can be a predictor of knowledge, food preference and eating behavior (54). In the present study, as majority of the test foods were representative of “western” foods, it is possible that the familiarity and preference for such foods among the control group could
have been lower. However, this was not observed with the sample in this study. Food preference scores in children did not vary based on ethnicity in the FE group or the control group (data not shown). Furthermore, children whose parents identified themselves as “South Asian” and who did not know the names of certain foods in English language, were able to name them in the language spoken at home after checking with the interviewer. Such a response (name of food) was considered being familiar with the food and hence the outcomes were not adjusted for ethnicity or other demographic variables. Nevertheless, including a greater variety of ethnically diverse foods within the FE program may be beneficial.

4.1 Effects on childrens’ familiarity and taste with foods

One of the main research questions of the study was to investigate whether the FE program increased familiarity and willingness to taste of familiar and novel foods. The results of the study revealed change in familiarity for two of the twenty foods tested in the study.

With respect to the ten familiar foods tested, while there were significant differences with knowledge of four foods over time indicating an increase in familiarity in both groups, a significant group by time interaction for cheddar cheese and cereal showed that the increase in knowledge over time was group specific. Children in the FE group were more familiar with these two foods at follow-up compared to the control group. It is to be noted that despite a higher proportion of children in the control group being familiar with cereal at baseline, this proportion did not increase at follow-up. However, with cheddar cheese, the proportion of children familiar at baseline was comparable between the two study groups, yet, a significant group by time interaction was seen at follow-up, indicating increased familiarity in the FE group compared to the control group, at follow-up. Cheese is one of the eight foods in package A and cereal in package B that was introduced to the children in the FE group as part of the program and it is
possible that exposure to and cooking with these foods increased familiarity at follow-up. Changes with only two of the ten familiar foods could also be attributed to ceiling effects, where the ability for any intervention to increase familiarity of already familiar foods is minimal (104). Foods such as milk, eggs, pizza may have been already familiar to the children and it is unlikely to see an effect on knowledge at follow-up.

When questioned if children had tasted the familiar foods tested in the study, a time difference was observed for kiwi and a group difference was observed for tuna. A group by time interaction was seen for eggs, indicating more children had tasted eggs in the FE group compared to the control group, at follow-up. Again, it is to be noted that egg is one of the foods introduced in package A of the FE program and is likely an effect of exposure. More children reported to have tasted kiwi over time. While kiwi was not one of the foods introduced as part of the FE program, the increase in the proportion of children who had tasted kiwi at follow-up could be attributed to classrooms participating in the provincially run BC Fruit and Vegetable Nutritional Program (105). Supported by the Province of BC and Provincial Health Services Authority (PHSA), the program aims to increase childrens’ exposure to, and willingness to try a variety of fruits and vegetables at school. Teachers from two FE classrooms and two control classrooms reported participation in the program during the time of this evaluation study.

With the ten novel foods tested in the study, a significant increase in knowledge over time was observed for shrimp and cream of broccoli soup, suggesting increased familiarity in both groups. There was no quantitative evidence to suggest increase in familiarity of novel foods in the FE group at follow-up, in this study. While past studies have documented increased familiarity and intake of novel foods due to the likely presence of ceiling effects, such an effect was not observed in the current study (104).
A myriad of studies have been published in the last decade investigating the effectiveness of school-based interventions aimed at improving diet, however, few interventions have focused on evaluation of programs in similar age groups. Studies of nutrition education programs in a comparable age group support our finding of beneficial effects on nutrition-related outcomes.

In a study by Hammond et al (106), evaluating the impact of an early childhood nutrition education program on kindergarten students, children’s familiarity with introduced foods increased over time in the intervention group. Another pre-post experimental study in Turkey (107) measured children’s (5 years of age) nutrition knowledge, food consumption and anthropometric measurements prior to, immediately following and one year after completing a nutrition education program. The children in the intervention group were offered lessons in addition to the basic nutrition education as prescribed by the Ministry of Education, while the control group received only the basic education. The intervention was based on Piaget’s cognitive development theory and emphasized a child-centered approach to provide positive guidance and influence eating behaviour. At post-intervention and one year following the program, the authors found that education increased children’s knowledge of foods and the group’s food preferences changed positively. However, no significant differences were observed in the anthropometric measurements between the groups (107). Cason KL and colleagues (108) also reported similar findings based on a theory-based curriculum of 12 lessons offered to children every second week within a classroom setting. A pictorial assessment of knowledge, attitude and likes showed a significant improvement in food identification and recognition, and increased willingness to taste foods at post-intervention. However, this study did not use a control or comparison group. More recently, an evaluation of a quasi-experimental school-based nutrition education intervention in kindergarten classrooms in US schools (109) was conducted. Pre-to-post changes were assessed in nutrition knowledge, dietary consumption, and parent...
behaviours in 25 kindergarten intervention classrooms and post intervention changes were compared with control classrooms. The study showed improved knowledge of food groups in the intervention group compared to control. Kindergarten children had significant improvements in categorizing foods into their respective food groups and identifying healthy breakfast and snack options post-intervention (109). Findings from a systematic review (110) that evaluated different types of healthy eating interventions for 3-6-year-olds and included interventions from ten kindergarten classrooms showed an increase in nutrition related knowledge and increased consumption of fruit and vegetable among the children. The review concluded that the level of increase in food/nutrition related knowledge as one of the major effects of school-based educational interventions in children, and greater benefits are gained from multicomponent interventions, such as the FE program. However, a majority of the studies included in the systematic review lacked long-term follow-up evaluations and hence it was difficult to assess if any changes (knowledge and/or willingness) after intervention were sustainable over time. The current study was designed to assess change in knowledge and willingness to try new and familiar foods immediately after intervention in comparison with a control group, however, change in dietary consumption in children was not captured. The lack of dietary information, pre and post-intervention and lack of longer follow-up does not allow for conclusions regarding how change in knowledge might influence the childrens’ eating behaviour and sustained effects. It is to be noted here that the study protocol aimed to capture parent-reported dietary consumption in children pre/post, but efforts were suspended due to non-response from parents (14 out of 93 parents completed diet records).
4.2 Effects on willingness to try familiar and new foods (Food preference scores)

Children’s willingness to try familiar and new foods was measured using food preference scores. The results revealed no significant change in children’s food preference scores in the control group and a significant increase in scores in the FE group. While group differences were exhibited at baseline, with the control group having higher preference scores, no changes were observed in the control group at follow-up for scores of all foods combined. A similar trend was also observed for the familiar foods and novel foods, when analyzed separately.

Food preference scores for all familiar foods combined did not show any group differences although scores tended to decrease over time in the control group while scores increased modestly over time in the FE group. When ‘liking’ scores for each of the individual foods in the familiar category were examined, an increase in preference was observed for two foods; cheddar cheese and chicken. It is worth noting here that preference for cheddar cheese increased at follow-up in the FE group and could be attributed to the program, as it is one of the foods introduced in package A. However, chicken was not introduced in the program as part of package A or B.

In contrast to familiarity, willingness to try novel foods as measured by food preference scores were significantly higher in the FE group at follow-up, compared to the control group. When ‘liking’ scores for novel foods were examined individually, children in the FE group showed increased preference for five out of the ten foods. Change in scores over time was significantly higher in the FE group for swiss cheese, red potato, kefir, chickpeas and falafel. It must be noted that cheese is one of the food categories introduced as part of the program as are potato and chickpeas (as a meat alternative). Three out of nine teachers in the FE group chose to introduce beans (chickpeas) as a meat alternative and this could be the reason why preference for chickpeas was higher at follow-up. While there is no information on whether the children were
introduced/exposed to Swiss cheese or red potato (specifically) as part of the FE program, increased preference for such foods at follow-up may be attributed to exposure of the food category (such as liking/willing to try any kind of cheese). This finding suggests that foods that were directly introduced in the program, such as cheese and potato were more accepted/liked by the children and may fulfill one of the goals of the program. It is possible that the observed impact of the program would differ if the ten familiar and ten novel foods tested in the study included only those foods introduced in the FE program. The selection of test foods for the current study was determined through personal observation and dialogue with kindergarten children at the time of the pilot study. The foods were also selected to overlap partially with the foods introduced to children as part of the FE program. While the teachers are provided with a list of 8 foods per package (two foods from each food group) to be introduced to the children, the goal of the program is to expand children’s exposure and willingness to try beyond what is introduced. If the FE program was to have a meaningful impact on children’s eating behaviour, effects on foods outside of the program would be expected. There are limitations to focusing on ten ‘novel’ foods and ten ‘familiar foods for the study. Not all foods would have been familiar to all children and similarly, not all foods would have been novel in an ethnically diverse sample as in the current study. However, in an evaluation within limited time, this method of selecting the test foods was the most feasible.

Overall, food preference scores for novel foods increased with time, when compared to familiar foods, and the increase was more pronounced in the FE group compared to the control group. This finding is in contrast to an earlier study where there was no significant increase in stated willingness to eat (introduced or non-introduced in the program) for either of the groups (106). Willingness to taste novel foods in children following intervention such as taste/sensory education has also been examined in a number of studies. Most studies in the literature come
from older children and showed mixed results. Taste/sensory education in 7-11-year-old children increased willingness to taste novel food in a study from Korea (111). The study was designed to examine the effect of sensory education on knowledge and neophobia and changes were assessed with self-administered questionnaires pre-and-post intervention. Similar results were observed in 9-12-year-old children from the Netherlands and 8-11-year-old children in Finland. In the study from Netherlands (112), children were divided into an intervention and control group and received 10-12 taste lessons including cooking and tasting. Knowledge was assessed at baseline, four weeks and six months post intervention. The study found that knowledge in the intervention group increased and persisted at 6-month follow-up. Similar results were observed in the Finnish study (113) where children who received 10 sessions of “Classes du gout” lessons. The study found that those who received the lessons had tried a larger proportion of novel foods than at baseline. However, other studies showed no change in willingness to taste novel foods when compared to the control group, immediately after intervention and at follow-up (114,115).

Within the Canadian context, one popular initiative is the “Kids’ Shop Smart Tours” (KSST), a program developed by dietitians to promote healthy food choices. The program was designed to meet the learning outcomes of the Healthy Living and Career Exploration of the BC Ministry of Education and Alberta Education curriculum. Similar to the FE program, teachers were provided with grade specific materials and a teaching guide in the form of a kit. However, KSST also includes a supermarket trip facilitated by a dietitian. The main objectives of the program were to introduce Canada’s Food Guide to Healthy Eating, recognition of the four food groups and attitudes towards trying and eating new foods. The population targeted by the KSST program were elementary school children in kindergarten to grade 3. Research evaluating this program showed mixed results with no increase in children’s willingness to try new foods but an increase in knowledge of Canada’s Food Guide (116).
Nevertheless, findings from the current study show an increased willingness to try at least some (five) of the ten novel test foods in the FE group immediately after intervention, when compared to the control group. This may indicate reduced food neophobia. Whether this willingness to try novel foods has a sustained effect and influenced eating behaviour was not measured as part of the study, as mentioned earlier, and warrants further research.

4.3 Effect on parent-perceived food neophobia

While child reported food neophobia (increased willingness to try novel foods) was lower after the FE program, the same cannot be said about parent-perceived measures of food neophobia. This finding suggests a disagreement between the children’s willingness to try new foods vs parents’ perception. Food neophobia scores as reported by parents decreased in the FE group, however, the decrease did not reach significance when compared to the control group. While willingness to try novel foods may be seen as behavioural food neophobia, children’s food neophobia may be genetic trait (75). A short-term evaluation such as the current study may have been successful in changing behavioural neophobia but not necessarily trait neophobia as perceived by parents (117). In contrast, a study that measured food neophobia in children before and after taste education using the same scale showed a significant decrease in food neophobia with a more pronounced decrease in younger children. The study required both parents and children to complete the food neophobia scale. However, the correlation between parent and children’s measures was low and thus only parent perceived food neophobia scales were used in the analyzes, similar to the current study.

The lack of evidence around decreased food neophobia as perceived by parents may mean that any immediate observed changes (post-program) in willingness to try novel foods are still occurring within the school environment. It is possible that any changes observed within the
home environment takes more time and/or children may have had limited opportunities to try new foods at home during this evaluation study (118). A further possible explanation for the observed changes in willingness to try novel foods within the school environment is teacher modelling. The SCT suggests that teacher modelling would be an effective method to encourage food acceptance in young children. The current study did not examine teacher modelling and its role; however, earlier studies showed mixed results. A study conducted by Hendy et al (119) showed that teachers rated modelling as the most effective way to encourage children’s food acceptance. A follow-up study by the same research team also found that ‘enthusiastic’ teacher modelling could be effective and maintain food acceptance in young children, however, the effect was minimal with the addition of a competing peer model. One other possible explanation for this disagreement may be reflective of the different methods of data collection for parents and children. Parents completed the food neophobia scale at baseline and follow-up which measured the parent perception of child neophobia, whereas childrens’ willingness to try new foods was assessed using visual aids, which may have influenced children’s response. Use of similar data collection tools may have eliminated any bias due to visual aids in children.

4.4 Teacher and parent perspectives

Evidence from open-ended questionnaires from teachers showed that the program was positively received. The “mystery can” activity was the most popular with the teachers as it helped stimulate the childrens’ interest in foods. The activity allows for sensory exploration and non-taste familiarization of the food where the children touch, smell and listen to the sound of the food by shaking the can. Children also learned about the size, shape, color, texture etc. through this activity. Evidence suggests that sensory exploration and non-taste familiarization of foods increase willingness try foods them when they are offered to eat at a later time (120,121).
Almost all teachers responded that the program was well designed, with appropriate resources and instructions to prepare and deliver in a classroom setting. Not surprisingly, all teachers strongly agreed/agreed that they would recommend the program to other teachers. The FE program is designed to fulfill the BC curriculum needs in Physical and Health Education and many of the activities integrate subject matter into Mathematics, Arts Education, Language Arts among others. However, ‘lack of time’ was among the top barriers to running the program. Redesigning the content and expanding the activities to better integrate into the curriculum may be useful for the teachers. Despite commenting about the lack of time to fit the activities and volunteers to assist with the cooking activities, teachers agreed that the program was well received by the children, interested in participating, enjoyed the activities and were more open to trying new foods. Similar positive responses from open-ended surveys were also observed from parents of children who participated in the FE program. Although, parents did not report any dramatic positive changes to childrens’ diet after the program, they were appreciative of the willingness to try foods within the home environment. Overall, the program was well-received by both parents and teachers. This suggests that targeting young children with food education programs within the school setting that promote healthy eating habits may be a worthwhile endeavor for children, teachers and parents.
4.5 Strengths and limitations

There are a number of notable strengths to this study. The study was conducted in a natural setting, making it more generalizable and repeatable in other classrooms. A purposive sampling method was employed to examine the impact of the FE program on children’s willingness to try new and familiar foods; the study sampled 214 children and analyzed data from 194 of them from KG/Gr1 classes from two school districts; Vancouver School Board and Surrey School District. Inclusion of two school districts suggest that the study captured a wider spectrum of demographic characteristics in the Lower Mainland. The measures examined in the study, including familiarity of foods and preference scores were selected to answer the primary outcome using validated scales. The study also used objective child-centered methods to measure food knowledge and preferences. The study design, a quasi-experimental study with pre-post design, a theory-based program and statistical methods that accounted for the repeated measures are major strengths of the current study. Comparative design using a control group helped to increase confidence that any changes that occur naturally (maturation) with respect to food behaviour was not falsely attributed to the FE program. The use of open-ended questionnaires to capture teacher and parent perspectives strengthened the evaluation. The responses from the parent and teacher surveys will be particularly useful in reporting back to the BCDA about the experiences of stakeholders, facilitators and barriers to program implementation and program sustainability.

There are, however, some shortcomings to this study that deserve consideration. The study was not designed to be a randomized, controlled trial (RCT) and hence has some limitations in the extent to which causality can be attributed to the FE program. A RCT is recommended in the future to infer causality. Teachers also (n=7 in FE group and n=6 in control group) reported to have been teaching ‘other’ healthy eating programs, apart from FE. This may
have been a major confounder in this study. It is unclear to what extent knowledge gained from other programs may have had an impact on the outcome of this evaluation study, although participation in such programs was similar in the control and FE group.

School and teachers’ enthusiasm for participating in the FE groups could have resulted in potential bias in responses. Similarly, only parents from the FE group were invited to participate in the open-ended survey. Parents with more positive comments may be more likely to participate, resulting in response bias. The control group in this study was predominantly recruited in year 2 due to recruitment barriers/difficulty in year 1, it is unclear how this may impact results. Food preference scores tended to be skewed towards higher scores in the control group at baseline, suggesting a ceiling effect whereby there is little room for improvement at follow-up which may overestimate the impact of the program.

Although, the assessments were five months apart, children may have been able to recall the names of foods shown at the pretest and thereby exhibit an inflated increased familiarity with foods at follow-up. However, the cognitive ability to memorize and recall names of foods would be similar for both the groups and hence this likely had a minimal impact on the study results. The use of food photographs in this evaluation also reflects a limitation of the study. For some foods, the visual representations may have not been as real as what children are exposed to, which may have influenced the knowledge and willingness to try the test foods. While the current study addressed only willingness to try the test foods, use of ‘real’ food was logistically impossible due to the in-class assessments. Another limitation is the relatively short time-frame (5 months) for the evaluation. It is possible that with a delayed follow-up, some of the changes might dissipate over time. Follow-up measurements to evaluate long term changes are necessary to determine if the program effects are sustained.
Dietary changes measured by food consumption were not captured in the current study and whether the willingness to try novel foods translated into behaviour change remains unknown. Parent participation in the dietary assessments that were part of the original protocol was low. However, since ‘liking’ is one of the key determinants of eating behaviour and consumption (54), it is likely that increase in consumption of healthy (variety and quality) foods would have been associated with the program. Conversely, children were keen to participate in the in-class assessments which suggests future studies should consider quick and easy tools to measure dietary intake in young children. Children’s eating behaviour may be influenced by likes and dislikes (preferences) of the parents. Whether parents had food neophobia, parental attitudes towards food and nutrition and its effect on their children was not captured in the study. Furthermore, the researchers did not observe the teachers while offering the program and so the study did not capture information on the number of children who actually tasted the foods in the classroom and, the effect of teacher modelling and/or peer modelling and its role in encouraging children to try new foods. The study also did not account for the heterogeneity of how the program was offered. Teacher surveys showed that the program was delivered in different ways with varying number of foods/recipes introduced and varying time frame. The interpretive coding of responses from the open-ended surveys may also have led to potential bias.

4.6 Implications for practice

Findings from this study contribute to the understanding of school-based interventions where food-related activities are used to enhance food experience in children. Childhood represents an important period to expose children to new foods and positively shape eating behaviours. While multi-component programs such as the FE that include food exposure, cooking, tasting and literary resources can be useful, barriers exist at the implementation level, as
shown in the current study. Enjoyment around food activities can help build a positive relationship with food before unhealthy habits are established. Teacher surveys showed that the social environment within the classroom setting increased willingness to try new foods. Evidence from Birch and colleagues suggest that social environment may have a key role in shaping healthy eating behaviour in young children (122). Nevertheless, the link between increased willingness to try new foods and dietary intake was not established in this study. While change in dietary intake is not the goal of the FE program, understanding its impact on dietary intake over time help encourage participation of teachers and parents. Future studies would benefit from longer longitudinal designs to assess the impact of FE.

4.7 Suggested recommendations for FE

The increased demands on teachers’ time must be taken into consideration in developing future activities within the program. Activities within the program may be redesigned and expanded to adequately fit the new BC curriculum and encourage use of food as a tool to teach other subjects within the curriculum. A more prescriptive approach to FE would help evaluate the program and thereby facilitate impact on willingness to try foods in children. However, it is likely that a prescriptive approach may also discourage uptake of the program by the teachers, as the flexible nature of FE is an attribute of the program. Given the multicultural nature of schools within Lower Mainland in BC, it is suggested that the program includes a variety of ethnic foods including traditional recipes (teachers may be able to choose from a range of foods based on the ethnic composition of the classrooms) that are representative of the different ethnicities. Parent link activities may also be expanded to involve parents in the program and to provide them with a better understanding of food education in the classroom, including parent newsletters, interactive take home-activities and resources translated in commonly spoken languages at home.
4.8 Conclusion

The study evaluated the impact of a classroom-based food experience program using a rigorous study design (quasi-experimental with control group). The findings from the study show limited quantitative evidence to demonstrate increase in knowledge and willingness to try new foods among KG/Gr1 age children using the FE program within the classroom setting. However, parents and teachers reported positive experiences with the food education program. This suggests that while schools may be a promising venue for addressing picky eating and positively influencing eating behaviour in young children, there are limitations associated with measuring the effectiveness of the FE program due to the heterogeneity of the program. A more prescriptive program may be beneficial for future evaluations to assess the program’s impact. Addressing barriers to successful implementation of programs within the school setting such as lack of time, volunteers and infrastructure may also help encourage wider uptake of such programs.
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Appendices

Appendix A- Recruitment letters to Schools

Appendix A.1 Recruitment letter to schools offering FE

Appendix A.2 Recruitment letter to schools offering FE and/or control classrooms
Appendix A.1

The Administrator/Principal

Dear Administrator

We are excited to let you know that we are conducting an evaluation of Food Explorers, the nutrition education program your KG and/or grade 1 teacher is planning on teaching during this school year. I am writing to ask your permission to contact the teachers to participate in this evaluation.

In the course of this evaluation, with your permission, we will send teachers email reminders and contact them as they go through the program to collect the following.

- Parent consent form
- Surveys for parents (to be completed at the beginning and end of the program)
- Surveys for teachers (online, to be completed at the end of the program)

We will be conducting short assessment of children’s food choices at the beginning and end of the program during class time. The classroom assessment will take only about 10 minutes per student and will be set-up to minimize disruption. The collective activities will take about 40 minutes.

The data collected will help us assess the changes in the food choices that students are making after completing Food Explorers. Researchers from the University of British Columbia are assisting us with the survey design and analysis. Data will only be reported at the aggregate level and no individual student, parent, teacher, or school will be identifiable.

As a token of appreciation for your participation in this project, teachers will receive a $100 mini-food grant for use in the classroom when teaching Food Explorers.

We hope you will give us permission to conduct this evaluation. If you choose to consent, kindly email names and contact details of KG and Grade 1 teachers to Gaya Murthy.

Thank you in advance for your support.

Yours sincerely,

Sydney Massey, MPH, RD
Director of Nutrition Education

BC Dairy Association
Appendix A.2

The Administrator/Principal

Dear Administrator

We are excited to let you know that we are conducting an evaluation of *Food Explorers*, the nutrition education program that is offered in KG and/or grade 1 classrooms across BC through funds and curriculum supported by the BC Dairy Association. Your KG/Grade 1 teacher may/may not be planning on teaching this program during the upcoming school year. I am writing to ask your permission to contact the teachers to participate in this evaluation to be part of the intervention group (those teaching Food Explorers) or control group (those who will not be teaching Food Explorers).

In the course of this evaluation, with your permission, we will send teachers email reminders and contact them as they go through the program to collect the following.

- Parent consent form
- Surveys for parents (to be completed at the beginning and end of the program)
- Surveys for teachers (online, to be completed at the end of the program)

We will be conducting short assessment of children’s food choices at the beginning and end of the program during class time. The classroom assessment will take only about 10 minutes per student and will be set-up to minimize disruption. The collective activities will take about 40 minutes.

The data collected will help us assess the changes in the food choices that students are making after completing *Food Explorers*. Researchers from the University of British Columbia are assisting us with the survey design and analysis. Data will only be reported at the aggregate level and no individual student, parent, teacher, or school will be identifiable.

As a token of appreciation for your participation in this project, teachers will receive a $100 mini-food grant for use in the classroom when teaching *Food Explorers*. If you consent to be part of the control group, teachers will receive $100 to be used for classroom resources.

We hope you will give us permission to conduct this evaluation. If you choose to consent, kindly email names and contact details of KG and Grade 1 teachers to Gaya Murthy.

Thank you in advance for your support.

Yours sincerely,

[Signature]

Sydney Massey, MPH, RD
Director of Nutrition Education
Appendix B- Parent recruitment letters/Consent forms

Appendix B.1 Teacher consent form

Appendix B.2 Parent recruitment letter

Appendix B.3 Eligibility screener for parents

Appendix B.4 Parent consent form
Appendix B.1

TEACHER CONSENT FORM – 1 YEAR PROSPECTIVE STUDY

Principal Investigator:
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Co-Investigators:
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Sponsor:
BC Dairy Association, Dairy Industry Research and Education Committee

Purpose:
This study is conducted by the University of British Columbia. The overall goal of our research is to understand the impact of a nutrition education program that is currently taught in a number of schools in BC (called Food Explorers) on students’ eating habits. In addition, we want to examine what factors of the program are helpful and which are not. To reach our goal we are studying children who are in classrooms where the Food Explorers program is taught (intervention) and children in classrooms where it is not (control group).

Study Procedures:
The intervention group was chosen at random from teachers who have completed training to teach the Food Explorers program. The control group was chosen at random from teachers of kindergarten and grade 1 classrooms in the same school district. The study procedures are the same for each group.

440 kindergarten and grade 1 students from participating districts and their teacher will be invited to participate in this study, which spans over 1 school year. You will not be asked to recruit participants we only ask your assistance with notifying us when children return consent forms. Children who participate in the study will complete a brief assessment of food preferences which takes about 10 minutes to complete. Children will be shown photographs of foods and asked if they know what the food is and how they feel about it (yummy, yucky, just okay). Study staff will lead the assessment, we ask your help in scheduling the assessment and introducing the staff to the children. These activities will take about 30 minutes of your time.

You will also be asked to complete a few demographic questions and other aspects of the classroom environment via online questionnaire. The sensitive demographic questions we collect is used in our analyses and important to describe who participated in our study. You do not have to answer any questions that you do not feel comfortable answering. After most of the school year has been completed (~7 months after the first measures), you will be asked to help us schedule the food preference assessment again as we are interested to see if childrens’ habits change over this period of time. This will take about 10 minutes of your time.

If you are part of the intervention group you may also be invited to participate in a 30-45 minute online survey when most of the school year has been completed. You are not obligated to participate in this part
of the study as only 40 teachers will be invited to take part in these surveys. The purpose of the survey is to discuss your experience with the Food Explorers program. During the survey, you do not have to answer any questions that you do not feel comfortable answering.

**Study Results:**
Group level data will be shared with the sponsor. If you participate in the additional survey, individual data that is identified by a code number (never by name) will be shared with the sponsor. The results of this study may be published in academic journal articles.

**Study Participants Criteria:**
To be eligible to participate, you must be the full-time teacher of a kindergarten or grade 1 classroom and meet the eligibility criteria. Teachers are eligible to participate if they teach a kindergarten or grade 1 student in a public elementary school in British Columbia. You must be willing to start the Food Explorers program in Fall 2017 (as soon as you receive the mini-grant). You must have access to the internet to participate. Please provide your e-mail on the last page of this form. A link to the study questions will be e-mailed to you. You must be proficient in English to participate.

**Voluntary Participation:**
Your participation in this study is entirely voluntary and you may refuse to participate. Further, you may terminate filling out the questionnaire at any time without giving a reason. There are no penalties for not participating or withdrawing from the study.

**Potential Risks:**
There are no known risks from participating in this study.

**Confidentiality:**
All data, will be identified only by a code number and will be kept on a secure password protected web server which will only be accessed by the research staff. The data will be kept as long as required by law. Once the data are no longer needed, they will be permanently erased. All data will be erased/deleted five years after the last study results have been published. Any reports of the completed study will present only group data so you will never be identified by name and your data will remain private at all times. All survey data will be collected on a secure web server and all data transfers will occur using a secure connection to maintain the confidentiality of your data at all times.

**Remuneration/Compensation:**
If you participate in the study as part of the intervention group, you will receive a mini food grant of $100 to support teaching the Food Explorers program without needing to apply for a BC Dairy Association mini food grant. Teachers in the control group will also receive $100 to support purchase of classroom resources. Funds will be given after this form has been completed.

**Contact Information:**
If you have any questions or desire further information with respect to this study, you may contact a member of our research staff at [contact information withheld].

**Contact for Concerns about the Rights of Research Subjects:**
If you have any concerns or complaints about your rights as a research participant and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the University of British Columbia Office of Research Ethics by e-mail at RSIL@ors.ubc.ca or by phone at 604-822-8598 (Toll Free: 1-877-822-8598).
Consent:

- I have read and understood the study information and consent form.
- I have had sufficient time to consider the information provided and to ask for advice if necessary.
- I understand that my participation is entirely voluntary.
- I am completely free to refuse to participate or withdraw from the study at any time.
- I have been told that I will receive a dated and signed copy of this form.

My signature below indicates that I have received a signed and dated copy of this consent form for my own records.

I consent to participate in the study.

________________________
Name and Signature of Teacher

Email and Phone Number of Teacher (for study communication purposes only)
Appendix B.2

Dear Parent,

We are excited to let you know that we are conducting an evaluation of *Food Explorers*, a nutrition education program that is taught in schools throughout BC. The goal of the program is to increase children’s willingness to try new foods and improve their dietary habits. I am writing to invite your son/daughter to participate in this evaluation.

We are studying children who are in classrooms where the Food Explorers program is taught (intervention) and children in classrooms where it is not (control group). Your child may be in the intervention or control group depending on whether the Food Explorers program is taught in their class. The study procedures are the same for each group. In the course of this evaluation, with your permission, we will send you email reminders and contact you as you go through the program to collect the following:

- Surveys for parents (to be completed at the beginning and end of the program)
- A 24-hour food diary over three days (to be completed at the beginning and end of the program)

We also will be conducting a short assessment of food choices at the beginning and end of the program during class time. The classroom assessment will take only about 10 minutes per student and will be set-up to minimize disruption. The surveys and food diary will only require about 40 minutes.

The data collected will help us assess the changes in the food choices that children are making after completing *Food Explorers* relative to students who do not participate in *Food Explorers*. Data will only be reported at the group level and no individual student, parent, teacher, or school will be identifiable.

We highly value your feedback. Participation in the evaluation is entirely voluntary. In order to determine your eligibility to participate in the study, please complete the enclosed Eligibility Screener. If you are eligible and choose to participate in this evaluation, we would appreciate it very much if you would complete the enclosed Consent Form and return it to us as soon as possible, by FAX (604-822-4994), by mailing it to us, or by returning it to the classroom with your child.

As a token of appreciation for your participation in this project, you will receive $25 after you provide consent. You will also receive an entry to win 1 of 2 iPads (each worth approximately $600). The winners will be chosen randomly at the completion of the study. You will be entered into the draw regardless of participation in the study.

Thank you in advance for your support.

Yours sincerely,
Appendix B.3

Eligibility Screener

Dear Parent,

We are excited that you are interested in participating in our evaluation of Food Explorers, a nutrition education program that is taught in schools throughout BC.

To participate we need your child to have certain qualities that will help us study our evaluations’ outcome. Please review the questions below. You will be entered into the draw for the iPads regardless of your answers and thus, we ask everyone to return the recruitment package.

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Do you plan to change schools during the school year?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Does your child attend a Francophone, First Nations or distance education school?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Does your child have a disability or health condition that influences diet? (e.g. Celiac disease)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you answer ‘yes’ to any of the questions, we regret that you are not eligible to participate. If you answer ‘no’ to all of the questions, you are eligible to participate. Please read the enclosed consent form to decide whether to consent or decline to participate.
Appendix B.4

PARENT CONSENT FORM – 1 YEAR PROSPECTIVE STUDY

Principal Investigator:
Dr. Rachel Murphy, School of Population and Public Health, University of British Columbia.

Co-Investigators:
Dr. Louise Mâsse, School of Population and Public Health, University of British Columbia.

Sponsor:
BC Dairy Association, Dairy Industry Research and Education Committee

Purpose:
This study is conducted by the University of British Columbia. The overall goal of our research is to understand the impact of a nutrition education program that is currently taught in a number of schools in BC (called Food Explorers) on students’ eating habits. In addition, we want to examine what factors of the program are helpful and which are not. To reach our goal we are studying children who are in classrooms where the Food Explorers program is taught (intervention) and children in classrooms where it is not (control group).

Study Procedures:
The intervention group was chosen at random from classrooms where the Food Explorers program is already taught. The control group was chosen at random from classrooms in the same school district that do not currently teach the Food Explorers program. Your child may be in the intervention or control group depending on whether the Food Explorers program is taught in their class. The study procedures are the same for each group.

440 kindergarten and grade 1 students from participating districts and their teacher will be invited to participate in this study, which spans over 1 school year. At the start of the study, your child will be asked to complete a brief assessment of food preferences which takes about 10 minutes to complete. Your child will be shown photographs of foods and asked if they know what the food is and how they feel about it (yummy, yucky, just okay). The assessment will be completed at school. You will be asked to complete a questionnaire about your child’s eating habits. This will take about 10 minutes to complete. To measure your child’s dietary habits, you will complete a 24-hour food diary over three days which will be collected online. This will take about 30 minutes to complete.

You will also be asked to complete a few demographic questions and other aspects of the family environment via online or paper questionnaire. The sensitive demographic questions we collect is used in our analyses and important to describe who participated in our study. You and your child do not have to answer any questions that you do not feel comfortable answering. After your child has completed most of the school year (~7 months after the first measures), your child will be asked to complete the assessment again and you will be asked to complete the questionnaire again as we are interested to see if your child’s habits change over this period of time.
If your child is in the intervention group you may also be invited to participate in a 30-45 minute online survey when your child has completed most of the school year. You are not obligated to participate in this part of the study as only 40 families will be invited to take part in these surveys. The purpose of the survey is to discuss your child’s experience with the Food Explorers program. During the survey, you do not have to answer any questions that you do not feel comfortable answering.

**Study Results:**
Group level data will be shared with the sponsor. If you participate in the additional survey, individual data that is identified by a code number (never by name) will be shared with the sponsor. The results of this study may be published in academic journal articles.

**Study Participants Criteria:**
To be eligible to participate, you must be the primary caregiver or parent of child who is in kindergarten or grade 1 and meets the eligibility criteria that was asked about in the enclosed Eligibility Screener. Children are eligible to participate if they are a kindergarten or grade 1 student in a public elementary school in British Columbia. Please provide your e-mail on the last page of this form so researchers can send you study reminders and questionnaires. Both children and parents need to be proficient in English to participate.

**Voluntary Participation:**
Your participation in this study is entirely voluntary and you may refuse to participate. Further, you may terminate filling out the questionnaires at any time without giving a reason. There are no penalties for not participating or withdrawing from the study.

**Potential Risks:**
There are no known risks from participating in this study.

**Confidentiality:**
All data will be identified only by a code number and will be kept on a secure password protected web server which will only be accessed by the research staff. The data will be kept as long as required by law. Once the data are no longer needed, they will be permanently erased. All data will be erased/deleted five years after the last study results have been published. Any reports of the completed study will present only group data so you will never be identified by name and your data will remain private at all times. All survey data will be collected on a secure web server and all data transfers will occur using a secure connection to maintain the confidentiality of your data at all times.

**Remuneration/Compensation:**
You will receive $25 for completing the questionnaires. You will also be entered in a draw to receive 1 of 2 iPads valued at $600 each after you complete the second questionnaire. You will be entered into the draw regardless of participation in the study. There will be a total of 2 draws and you will have about a 1 in 350 chance of winning.

**Contact Information:**
If you have any questions or desire further information with respect to this study, you may contact a member of our research staff at [604-875-2000 ext 5563]

**Contact for Concerns about the Rights of Research Subjects:**
If you have any concerns or complaints about your rights as a research participant and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the University of British
Columbia Office of Research Ethics by e-mail at RSIL@ors.ubc.ca or by phone at 604-822-8598 (Toll Free: 1-877-822-8598).

Parent Consent:
• I have read and understood the study information and consent form.
• I have had sufficient time to consider the information provided and to ask for advice if necessary.
• I understand that my participation as well as that of my son/daughter are entirely voluntary.
• We are completely free to refuse to participate or withdraw from the study at any time without changing the quality of care that we receive in any way.
• I have been told that I will receive a dated and signed copy of this form.

My signature below indicates that I have received a signed and dated copy of this consent form for my own records.

I consent to my son/daughter’s participation in the study.

______________________________________________
Child’s name

I consent to participate in the study.

_______________________________________________
Name and Signature of Parent

________________________________________
Email and Phone Number of Parent (for study communication purposes only)
Appendix C- In-class child assessment forms
1. I want you to tell me what this food is. (Follow-up: What type of _____________ is this?)

Show in the following order:

<table>
<thead>
<tr>
<th>Food photograph</th>
<th>Child able to name the food (if no, experimenter provides name.)</th>
<th>2. Have you tasted (name of food) (if unsure, state the name of the food &amp; repeat question)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato (white)</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Pumpernickel bread</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Kiwi</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Swiss cheese</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Cereal (Shreddies)</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Shrimp</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Potato (red)</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Oatmeal</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Cream of broccoli soup</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Milk</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Cheddar cheese</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Wild rice</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Egg</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Kefir</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Tuna (top down)</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Chickpeas</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Pizza</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Chicken (leg)</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
<tr>
<td>Falafel</td>
<td>Yes ☐ No ☐</td>
<td>Yes ☐ No ☐ n/a</td>
</tr>
</tbody>
</table>

# of photographs shown until saturation:__________________________

Child refused to answer for:

1. ______________________  2. ______________________  3. ______________________
2. Now, I want you to point to the face that you would make when eating:

<table>
<thead>
<tr>
<th>Food photograph</th>
<th>Child points to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato (white)</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Pumpernickel bread</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Kiwi</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Swiss cheese</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Cereal (Shreddies)</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Shrimp</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Potato (red)</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Oatmeal</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Cream of broccoli soup</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Milk</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Cheddar cheese</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Wild rice</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Egg</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Kefir</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Tuna (top down)</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Chickpeas</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>THIS Pizza</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Chicken (leg)</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
<tr>
<td>Falafel</td>
<td>Yummy face ☐  Just okay face ☐  Yucky face ☐</td>
</tr>
</tbody>
</table>

# of photographs shown until saturation: _____________

Child refused to answer for:

1. ______________________  2. ______________________  3. ______________________
Appendix D- Parent /teacher questionnaires

Appendix D.1 Teacher demographic survey

Appendix D.2 Parent demographic survey

Appendix D.3 Food neophobia and pickiness scale
Appendix D.1

Paper/Online-Survey (on UBC Fluidsurveys) : Teachers Demographics

The following questionnaires ask about yourself. Please choose the best answer to each question.

1. How old are you?

2. What is your gender?
   1. Male
   2. Female

3. You may belong to one or more racial or cultural group on the following list. Mark up to 4 responses that apply. Are you…?
   1. White
   2. South Asian (e.g., East Indian, Pakistani, Sri Lankan)
   3. Chinese
   4. Black
   5. Filipino
   6. Latin American
   7. Arab
   8. Southeast Asian (e.g. Vietnamese, Cambodian, Malaysian, Laotian)
   9. West Asian (e.g., Iranian, Afghan)
   10. Korean
   11. Japanese
   12. Other - Specify

4. How many years have you been employed as a teacher?

5. How many years have you taught the Food Explorer’s program?

6. Besides the Food Explorer’s program do you teach nutrition in your classroom? If yes, please specify (e.g. name of program, activities)

7. How many students are in your classroom?

Date Completed:

Subject ID:
Appendix D.2

Paper/Online-Survey (UBC Fluid surveys)

Parent Demographics

The following questionnaires ask about yourself and your son/daughter who is part of this study. Please choose the best answer to each question.

1. How old are you?

2. How old is your son/daughter who is in the study?

3. What is your gender?
   1. Male
   2. Female

4. What is the gender of your child?
   1. Male
   2. Female

5. What is your marital status? Are you…?
   1. Married
   2. Living common-law
   3. Widowed
   4. Divorced
   5. Separated
   6. Single, never married

6. Besides yourself, how many people who live with you are 18 years or older?

7. How many people who live with you are under age 18?

8. What is the highest grade or year of school you completed?
   1. Less than high school diploma or equivalent
   2. High school diploma or high school equivalency certificate
   3. Trade certificate or diploma
   4. College, CEGEP or other non-university certificate or diploma (other than trades certificates or diplomas)
   5. University certificate or diploma below the bachelor’s level
   6. Bachelor’s degree (e.g. B.A., B.Sc., LL.B.)
   7. University certificate, diploma or degree above the bachelor’s level
9. You may belong to one or more racial or cultural group on the following list. Mark **up to 4 responses that apply**. Are you…?

1. White
2. South Asian (e.g., East Indian, Pakistani, Sri Lankan)
3. Chinese
4. Black
5. Filipino
6. Latin American
7. Arab
8. Southeast Asian (e.g. Vietnamese, Cambodian, Malaysian, Laotian)
9. West Asian (e.g., Iranian, Afghan)
10. Korean
11. Japanese
12. Other - Specify

10. Can you estimate in which of the following groups your household income falls? Was the total household income during the year ending December 31, 2015?

Income can come from various sources such as work, investments, pensions or government. Examples include Employment Insurance, Social Assistance, child Tax Benefit and other income such as child support, spousal support (alimony) and rental income

1. Less than $10,000
2. $10,000 to less than $50,000
3. $50,000 to less than $100,000
4. $100,000 to less than $150,000
5. $150,000 and over
6. Don’t know

11. Does your child follow a special diet (e.g. vegetarian, Halal, milk allergy)?

Date Completed:

Subject ID:
Appendix D.3

Paper/Online survey (UBC Fluid surveys)
Food Neophobia and pickiness

Please mark the number that represents how you feel about the following statements

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>My child does not trust new foods</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>If my child doesn’t know what’s in a food s/he won’t try it</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>My child is afraid to eat things s/he has never had before</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>My child will eat almost anything</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>My child is very particular about the foods s/he will eat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>My child is constantly sampling new and different foods</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>My child’s diet consists of only a few foods</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>My child is unwilling to eat many of the foods that our family eats at mealtimes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>My child is fussy or picky about what she/he eats</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E- Open-ended questionnaires

Appendix E.1 Teacher questionnaires FE group

Appendix E.2 Parent questionnaires FE group
Appendix E.1

Online-Survey (UBC Fluid surveys/Qualtrics) : Intervention Teachers

The purpose of this survey is to understand your experience teaching the Food Explorers Program. We want to discover what worked and did not work with the Program for you and the children you taught.

Which Food Explorers’ Package did you teach?  
A  [ ]  B  [ ]

What foods did you teach?

Over what period of time did you teach the program? (e.g. one food per month, all foods in one month)

The Food Explorers program includes a variety of activities, including:

1. Introductory Activity like using the Mystery Can or playing Who Am I?
2. Discussion
3. Using books, poems or songs
4. Preparing recipes and tasting the food
5. Keeping a Food Explorers Journal
6. Extension activities (visiting a farm, grocery store, growing plants, etc)

Thinking about these activities:

1. What activities were the most helpful for teaching the program?
2. What activities were the least helpful for teaching the program?
3. What were some of the challenges in teaching the program?
4. What would make the Food Explorers program better?
5. How would you describe the children’s willingness to try new or familiar foods?
6. What happened to children’s willingness to try new or familiar foods over the time the Food Explorer’s Program was taught?
7. What was the most significant change in the children over the time the Food Explorer’s Program was taught?
If you have additional comments about the Food Explorers Program, please share below.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The program instructions were clear</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>2. The activities were easy to complete in the classroom</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>3. Children wanted to participate in the program</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>4. I felt confident teaching the program activities</td>
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<td>5. The program helped children try new foods</td>
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<tr>
<td>6. I would teach the program again</td>
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<td>7. I would recommend the program to other teachers</td>
<td>○</td>
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</table>

Date Completed:

Subject ID:
Appendix E.2

Online-Survey (UBC Fluid surveys/Qualtrics): Intervention Parents

The purpose of this survey is to understand you and your child’s experience with the Food Explorer’s Program. We want to discover changes (good and bad) in your child’s dietary habits and behavior during the time the Food Explorer’s Program was taught.

1. How would you describe your child’s willingness to try new or familiar foods?

2. What change(s) have you seen in your child’s willingness to try new or familiar foods over the time the Food Explorer’s Program was taught?

3. How would you describe your child’s diet? Many different foods? Few foods?

4. What changes have you seen in your child’s diet over the time the Food Explorer’s Program was taught?

5. What was the most significant change in your child over the time the Food Explorer’s Program was taught?

6. What did your child share with you (or your family) from the Food Explorers Program?

7. If you have additional comments about the Food Explorers Program, please share below.

Date Completed:

Subject ID:
Appendix F- Food preference scores group by time interaction plots
Fig. 1 Food preference scores- group by time interaction plot for Cheddar cheese

Fig. 2 Food preference scores- group by time interaction plot for Chicken
Fig. 3 Food preference scores- group by time interaction plot for Swiss cheese

Fig. 4 Food preference scores- group by time interaction plot for Potato, red
Fig. 5 Food preference scores- group by time interaction plot for Kefir

Fig. 6 Food preference scores- group by time interaction plot for Chickpeas
Fig. 7 Food preference scores- group by time interaction plot for Falafel