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Mount Saint Vincent University
Department of Applied Human Nutrition

**Childhood obesity in the family environment:
Family rules and the diet quality of New Brunswick school children**

By
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A Thesis
Submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Applied Human Nutrition

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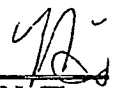

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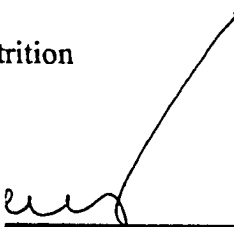
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Abstract

Background: The incidence and prevalence of obesity are increasing among Canadian children. The loss of health, reduction in quality of life, and health care expenditures associated with obesity are perpetuated into the future since obese children are likely to become obese adults. Though obesity is partially heritable, environmental risk factors contribute significantly to the etiology of this condition. Many of these modifiable risk factors for childhood obesity originate within the family environment.

Research Objectives: The purpose of this research was to explore and quantify modifiable risk factors for childhood obesity that exist within the family environment. These risk factors included diet quality, family rules, and food procurement at school.

Methods: A random sample of 250 families with children in grades 4 and 5 in District 18 in New Brunswick were sent questionnaires in the mail. The Questionnaire for Parents sought information on food procurement at school and family rules surrounding dietary independence, child-feeding practices and family meals. The Questionnaire for Children was a food frequency questionnaire validated for use with children of this age that had been previously administered in other provinces, using *Canada's Food Guide for Healthy Eating* as the standard of comparison. Descriptive and inferential statistics were used to describe the results of these surveys and to explore relationships among the variables. Three principal indices were created: the Weighted Summed Diet Quality Index, the Feeding Practices Index (FPI), and the Dietary Independence Index (DII).

Results: Sixty-one families (24%) participated in this survey. The mean Weighted Summed Diet Quality Index was 6.30 on a scale of 0 to 10. Only 20% of children in the sample consumed the minimum recommended number of servings from 3 or more food groups, while 49% consumed the minimum number of recommended servings from 1 or fewer food groups. The mean DII score was 6.45 on a scale of 0 to 10, indicating a moderate level of dietary independence. The mean FPI score was 4.06 on a scale of 0 to 5, indicating that parents in the sample generally espoused positive child-feeding

practices. Food procurement at school was common, with 67% of the children often or sometimes purchasing food or beverages at school. Hot dogs, pizza, and milk were among the items most commonly purchased.

No statistically significant relationships were observed among the variables, but two important trends were evident in the sample. First, children with better diet quality tended to exhibit a higher level of dietary independence. Second, children with better diet quality tended to have parents with more positive child-feeding practices.

Conclusions: The diet quality of New Brunswick school children needs improvement. Too many children did not meet the recommendations in Canada's Food Guide to Healthy Eating. Greater emphasis on consuming a variety of foods from the four food groups is needed. Overall, the results suggest that parents need to focus their attention on promoting healthy food choices rather than limiting snack foods. A concentrated and concerted effort to improve the diet quality of growing children is necessary to foster good health and reduce their risk of chronic disease.

This research supports the contention that the family environment has the power to impact children's diet quality. Parents with healthy child-feeding practices who encourage and supervise an appropriate level of dietary independence were more likely to have children with better diet quality. Given the multitude of competing and contradictory nutrition messages that exists in the larger environment, parents need to work even harder to create a family environment where children have both the opportunity and the encouragement to consume a good quality diet.

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Chapter 1: Introduction

1.1 Problem Statement

The development of eating practices and behaviors in children results from a complex interaction of intrapersonal, interpersonal and environmental factors. The family is an interpersonal, social environment that contributes to the development of children's eating practices and behaviors, whether healthful or unhealthful. Research demonstrates that unhealthy eating practices and behaviors, initiated in childhood and crystallized throughout the life cycle, place children at an increased risk of chronic disease in both the present and the future. Childhood obesity is one such chronic health problem whose incidence and prevalence continue to increase.

Children are an important population subgroup at whom specialized obesity prevention and intervention programs should be targeted. Between 1981 and 1996 the prevalence of obesity more than doubled among Canadian girls and boys; currently, one in ten children aged 8 to 11 years is obese. Obese children are more likely to present with physiological and psychological illness than are children of a healthy body weight. In addition, pediatricians are treating obese children for conditions typically associated with adult obesity, such as hypertension, type 2 diabetes mellitus and dyslipidemia (1, 2, 3).

Obese children are at significant risk of becoming obese adults, and will therefore accrue health care costs throughout their lifetime. The direct and indirect costs of obesity and its co-morbidities, which exceeded \$1.8 billion in Canada in 1997, have the potential to be considerably elevated in this population since these individuals will require medical treatment for a greater number of years. The annual health care costs related to hypertension, an important obesity co-morbidity, are \$24 million in Nova Scotia (4).

Aside from the health care expenditures they may precipitate in the future, obese children are at risk for many medical, psychological and social impediments to their productivity, well-being, and quality of life (1, 3). In order to design more effective treatment and prevention strategies for childhood obesity, health professionals must glean a greater understanding of the modifiable risk factors for childhood obesity.

Children's eating practices and behaviors can have a significant impact on their current and future health status. Poor diet quality during childhood can result in impaired growth and development, nutritional deficiencies, and the development of inappropriate weight status. Unhealthy approaches to food and nutrition can also persist throughout a child's lifetime, placing him or her at risk for a variety of chronic diseases, including obesity (5). Poor diet quality and unhealthful eating practices and behaviors are therefore modifiable risk factors for obesity that originate, at least in part, within the family environment

1.2 Research Objectives

The purpose of this research is to examine modifiable risk factors for childhood obesity that exist in the home and school environments of pre-adolescent children. These modifiable risk factors include diet quality, family rules, and food procurement at school. Specifically, this research will be guided by the following objectives:

- To assess the diet quality of pre-adolescent children
- To describe and quantify family rules regarding child-feeding practices, family meal patterns and dietary independence
- To explore relationships between diet quality and family rules

- To assess the opportunities for food procurement at school, and
- To determine the frequency with which children avail themselves of these opportunities

Chapter 2: Literature Review

2.1 The Heritability of Obesity

Complex interactions of genetic and environmental factors contribute to the etiology of obesity. Estimates of heritability vary from 25% to 40% (6). One model suggests that individual susceptibility to excess adiposity is determined by genetics, while environmental factors determine whether that susceptibility manifests itself as overweight or obesity (7). Simply, the development of obesity is influenced by the interactions between genes and the environment. These interactions mediate physiological responses to environmental factors such as diet composition and physical activity (8).

The environmental contributors to the obesity equation are of interest to health professionals since these represent the only modifiable risk factors for this pervasive chronic disease. The obesogenic environment is one which “idealizes thinness and stigmatizes fatness, but paradoxically encourages excess food intake and quick approaches to weight loss” (9). Modern society could comfortably be classified as an obesogenic environment and, as such, is taking its toll on the health of children and youth.

2.2 Health Consequences of Childhood Overweight and Obesity

The health consequences of childhood overweight and obesity involve both short- and long-term risks to physical, mental, emotional, and social health. Children who are overweight or obese often display many of the risk factors for cardiovascular disease, including elevated blood pressure and dyslipidemia. They are also at risk for insulin

resistance, type 2 diabetes, sleep apnea, asthma, and orthopedic or joint disorders (10, 11).

Obesity is associated with a lower quality of life among pre-adolescent children, according to a study conducted on 371 children aged 8 to 11 years. Children with a Body Mass Index (BMI) at or above the 95th percentile have significantly lower scores for psychosocial health, self-esteem, and physical functioning on the Child Health Questionnaire (12). Obesity in childhood is consistently associated with low self-esteem, poor body image, and increased incidence of psychological or behavioral disorders (10, 11).

Children who are overweight or obese are more likely to be the victims of bullying than their normal weight peers, according to the responses of Canadian adolescent and pre-adolescent children to the World Health Organization Health Behavior in School-Aged Children Survey (13). Boys and girls, aged 11 to 16 years, with a higher BMI are more likely to endure verbal insults and teasing by their peers. In addition, increasing BMI in girls is significantly associated with the risk of physical forms of bullying. Among older adolescents, but not younger or pre-adolescents, obesity is positively associated with the perpetration of bullying behaviors toward others.

Overall, overweight and obese children are at risk for many physical, social, and psychological barriers to good health and healthy child development. Many of these health concerns will persist into adulthood since children or adolescents who are obese are most likely to become obese adults. Therefore, many of the health crises faced by obese adults, including cardiovascular disease, may have originated during their youth (10).

Unfortunately, a known familial risk of cardiovascular disease appears to have little impact on food choices. A study involving grade 5 children failed to reveal differences in diet quality between those who had a positive family history of cardiovascular disease and those who did not (14). Twenty-three percent of the 297 children studied were at risk for cardiovascular disease, based on family history. These children also had significantly higher cholesterol than their peers. Overall, there are no significant differences in consumption of macronutrients, fiber, cholesterol, or fat between children with a positive family history for cardiovascular disease and children without this genetic risk. Both groups of children had intakes of total fat and saturated fat that were well above the recommended levels. This study demonstrates that diet quality is influenced by factors other than family history of illness.

2.3 Diet Quality

Diet quality is assessed by comparing the dietary intake of an individual or group with current nutritional guidelines. Examples of these guidelines include *Canada's Food Guide to Healthy Eating* and *Canadian Guidelines for Healthy Eating*. The greater the compliance with the recommendations offered by these tools, the higher the quality of the diet (15).

The Healthy Eating Index is one established means by which diet quality can be quantified. Created by the US Department of Agriculture, this index gives a score out of 100 by assessing different domains of diet quality, including compliance with the *American Food Guide Pyramid*, adherence to recommendations for dietary fat and sodium intake, and the degree of variety evident in the diet (16). The quantification of

diet quality, through use of the Healthy Eating Index or by other means, allows for comparisons among individuals or across groups, as well as the examination of diet quality as a risk factor for poor health.

Diet quality is inversely related to a child's BMI (15). It is a modifiable risk factor for childhood obesity, as well as for other health concerns ranging from vitamin and mineral deficiencies to other chronic diseases. Poor diet quality is an important risk factor for general poor health among children, which can, in turn, manifest itself as an unhealthy weight status (5, 17). As children move from childhood to adolescence, diet quality tends to decline. Reasons for this include growing autonomy and decreased dependence on the family, greater participation in extra-curricular activities, part-time employment, irregular meal patterns, and peer pressure to conform to perceived norms of weight and body type (5, 18). Therefore, older children and pre-adolescents should be the focus of nutrition education strategies aimed at improving diet quality in order that they may become better equipped to make healthier food choices during the coming years.

Children from lower socioeconomic backgrounds often have poor diet quality and are at risk for nutritional deficiencies and positive energy balance. One hypothesis is that an inverse relationship exists between a food's energy density and its price. Families experiencing food insecurity are therefore required to buy less-healthy foods in order to provide their children with sufficient calories and satiety (19).

Among low-income, single parent families in Atlantic Canada both mothers and older children have great difficulty complying with the nutrition recommendations in *Canada's Food Guide to Healthy Eating*; most do not consume the minimum number of

recommended servings from more than one food group. Only 0.5% of children meet the recommendations for the minimum number of servings from 3 or more food groups. Overall, only 1.4% economically disadvantaged school children consume a good quality diet. (20).

Socioeconomic status is also negatively associated with the frequency of family meals; families of lower socioeconomic status are less likely to have common family meals. Other family dynamics also have an impact on the frequency of family meals. Older children are less likely than young children to share meals with their family. Adolescent girls participate in family meals less often than their male counterparts. And family meals occur less frequently in families where the mother is employed full-time. Reports on the frequency of family meals vary; overall, 25% to 43% of pre-adolescent and adolescent children share a meal with their family every evening (21, 22).

The more frequently families share meals, the better the diet quality of the children. Among older children and adolescents, family meals are associated with a higher intake of fruit and vegetables, grain products, fiber, calcium, folate, vitamin B6, vitamin B12, vitamin C, vitamin E, vitamin A, iron, protein, and energy. More frequent family meals are also associated with a decreased intake of saturated fat, fried foods, and soft drinks. Children consume the greatest portion of their daily energy and nutrient intake at the evening meal, and this meal is of a better quality when it is a shared family event (21, 22).

Although family meals are associated with a higher-quality diet, some children still do not consume a diet that meets the minimum dietary recommendations. For example, fruit and vegetables are more available in homes where families eat together

more frequently, and pre-adolescent and adolescent children who share family meals consume 0.8 more servings of fruit and vegetables daily than children who do not eat with the family. However, only 1 in 5 children in this age group meets the recommended minimum of 5 servings of fruit and vegetables per day (17, 21). Therefore, common family meals offer one strategy by which diet quality can be improved, but this practice is best used in conjunction with other approaches to optimizing nutritional intake.

A possible link between diet quality and obesity can be found in the modern eating trends that contribute to poor diet quality. Today's children, compared to their parents' generation, eat a greater number of meals away from home, consume more sugary soft drinks, are provided with larger portion sizes, and display more erratic eating patterns. For example, 46% of the family food budget in the United States is spent on meals away from home, and those meals are larger than they used to be. In 1957, the average restaurant hamburger weighed 1 ounce, compared to 6 ounces in 1997. Medium-sized popcorn at the movie theatre has grown from 3 cups to 16 cups. Modern norms of eating behavior may not be conducive to the consumption of a high-quality diet, nor to the development and maintenance of a health body weight (15).

The Bogalusa Heart Study examined how the diet composition of American children has changed over a 20 year period (23). A total of 1584 10-year-old children participated in a 24-hour food recall between 1973 and 1994. Results of this study reveal both favorable and unfavorable changes in diet quality. Significantly fewer children are consuming fats and oils, candy, desserts, and sweetened beverages. Significantly more children are drinking fruit juice, and drinking it in larger quantities. Children who eat candy and desserts are consuming smaller amounts of these foods. Overall, American

children are consuming a larger volume of food each day, particularly at lunch and dinner. This increase could potentially translate into the consumption of excess calories, which in turn leads to overweight and obesity.

Recent research has focused on the impact of “other” foods, fast foods, and sweetened beverages on the diet quality and weight status of children. These foods are of particular concern because of their potential to lead to excess energy consumption without concomitant nutrient intake. Low in nutrients and high in energy, other foods, fast foods, and sweetened soft drinks provide children with empty calories while displacing more nutritious choices (24, 25). Although these less healthy food choices are not high in nutrients, they have nonetheless become important nutrient sources because they are being consumed frequently and in large quantities, thereby replacing more nutrient-dense choices (26).

More than 30% of American children aged 4 to 19 years consume fast food on any given day, according to data from the Continuing Survey of Food Intakes by Individuals and the Supplemental Children’s Survey. This represents 29% to 38% of their caloric intake for that day. Consumption of fast food is associated with increasing intakes of energy, fat, saturated fat, carbohydrate, and sweetened beverages. Conversely, fast food intake is associated with decreasing consumption of milk, fruit, and fiber (24).

In Canada, 25% of the total energy in the diets of both adults and adolescents comes from “other” foods, according to results of the Food Habits of Canadians study (27). Among 13 to 17 year old children participating in this study, cakes/cookies/pies/donuts/granola bars, carbonated beverages, and salty snacks are among the highest contributors to their overall nutrient intake. Carbonated beverages

also make a significant contribution to overall energy intake; 61% of the Canadian adolescents surveyed consumed carbonated beverages on the day of the interview, giving an average caloric intake of 300 kcal. Sweetened fruit drinks are also popular, and are an important source of vitamin C for both boys and girls (26).

In the United States, soft drink consumption is increasing. The number of children, aged 6 to 17 years, who consume sweetened soft drinks increased by 48% from 1977-78 to 1994-98. The contribution to total energy intake made by sweetened soft drinks increased from 2.9% to 5.9% during the same period. The portion size of soft drinks being consumed increased by 51% (25). The consumption of sweetened beverages may have a negative impact on overall diet quality by replacing more nutritious choices, such as milk or fruit juice (28).

What remains uncertain is the long-term impact of this trend on energy intake and weight status. Due to inconclusive research in this area, no Upper Limit exists for added sugars. According to the report on Dietary Reference Intakes for macronutrients, “it appears that the effects of increase intakes of total sugars on energy intake are mixed and the increased intake of added sugars are most often associated with increased energy intake. There is no clear and consistent association between increased intake of added sugars and BMI” (29). What is clear, however, is that recent dietary trends toward increasing consumption of other foods, fast foods, and sweetened beverages has the potential to negatively affect overall diet quality.

Another contributor to poor diet quality is infrequent breakfast consumption. Among children, eating breakfast is positively associated with a good diet quality and negatively associated with obesity. Compared with children who skip breakfast, children

who eat breakfast have healthier nutrient and caloric intakes. Children from lower socioeconomic backgrounds are less likely to eat breakfast than children with higher family incomes. Other proposed barriers to breakfast consumption among children include having to prepare their own breakfast, having to eat by themselves, a lack of ready-to-eat breakfast foods, and a lack of time to prepare the meal (30, 31).

In Canada, greater efforts to increase the frequency of breakfast consumption are necessary. Although less than 3% of children never eat breakfast, only 58.3% of school children on Prince Edward Island, and 68.7% in Ontario, eat breakfast every day (32). Among younger children, there is greater concern with the quality of the breakfast meal than with its frequency. More than 95% of preschool children eat breakfast every day, but 27% of these have intakes of less than 200 kcal at the morning meal and 33.4% have intakes of less than 15% of their daily energy requirements (31).

Frequency of breakfast consumption decreased by 9% among American children aged 8 to 10 years from 1965 to 1991. Among children who eat breakfast, the energy content of this meal has declined while its quality has improved. Children are consuming less butter and margarine, less white bread, fewer servings of bacon and eggs, and less whole milk. They are eating fruit, whole grains, and low-fat milk with increasing frequency (30). A similar trend is evident in Canada, where milk, fruit juice, fruit, cereal, and bread are the foods most frequently consumed at breakfast (31).

While many of the risk factors for poor diet quality exist within the family environment, children's diet quality is also related to the foods and beverages consumed in the school environment. As much as 40% of children's daily energy intake comes from foods and beverages consumed at school (5). Young adolescents who attend schools

with cafeteria service and vending machines consume fewer servings of fruit and vegetables throughout the day, and have a higher fat intake, than students whose schools do not provide these opportunities for purchasing food and beverages. In addition, students who have access to vending machines at school are more likely to purchase unhealthy snacks foods from these machines than to buy fruit from their school's cafeteria. This suggests that if palatable, high energy snack foods are available, students will preferentially purchase these items. Further, data from 24 hour recalls shows that students who consume unhealthy foods at school do not compensate for this by choosing healthier foods outside of school. Overall, it is clear that the school environment can significantly impact the overall diet quality of its students (33).

Not all research supports diet quality as a risk factor for childhood obesity. No association between diet composition and obesity is evident in the research of Rocandio et al (34), who found that intake of fat and protein do not differ significantly between overweight and non-overweight children, and that children of healthy weight consume significantly more calories from carbohydrates than overweight children. However, there are several methodological limitations to this study, including small sample size (n=32). Consumption was calculated from food weighing records kept by the parents, which could be biased by weighing errors, inconsistent number rounding, over- or under-reporting, and failure to accurately include foods eaten away from home. The authors of this study conclude that childhood overweight is largely attributable to reduced energy output, rather than high intake, but did not measure physical activity. Finally, the overweight children in this study already had an unhealthy weight status at the time of

their participation; their intakes of macronutrients may have therefore been elevated in the past, prior to their involvement in the study.

Overall, the body of research in this area supports the inclusion of diet quality as a modifiable risk factor for childhood obesity and other chronic health concerns. Specific dietary practices - including infrequent family meals, failure to consume breakfast, and reliance on high-energy/low-nutrient foods as important nutrient sources – have been associated with an increased risk of poor diet quality and/or unhealthy weight status. Further assessment and quantification of diet quality is necessary for the development of programs that target this modifiable risk factor in children.

2.4 The Family Environment

“Parents can influence their children’s dietary practices, physical activity, sedentary habits, and body satisfaction by controlling availability and accessibility of foods, meal structure, food socialization practices, and food-related parenting style. Knowledge of nutrition and modeling of behaviors and attitudes are also influential” (9)

Environmental risk factors within the family may mediate the relationship between genetics and childhood weight gain. If these factors are identified, efforts to modify these risks could reduce childhood overweight and obesity despite the genetic contribution (35). The family environment fosters the development of children’s eating behaviors, food preferences, and attitudes toward health and nutrition (5). Through direct communication, modeling, the provision of food, and other child-feeding practices, parents have a tremendous influence over the nutritional health of their children (36).

Family members tend to exhibit similar eating patterns, whether due to environment, genetics, or both (37). Under laboratory conditions where children are free to select the type and amount of foods consumed, siblings choose meals of similar energy

and macronutrient content. Further research is needed to determine whether this pattern holds true for parents and children.

The parent-child relationship, in the context of food and eating practices, is mediated by parenting style. Authoritarian, authoritative, permissive, and neglectful are the four principle parenting styles first identified in the work of Baumrind (38, 39). These parenting styles differ in the levels of strictness and responsiveness that parents direct toward their children. Authoritarian parents display high levels of strictness and low levels of responsiveness or involvement. Authoritative parents are also highly strict, but temper this by being highly responsive to and involved with their children. Permissive parents display low levels of strictness and high levels of responsiveness. Finally, neglectful parents are low on both strictness and responsiveness (39).

In terms of child-feeding, authoritarian or demanding parents exert considerable control over when, what, and how much their child eats. This approach restricts the child's autonomy and teaches him or her to rely solely on external food cues, which can lead to inappropriate intake and unhealthy weight status. At the opposite extreme are permissive and neglectful parents who both tend to afford their child complete control over the timing and composition of meals and snacks, as well as over how much is consumed. This eliminates the parents' opportunity for teaching and modeling appropriate food habits (39, 40).

Authoritative or responsive parenting style is most conducive to the development of healthy eating habits among children (39, 40). These parents share control and decision-making with their children; parents may decide what foods are served and when meals are scheduled, while children determine how much they consume of the foods

being offered. This parenting style teaches children to respond to their own internal cues of hunger and satiety, as well as provides parents with opportunities for teaching and modeling healthy food practices (40). Adolescents who live with authoritative parents consume significantly more servings of fruit, and espouse healthier attitudes toward eating fruit, than adolescents raised with any other parenting style (39). Overall, authoritarian or responsive parents are best placed to address modifiable risk factors for childhood obesity and support the development of a healthy body weight.

2.5 Body Mass Index

Parental BMI is the strongest predictor of obesity in both boys and girls (41). Overweight parents and their children share other traits that may also have a negative impact on weight status. Young children of obese parents demonstrate a greater liking for high-calorie, low-nutrient foods and a greater dislike for vegetables, compared with children whose parents are not obese. Children of obese parents also accrue more time in front of the television or computer than children of non-obese parents (35).

Although maternal obesity is a stronger predictor of children's increase in BMI and adiposity than is paternal obesity (42), predicting change in BMI is most reliable when characteristics of both parents are considered. A longitudinal study by Davidson and Birch examines familial risk factors for childhood overweight in a sample of 197 young girls and their parents. Number of overweight parents, maternal change in BMI, paternal enjoyment of physical activity, and paternal energy and fat intake are all predictors of young girls' change in BMI between the ages of 5 and 7 years.

Collectively, these variables account for 26% of the variance in the children's change in BMI (43).

Overweight or obese children are more likely to have overweight parents, according to a prospective study that followed children and their families from birth to age 9.5 years (44). Of the 150 children who participated in this study, 25.3% had a BMI above the 85th percentile at 9.5 years and 9% had a BMI above the 95th percentile. Other identified risk factors for overweight and obesity include a history of temper tantrums related to food and low parental concern about the child's thinness, both of which may relate to child-feeding practices.

Body Mass Index is significantly higher in young adults who, as children, were taught to clean their plates, compared with those who were allowed to control their own intake based on feelings of satiety. Similarly, children whose parents used food as a reward or incentive have a significantly higher BMI in young adulthood than those whose parents did not engage in this practice (40). These findings serve to underscore the importance of child-feeding practices on weight status and life-long nutritional health.

2.6 Child-Feeding Practices

Child-feeding practices have a greater impact on body mass than does dietary fat intake (45). They are part of the non-shared family environment; children in the same family will have different experiences with their parents' approaches to nutrition and feeding (46). Through these practices, parents influence the development of feeding behaviors in their children, including food preferences, energy intake, and self-control. Evidence suggests that early child-feeding practices lead to the development of food

habits that are static into adulthood. Older adolescents and young adults are more likely to clean their plates, choose to eat dessert, consume regular meals, and reward themselves with food if these practices were ingrained during childhood. Similarly, older adolescents and young adults are more likely to select foods for their nutritional value if their parents discussed nutrition with them as children (40). Early child-feeding practices, therefore, can have a lasting impact on children's nutritional health, including weight status.

Comments by parents regarding the weight status of their pre-adolescent children have a more significant effect on the child's eating practices than does parental modeling (47). The relationship between comments by parents and behaviors by their children is strongest between mothers and daughters. Recognizing that unhealthy dieting practices can lead to obesity, disordered eating and unfavorable body image, a study by Smolak et al examines the early dieting experiences of boys and girls in grades 4 and 5. Two hundred and twenty parents and their pre-adolescent children responded to questionnaires regarding family attitudes toward the child's weight status and dieting history. Although the weight-related attitudes and behaviors of both boys and girls are significantly related to their parents' comments about weight, this relationship is most pronounced in young girls and is strongest when the comments originate with either the mother or with both parents.

This is consistent with other findings. Fifteen percent of the variance in total fat mass of 7 to 14 year old children can be attributed to the combined effects of maternal concern for her child's weight and the pressure she exerts on her child to eat. Maternal concern with weight is positively correlated with higher total fat mass in children, while

the exertion of maternal pressure to eat is positively correlated with lower total fat mass. This could indicate that mothers express more concern regarding the weight of heavier children while urging thinner children to eat (45).

Parental behaviors may have a lesser impact on children's eating practices and behaviors than the child's interpretation of their parents' behaviors. The food-related attitudes and behaviors of college students are more significantly associated with their perceptions of their parents' behaviors than with the parents' self-reported behaviors. In addition, the student's perceptions of parental criticisms have a greater impact on their attitudes and behaviors than their perceptions of parental modeling, a phenomenon which is consistent with other findings that emphasize the superior influence of words rather than deeds (36).

The discord between the perceptions of parents and children is particularly pronounced with adolescents. Parents and children have substantially different interpretations of the family mealtime environment, as revealed by a study of 282 young adolescents and their parents. Compared to their adolescent children, parents note more frequent arguments during meals, more frequent breakfast consumption by their children, and a greater number of shared family meals. Conversely, adolescents perceive themselves as making a greater and more frequent contribution to meal preparation than their parents report (18). This illustrates the need for education and intervention strategies to consider parental influence from the point of view of both the parent and the child.

Parents of overweight or obese children may espouse incorrect views of childhood nutrition (17). In one study of parents of 6 to 10 year old children, those

whose children were overweight were more likely to agree with erroneous statements such as “It doesn’t matter which foods my child eats. As long as they eat enough, they will grow properly” and “The study child is old enough to take care of feeding him/herself”. This phenomenon has been refuted, however, in other research. Parents’ knowledge of healthy eating and childhood nutrition is not associated with their children’s weight status, according to a study by Etelson et al. (48). Both of the above studies, however, have methodological limitations that include small sample size and non-random sampling. Overall, current literature can neither support nor refute a correlation between parents’ knowledge of nutrition and children’s weight status.

Contrary to popular myth, children will not independently and spontaneously select foods that meet their nutritional requirements. Instead, children tend to choose foods that are either familiar or high in calories and low in nutrients (49). Familiarizing children with nutritious foods can increase the likelihood that they will select these foods when given the opportunity to make independent food choices. However, parents generally focus on restricting low-nutrient foods rather than promoting more nutritious choices. Overall, restricting children’s diet is counter-productive. A more effective approach is to familiarize children with healthy foods, make them readily available, and encourage their consumption.

Parental restriction of high-energy, low-nutrient foods may promote childhood overweight and obesity by increasing the child’s interest in, and desire for, the restricted food. This practice may reduce the child’s self-control and promote an immoderate intake of the restricted food should it become available. Restrictive parents are more likely to have a low BMI, be well-educated, and have children with a higher weight-for-

height ratio (50). Young girls are less able to exert self-control over their food intake if their mothers exhibit dietary restraint; mothers who restrict their own intake are also more likely to attempt to control their daughters' diet (46). In addition, food restriction by parents is associated with a child's decreased ability to respond to internal cues of hunger and satiety (45).

Children whose intakes are highly restrained and controlled by their parents have a higher BMI than children whose parents are less restrictive. Parents also tend to exert greater dietary restraint over girls than boys. Conversely, parents are more likely to use food as a means of reward or comfort for sons rather than daughters. For both boys and girls, parents focus their restrictions on specific aspects of their children's diet. According to their children, these areas include over-eating, snacking, and consumption of sweets or candy (51).

Closely related to dietary restraint is dietary disinhibition, or the removal of dietary restraints in response to environmental stimuli other than hunger. Maternal BMI and dietary disinhibition are positively correlated with the weight-for-height of their young daughters. Maternal dietary disinhibition also has a strongly positive relationship with girls' energy intake when they have free access to palatable foods (52).

Similarly, the Framingham Children's Study found that dietary restraint and dietary disinhibition in parents, taken together, are associated with an increase in anthropometric measures of childhood overweight, including BMI and skin fold tests. This relationship is most pronounced in families where both parents display dietary restraint and disinhibition (42). This illustrates how misguided child-feeding practices can have a negative impact on weight and health status.

2.7 Perceptions of Childhood Obesity and the Overweight Child

The increasing prevalence of childhood overweight and obesity has led to increased public awareness of this health issue. Among the general public, media advertising of unhealthy foods and excess fast food consumption are among the most commonly identified causes of childhood obesity. Further, while members of the general population appear to recognize that there are multiple and complex risk factors for obesity, they tend to place greater blame on poor eating habits over lack of physical activity (53). This demonstrates that members of the general public are aware that modern society is an obesogenic environment.

Unfortunately, the heightened awareness of childhood obesity in the general population may be less pronounced at the level of the individual family. Most parents of overweight or obese children underestimate their child's weight. Only 10.5% of parents with obese children aged 4 to 8 years have an accurate perception of their child's weight, compared to 59.4% of parents whose children are of normal weight (48). Similarly, 45% of parents with obese preschoolers describe their child's weight as "fine" (54). As the prevalence of childhood overweight and obesity increase, shifting perceptions may mistake commonality for normalcy; the overweight or obese child may be perceived as being of normal weight when compared to his or her peers.

2.8 The Role of the Family in the Treatment of Childhood Obesity

It is necessary for parents to take an active role in recognizing and addressing childhood overweight and obesity within their own families. Recent research suggests

that health professionals may be inconsistent in the diagnosis and treatment of obesity in children (55). Only 53% of obese children visiting a primary healthcare facility are documented as being obese by health professionals, according to a retrospective review of medical charts. Obesity is least likely to be identified in preschool children or those with mild obesity. Among children whose obesity is identified and documented, treatment recommendations do not always conform to current practice guidelines. This highlights the need for cooperation by parents and health professionals to address this growing problem.

The treatment of childhood obesity is most successful if programs focus on the family and teach parents to help their children make important lifestyle changes. In a longitudinal prospective study, 60 obese pre-adolescent children were randomly assigned to either a family-based treatment program or a traditional program for 12 months. Thirty-five percent of those in the family-based group achieved “non-obese status”, compared to only 17% in the control group. In addition, the total amount of weight lost by all participants in the family-based program was greater, and the drop-out rate was lower, than in the control group. These results are independent of the child’s initial weight, the child’s gender, and the parents’ weight (56). It is clear that the family environment is significant for its influence on the development, prevention, and treatment of childhood overweight and obesity.

Chapter 3: Theoretical Framework

The theoretical framework that guides this research is Family Systems Theory. A system is defined as “any set of objects that relate to each other in a way that creates a superentity”, or “a boundary-maintained unit composed of interrelated and interdependent parts” (57). This framework views the family as a system, a “living, growing superpersonality that has as its essence the interaction of its members” (57). Family systems theory offers a heuristic construct by which family dynamics and relationships can be explored; this exploration can provide insight into the behaviors of family members, both as individuals and as a cohesive group (58).

The basic assumptions of Family Systems Theory, as identified by White and Klein (58), are as follows:

1. All parts of the system are interconnected.
2. Understanding is only possible by viewing the whole.
3. A system’s behavior affects its environment, and in turn the environment affects the system.
4. Systems are heuristics, not real things.

Other central tenets of Family Systems Theory that are relevant to this research include **family rules, pathological communication, circular causality and feedback, equilibrium, and boundary maintenance** (57, 59). **Family rules** are the norms of behavior that govern everyday family life, though they are usually unspoken or even unacknowledged. They tend to remain static over time, and conflicts can arise if a family member breaks these rules. If other family members respond with

negative feedback and attempt to compel conformity, the new behavior will likely not persist. Conversely, if the new behavior is encouraged and supported by other family members through positive reinforcement, the behavior is likely to continue and become a new family rule in a process known as morphogenesis.

This has important implications for health behavior. If existing family rules facilitate poor health habits, for example a lack of physical activity or frequent meals at fast food restaurants, it can be difficult for one member of the family to make healthy changes. However, if the entire family supports the new behavior, then this healthier lifestyle can eventually become entrenched as a new family rule.

The family rules to be investigated in this research include child-feeding practices, dietary independence, and family meal patterns, each of which have the potential to positively or negatively effect diet quality and nutritional health. Food procurement at school is partially governed by family rules. The school environment is part of the larger environment with which the family system interacts; decisions regarding the frequency with which children purchase food at school, and the types of foods being purchased, depend on factors in both the family and school environments. For example, school policies may determine what foods are offered and when they are available, while family norms of behavior dictate what the child purchases and how often.

Family conflict may result from **pathological communication**, which represents “various kinds of unclear and confusing ways of relating” (57). For example, pathological communication occurs when the content of a verbal message is contradicted by non-verbal cues. In the context of child-feeding, children may

receive inconsistent messages regarding food and nutrition if there is a gap between what parents practice themselves and what they expect from their children; parents may be engaging in pathological communication if they are modeling food habits that are in stark contrast with their child-feeding practices.

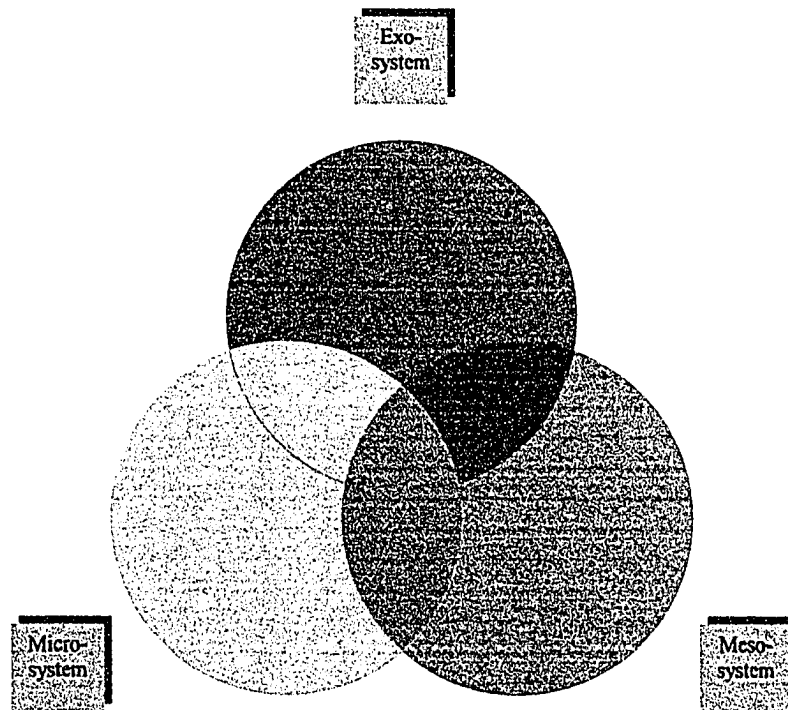
Circular causality, as opposed to linear causality, governs familial interactions. The actions and behaviors of family members have multiple and multidirectional effects. In other words, the behavior of one family member has varying effects on each of the other members, leading to diverse and perhaps contradictory consequences within the family unit. Closely related to circular causality is the concept of **feedback**, which is defined as “a system’s capability to monitor its own progress toward a set of goals, to correct and elaborate its response, and even to change its goals” (59). While circular causality describes interactions within the family system, the concept of feedback explains how that system interprets and responds to its environment.

The family system, like any system, strives to maintain **equilibrium**; a change in one part of the whole will precipitate changes in other areas. Therefore, lasting changes occur via acceptance at the systems level, not merely the level of the individual. In the context of health behavior, this means that changes in lifestyle will be most effective if those changes are adopted by the entire family, not solely by the target individual.

Family Systems Theory is an ecological framework in that it acknowledges the reciprocal relationships that exist between families and their environment. Through a process termed reciprocal determinism, the family environment is influenced by, and

influences, multiple levels of the larger context in which it exists. The work of Urie Bronfenbrenner names these environmental levels as the microsystem, the mesosystem, and the exosystem (Figure 1) (5, 60).

Figure 1 – Levels of environmental interactions in an ecological model

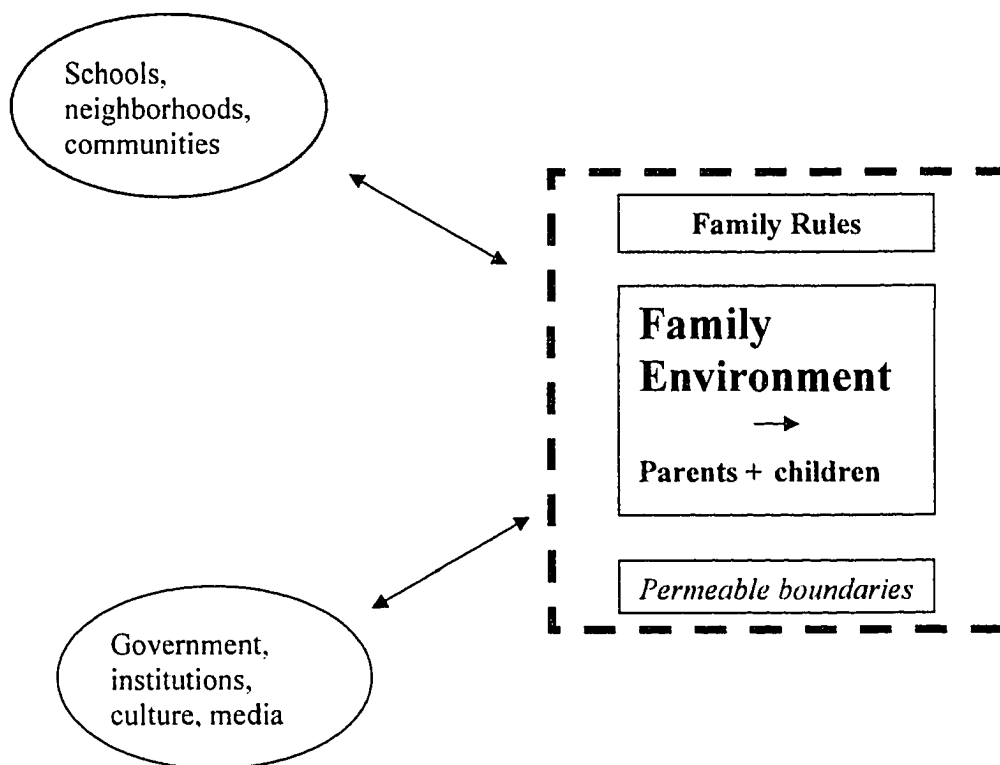


In this research, the microsystem refers to the family environment, where the daily lives of family members are governed by family rules and the interpersonal relationships among parents and children. The mesosystem is represented by the schools the children attend and by the neighborhoods and communities in which the

families live. The exosystem is the broader context in which families operate. This largest environmental sphere includes government and institutional policies, cultural norms, and the mass media (60).

As depicted in Figure 1, the micro- , meso-, and exo- systems overlap and intermingle. However, not every aspect of each environmental level impacts other levels; this is governed, at least at the family level, by **boundary maintenance**. Each family can be viewed as a discrete system with its own boundaries that separate the family system from its outside environment. Boundary maintenance is the process by which family systems maintain their integrity, in that “external elements seen as hostile to the system’s goals and policies are actively filtered out, while those seen as beneficial to the pursuit of the system goals and policies may be actively sought out and incorporated” (59). A system’s boundaries may be open or closed, or somewhere in between, depending on the degree to which outside agents are allowed to influence the system. The relative permeability of a system’s boundaries appears to have an impact on the overall success or health of that system (Figure 2).

Figure 2 – Boundary maintenance in the family environment



In the context of childhood nutrition, the permeability of a family system's boundaries may determine, for example, how their food choices are affected by the close proximity of fast food outlets in the neighborhood, or by subsidized school milk programs, or by heavy media attention to fad diets. Parents who are able to incorporate healthful behaviors into their family lives, while simultaneously disregarding practices that run counter to their health goals, are practicing effective boundary maintenance. Boundary maintenance can therefore have a positive or negative impact on the effectiveness of parents' child-feeding practices and on children's overall nutritional health.

Overall, Family Systems Theory is an ecological framework that is helpful in understanding health behaviors and in delineating relationships among the environmental influences on those behaviors. This theory highlights the importance of examining health and nutrition issues in context. Specifically, understanding modifiable risk factors for childhood obesity necessitates an exploration of the environmental context in which these factors develop – in this case, the family and school environments. Given the importance of this health issue, and the complexity of its etiology, the application of an ecological framework to this research is a logical approach to identifying and explaining the environmental risk factors for overweight and obesity faced by pre-adolescent children.

Chapter 4: Methodology

4.1 Research Design

This study employed a survey design, which is most suited to the research objectives of describing and quantifying the relationships among variables as they exist in the target population.

4.2 Subjects and Sampling

The subjects of this research were school children in grades 4 and 5, together with their parents. The sample was drawn from all children who were enrolled in grade 4 or 5 in New Brunswick's School District 18 during the 2003-2004 school year, including children in both regular and French Immersion classrooms. District 18 is comprised of schools in both urban and rural areas; it encompasses the city of Fredericton and the villages of Boiestown, Doaktown, Harvey, McAdam, Stanley, and New Maryland. There are 22 elementary schools in this district, with approximately 2000 students enrolled in grades 4 and 5.

From a complete list of all children enrolled in grades 4 and 5 in District 18, a random sample of 250 children was computer-generated by the District office. The Director of Education then provided the researcher with this list, which also included the parents' names and mailing addresses. It was necessary to over-sample due to the anticipated low response to a mailed survey; an initial sample of 250 was selected because it allowed for a low response rate while keeping costs at an acceptable level.

4.3 Data Collection Tools

The data collection tools used in this study included a food frequency questionnaire for the children and a questionnaire for the parents. Both were self-administered. The food frequency questionnaire (FFQ) was developed by Evers and Taylor (32) and has been validated for use with this age group. It has been previously administered on Prince Edward Island and in Southern Ontario to assess children's diet quality by comparing their intake with *Canada's Food Guide to Healthy Eating*. Items from all four food groups are included, in addition to items from the "other foods" group. For purposes of this study, the food frequency questionnaire was referred to as the Questionnaire for Children (Appendix A).

The Questionnaire for Parents (Appendix B) was designed by the researcher, and contained both closed- and open-ended questions. Its purpose was to measure salient aspects of the family environment, specifically children's level of dietary independence, parents' child-feeding practices, and family meal patterns. It also served to gather information on the availability and consumption of foods in the school environment. This questionnaire was at a grade 4 reading level to make it amenable for use with parents having a range of literacy levels.

Prior to administration, the Questionnaire for Parents was pilot-tested on 15 parents with children in elementary school, both in New Brunswick and Nova Scotia. These parents were selected based on heterogeneity, with consideration given to rural and urban residence, as well as to educational and socioeconomic backgrounds. Parents were asked to complete the questionnaire and to comment on the clarity and readability of the

questions, as well as to identify any questions they found ambiguous or offensive. No changes were made to the Questionnaire for Parents following the pilot-testing.

Face validity of the Questionnaire for Parents was established by professionals in the Department of Applied Human Nutrition, who determined that the questions were relevant to the domains covered by the questionnaire, and in the Department of Mathematics and Computer Studies at Mount Saint Vincent University, who evaluated the overall design of the questionnaire and ensured that its questions were amenable to the planned statistical procedures.

The Questionnaire for Parents did not ask parents to disclose their height and weight, nor the height and weight of their children; the participants' BMI could therefore not be calculated. There are several reasons for this. First, this information is not necessary since the research objectives focus on the delineation of potential risk factors for early obesity, not the presence or absence of obesity at the time of the study. Second, this study design would necessitate reporting of height and weight by the parents. Self-reported anthropometric measures are likely to be inaccurate, with height being overestimated and weight being underestimated. This inaccuracy would underestimate the prevalence of overweight and obesity in the sample (61, 62, 63). Third, BMI may not be an appropriate measure for the weight status of pre-adolescent children, especially young girls. Most girls of this age are pre-pubertal and often experience some weight gain prior to a growth spurt. Therefore, their BMI measurements could be temporarily elevated and not reflective of true weight status. (47). Finally, questions pertaining to anthropometrics could be viewed as value-laden by participants. It is essential that

parents perceive the questions as value-free in order to elicit spontaneous and accurate responses.

4.4 Procedures

The Questionnaire for Children and the Questionnaire for Parents were mailed to the 250 randomly selected families at the addresses provided by District 18. These were accompanied by a cover letter from the researcher that explained the research and provided instructions for completing the questionnaires (Appendix C). Potential participants were assured that all responses were confidential and anonymous. The cover letter also clearly stated that participation was voluntary, and that returning the completed questionnaires constituted implied consent to participate in the study. A self-addressed stamped envelope was provided to facilitate the return of the questionnaires.

Two weeks following the initial mail-out, a reminder was sent to all 250 families in the sample (Appendix D). This reminder asked that completed questionnaires be returned to the researcher as soon as possible, if parents had not already done so. All parents in the sample received these reminders since, in the interests of complete anonymity, it was not possible to determine who had already returned the completed questionnaires. Responses were mailed to a post-office box to which only the researcher had access. Only the researcher, the thesis supervisor, and members of the thesis committee had access to completed questionnaires.

4.5 Ethical Considerations

This research presented minimal risk to participants. Questions on the Questionnaire for Parents strived to be neutral, value-free, and inoffensive. Nonetheless, questions pertaining to food, nutrition, and child-feeding practices have the potential to raise concerns among parents whose particular life circumstances preclude them from providing their children with optimally nutritious foods. In addition, careful consideration of family practices could be distressing to parents in troublesome circumstances. For this reason, the Questionnaire for Parents did not ask personal questions such as weight status, socioeconomic background, marital status, or family income.

The Questionnaire for Children, the food frequency questionnaire developed by Evers and Taylor (32), was constructed for use with children from a variety of socioeconomic backgrounds. For example, the tool asks how often children consume a vegetable, with no distinction made between more and less expensive vegetables, vegetables with seasonal availability or vegetables that are fresh, frozen or canned. In this way, families who may be experiencing food insecurity are not asked to disclose how often they consume foods that may be inaccessible to them, as is the case with many other food frequency questionnaires.

4.6 Approval of the Research Protocol

This research was approved by the University Research Ethics Board at Mount Saint Vincent University (Appendix E) and by School District 18 in Fredericton, New Brunswick.

4.7 Data Analysis

Data analysis was completed using Microsoft Excel and SAS. Each of the 25 food items on the food frequency questionnaire was assigned to one of five food groups, in accordance with *Canada's Food Guide to Healthy Eating*: grain products, fruit and vegetables, meat and alternatives, dairy products, and other foods. A list of the food items assigned to each group is described in Table 1.

Table 1 – Food items from the Questionnaire for Children listed by food group

Grain Products	Fruit and Vegetables	Meat and Alternatives	Dairy Products	Other Foods
Bread, bagels, pitas, English muffins, crackers, tortillas	Potato	Eggs	Milk	French fries
Rice	Salad	Beans (baked, kidney beans, lentils, tofu)	Cheese	Ice cream
Spaghetti, macaroni or other pasta	Other vegetables	Peanut butter	Yogurt & frozen yogurt	Pizza
Cold cereals	Fruit	Hamburgers, beef, pork, hot dogs, sausages, lunch meat, other meats		Cakes, cookies, pie, doughnuts
Cooked cereals	Fruit juice	Chicken, turkey or fish		Potato chips, tortilla or nacho chips, Cheesies, pretzels, other snack foods
				Candy, chocolate bars
				Regular (not diet) pop

The food frequency questionnaire asks children “How often have you eaten any of these foods in the last seven days?”. Each of the 5 response categories was assigned a number that corresponds to the number of servings consumed daily. This transformation

from weekly frequency of consumption to daily number of servings is described in Table 2. The calculation of number of daily servings was the same for four of the five food groups, specifically fruit and vegetables, meat and alternatives, dairy products, and other foods. For grain products, it was necessary to increase the number of servings assigned to each response category in order to improve the accuracy of this measure. The food items listed in the grain products group are usually consumed in amounts that are equal to two serving sizes, for example two slices of bread in a sandwich, one hamburger or hot dog bun, 60g of cold cereal, or 1 cup of pasta. It was therefore reasonable to increase the number of servings assigned to each response category in order to avoid an underestimation of the intake of grain products.

Table 2 – Response categories on the Questionnaire for Children and the corresponding number of daily servings for items in each food group

Response Category	Number of Daily Servings	Number of Daily Servings
	Fruit and Vegetables, Meat and Alternatives, Dairy Products, and Other Foods	Grain Products
At least twice a day	2	4
Once a day	1	2
4 to 6 times a week	0.5	1
1 to 3 times a week	0.25	0.5
Never	0	0

Three indices were created to describe the diet quality of children in the sample, based on the four food groups only (grain products, fruit and vegetables, meat and alternatives, and dairy products). The first was the **Diet Quality (DQ) Score**. For this measure, each subject was given a score from 0 to 4, which represents the number of food groups in which the minimum number of recommended servings is met. Table 3 presents the recommended number of servings for each food group in *Canada's Food Guide to Healthy Eating*.

Table 3 – Minimum number of recommended servings for each food group

Food Group	Minimum Number of Recommended Servings
Grain Products	5
Fruit and Vegetables	5
Meat and Alternatives	2
Dairy Products	2

The second index of diet quality was the **Summed Diet Quality Index**. To calculate this index, the number of servings in each of the four food groups was summed for each subject, up to the minimum number of recommended servings. The grain products and fruit and vegetable groups each received a maximum score of 5, and the meat and alternatives and dairy products groups each received a maximum score of 2. Each subject therefore received a score from 0 to 14. This score was then used to create the third measure of diet quality, the **Weighted Sum Diet Quality Index**, in which each of the four food groups is weighted to be of equal value in the final index score. The Weighted Summed Diet Quality Index is a score from 0 to 10.

The Questionnaire for Children also examines breakfast consumption, asking “How often do you have something for breakfast?”. The five response categories are “every day”, “some days”, “rarely”, “weekends only”, and “never”. These data was analyzed by calculating the frequency with which each response category was selected.

The Questionnaire for Parents covered four domains: dietary independence, child-feeding practices, family meals, and the school environment. The **Dietary Independence Index (DII)** was created to measure the children’s degree of autonomy in making food choices. Response categories in this section included “never”, “sometimes”, “often”, and “always”; an additional choice was available for the questions where a response of “not applicable” was indicated. The responses of each parent subject were summed and rescaled to generate a score from 0 to 10, with higher scores indicating greater independence on the part of the child. The Dietary Independence Index had a Cronbach’s Alpha score of 0.60, which indicates an acceptable level of internal validity for this measure.

The parents’ child-feeding practices were quantified through the calculation of the **Feeding Practices Index (FPI)**. Possible responses to these questions were “strongly agree”, “agree”, “neutral”, “disagree”, and “strongly disagree”. The questions in this section were coded so that the most desirable answer to each question was “strongly agree” on the 5-point Likert scale. Responses were then summed and recoded to generate an FPI score ranging from 0 to 5, where 5 represents the best possible child-feeding practices according to the current literature. Following the initial calculation of Cronbach’s Alpha, two questions were removed from the FPI: “I don’t try to control what my son or daughter eats” and “I don’t expect my son or daughter to try a new food

if he or she doesn't want to". The deletion of these questions does not detract from the information provided by the FPI since their subject areas were addressed by other questions that remained part of the index. The final Crombach's Alpha for the FPI was 0.64, which indicates an acceptable level of internal validity for this index.

The section on family meals consisted one question, asking parents to identify which of five scenarios best describes their family at the evening meal: "We usually eat together and everyone eats the same foods", "We usually eat together and plan meals around what the children will eat", "We usually eat together and not everyone eats the same food", "We don't usually eat together but we eat the same food", and "We don't usually eat together and we eat different foods". This section sought information on whether families ate this meal together and whether they all ate the same foods. Descriptive statistics were used to measure the frequency with which each option was selected.

The section on school environment was unique in that it included both closed- and open-ended questions. Descriptive statistics were used to quantify subjects' responses to the closed-ended questions, four of which asked for a "yes", "no" or "not sure" response and one of which used a 5-point Likert scale. The open-ended questions asked parents to list the foods that were available at their child's school, and which of these foods were consumed by their child. Each food mentioned was assigned a number, and a food list of 50 items was generated. Descriptive statistics were then calculated to delineate the availability, and frequency of consumption, of these foods

Coefficients of correlation were calculated to explore the potential relationships among the variables described by the Questionnaire for Parents and the Questionnaire for

Children. Three of the variables were dichotomized along the median: the Weighted Summed Diet Quality Index, the Dietary Independence Index and the Feeding Practices Index. Responses were classified as either “high” (above the median) or “low” (below the median). Relationships among these new variables were explored using correlations and Chi Squared ($p < 0.05$).

Chapter 5: Results

5.1 Response Rate

Sixty-one families returned completed questionnaires, giving a response rate of 24.4%.

5.2 Diet Quality

The mean Diet Quality Score was 1.56 on a scale of 0 to 4, with higher numbers representing better diet quality. The mean Summed Diet Quality Index was 10.85 on a scale of 0 to 14, again with higher scores being associated with better diet quality. Finally, the mean Weighted Summed Diet Quality Index was 6.30 on a scale of 0 to 10, with 10 representing optimum diet quality (Table 4).

Table 4 – Mean score of each measure of diet quality

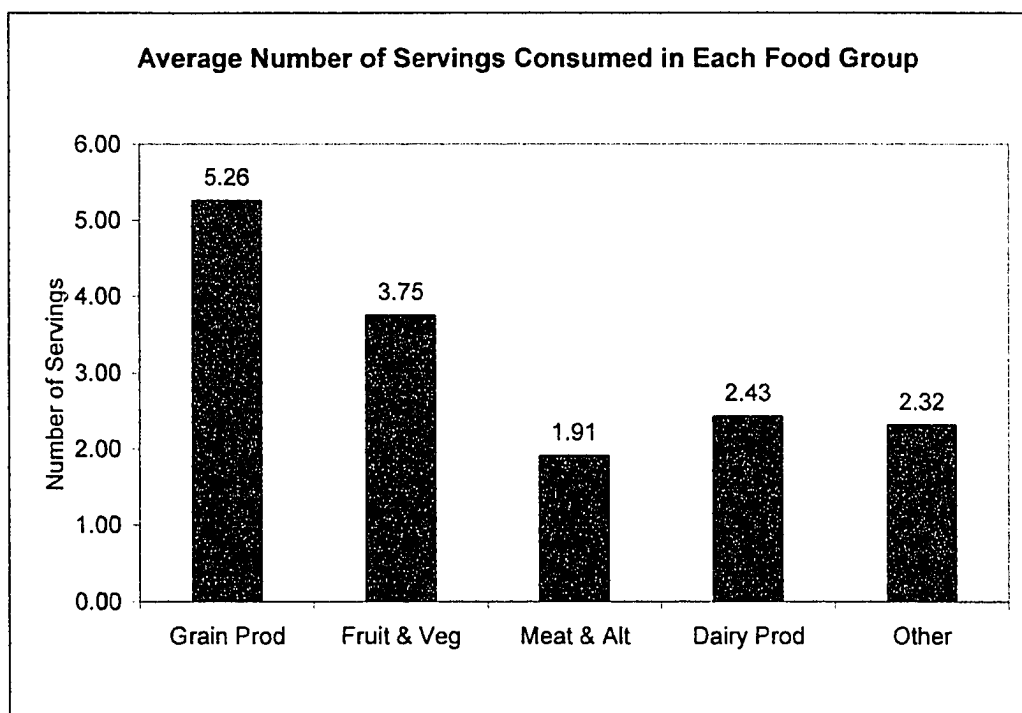
Diet Quality Measure	Mean Score	Score Range
Diet Quality Score	1.56	0 – 4
Summed Diet Quality Index	10.85	0 - 14
Weighted Summed Diet Quality Index	6.30	0 - 10

The mean number of servings consumed in each food group is presented in Figure 1. The children in the sample consumed an average of 5.26 servings of grain products, 3.75 servings of fruit and vegetables, 1.91 servings of meat and alternatives, 2.43 servings of dairy products, and 2.32 servings of other foods. These average servings meet or exceed the minimum daily serving recommendations for grain products and dairy

products only, although the value for meat and alternatives is only slightly below the recommended (Figure 3).

In the fruit and vegetables group, children consumed more servings of fruit than of vegetables. On average, approximately 1.6 servings of vegetables were consumed daily, compared with approximately 2.2 servings of fruit. The greatest contributor to intake of food from this group was consumption of fruit juice, with children consuming an average of 1.2 servings daily.

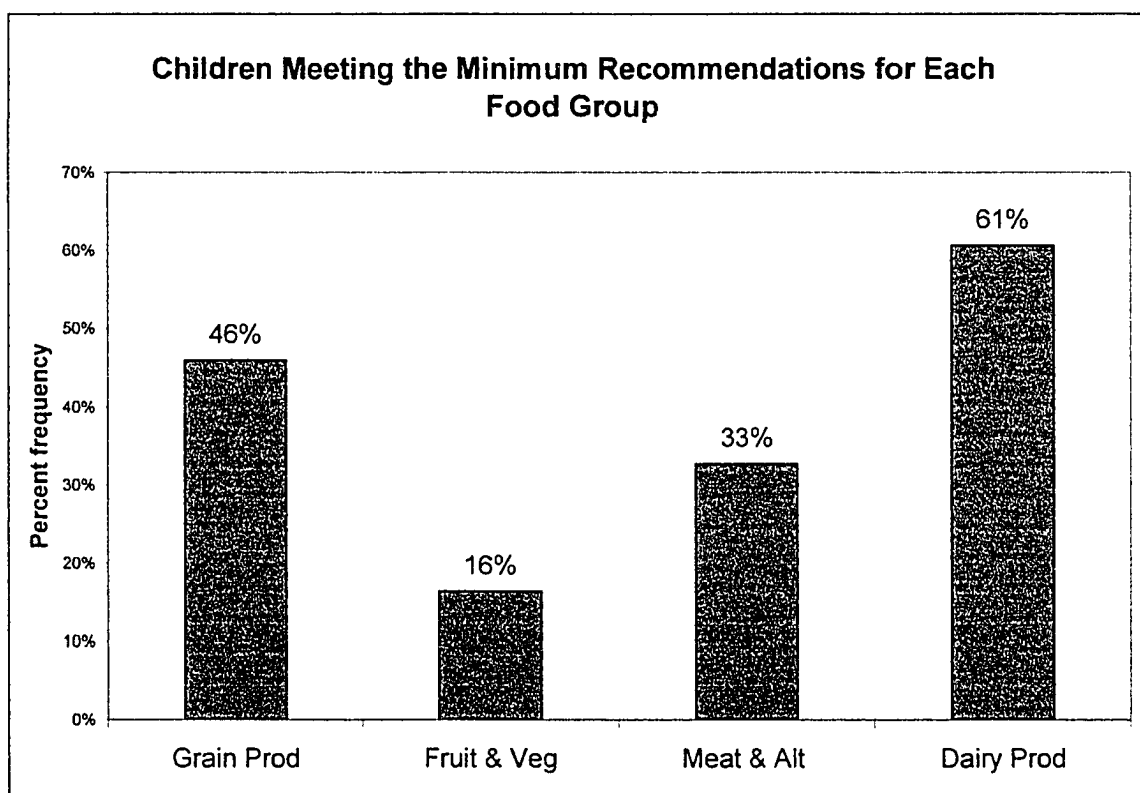
Figure 3 – Average number of servings consumed in each food group daily



The greatest number of children (61%) met the minimum number of recommended servings of dairy products. Less than half of the children (46%) met the minimum number of recommended servings from the grain products group. One third

consumed the minimum number of servings from the meat and alternatives group (Figure 4).

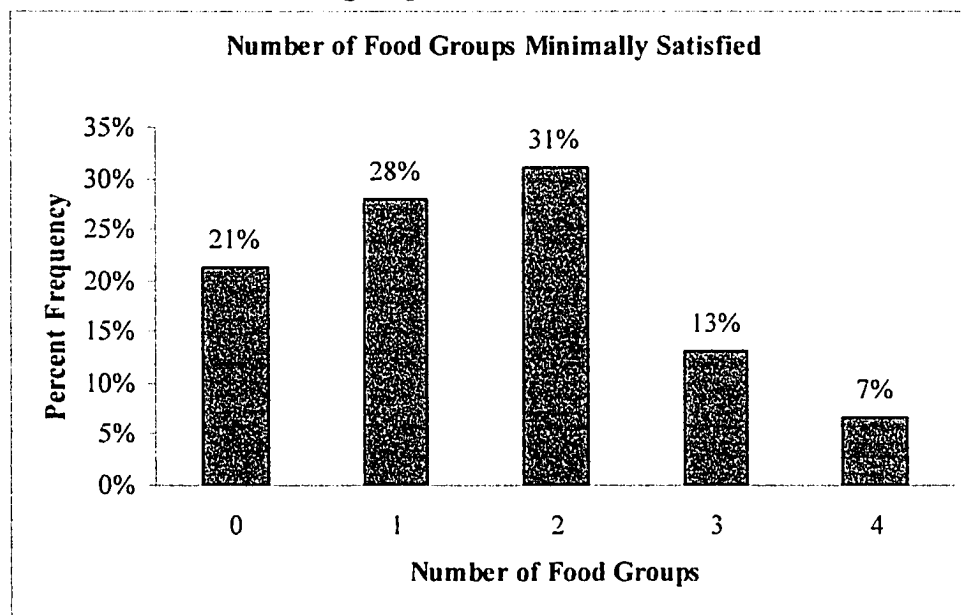
Figure 4 – Percent of children who met the minimum number of recommended daily servings for each food group



The food group with the lowest level of consumption was fruit and vegetables, with only 16% of the sample managing an intake equal to the minimum recommendation. Children consumed fewer servings of vegetables than of fruit. On average, they consumed 1.6 daily servings of vegetables, compared with 2.2 daily servings of fruit. Fruit juice was the most frequently-consumed item from the fruit and vegetables group, with children drinking an average of 1.2 servings of fruit juice per day.

Very few children consumed diets that provided them with the minimum number of recommended servings from all four food groups (7%), or from three of the four food groups (13%). More than half of the children in the sample (59%) were able to meet the minimum recommendations for only one or two food groups. Many children (21%) failed to consume the minimum number of recommended servings from any of the food groups (Figure 5).

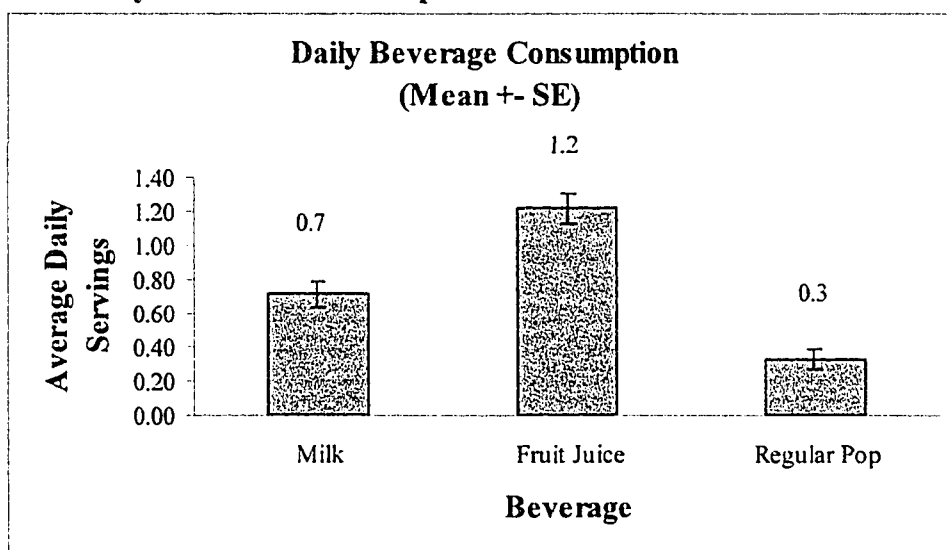
Figure 5 – Percent of children who met the minimum number of recommended servings in 0, 1, 2, 3 or 4 of food groups.



The Questionnaire for Children measured the consumption of three beverages: milk, fruit juice, and regular pop. The mean number of servings of each beverage consumed by children in the sample is presented in Figure 6. The most frequently consumed beverage was fruit juice, while regular pop was a much less common beverage choice. Average fruit juice consumption was 1.2 servings per day, four times greater

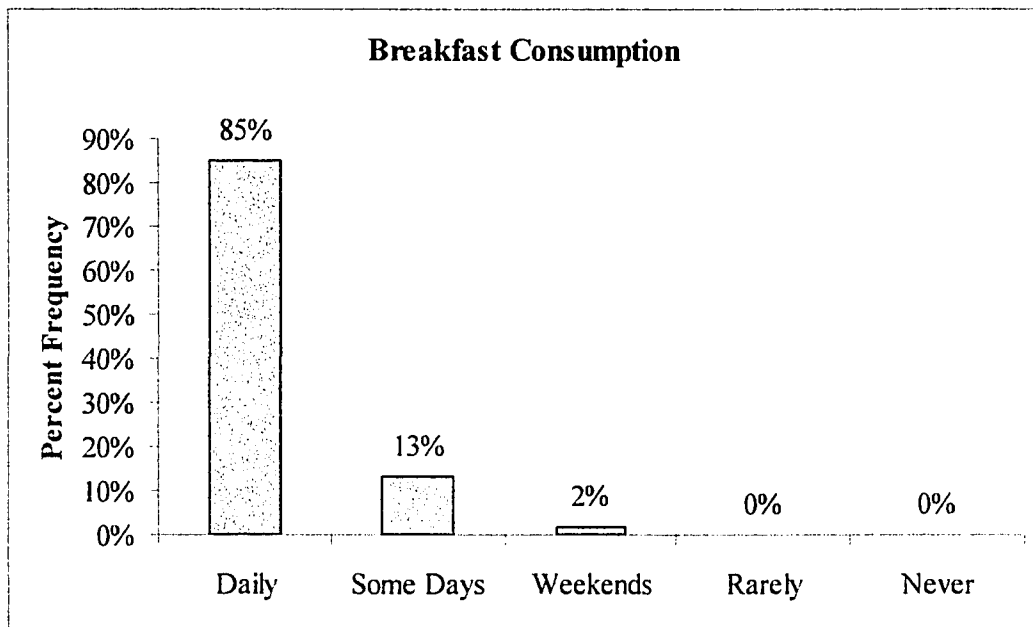
than the average number of servings of regular pop. Average milk consumption fell between the other two choices, with an average of 0.7 servings per day.

Figure 6 – Average number of daily servings of milk, fruit juice and regular pop consumed by children in the sample



The majority of children consumed breakfast on a daily basis. In response to the question "How often do you have something for breakfast?" 85% of respondents chose the answer "daily". Thirteen percent answered that they ate the meal on "some days". A small number of children (2%) only ate breakfast on weekends. No child responded that he or she "never" or "rarely" ate the morning meal (Figure 7).

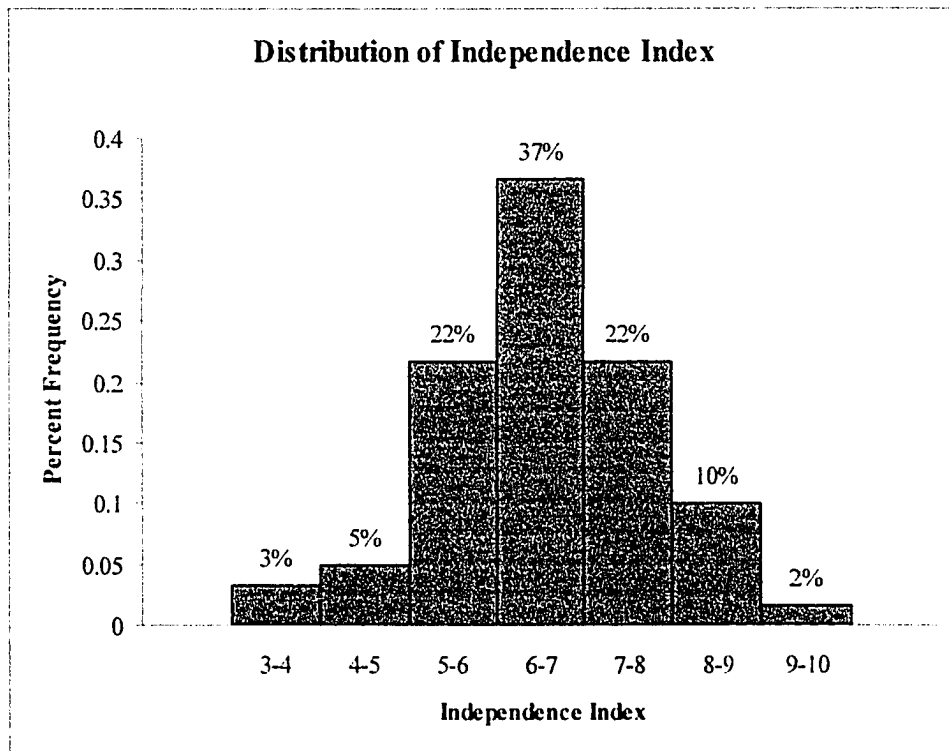
Figure 7 – Frequency of breakfast consumption, determined by children’s responses to the question “How often do you have something for breakfast?”



5.3 Dietary Independence

Most of the children in the sample displayed a moderately high level of dietary independence. The mean Dietary Independence Index score was 6.45 on a scale of 0 to 10, with 10 representing the highest degree of independence on the part of the children. The distribution of this index follows (Figure 8). The greatest number of respondents (37%) had a score between 6 and 7. Two percent had a score greater than 9 and 3% had a score between 3 and 4. No one had a score lower than 3.

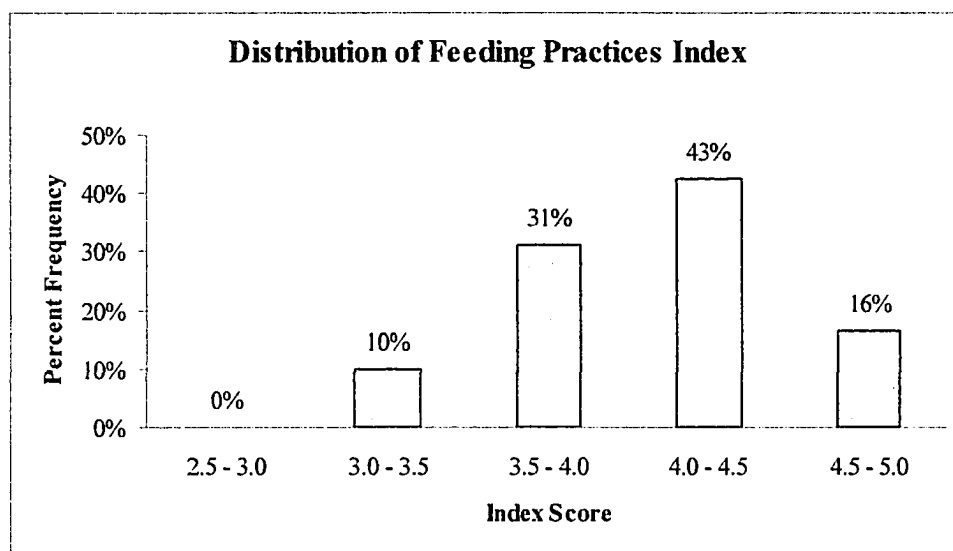
Figure 8 - Distribution of the Dietary Independence Index



5.4 Child-Feeding Practices

Overall, the parents in the sample displayed positive child-feeding practices. The mean Feeding Practices Index was 4.06 on a scale of 0 to 5, with 5 representing optimum child-feeding practices. The distribution of this index follows (Figure 9). Ninety percent of parents in the sample received a Feeding Practices Index score of greater than 3.5. No parent had a score of lower than 3.0. The greatest number of parents (43%) had a between 4.0 and 4.5.

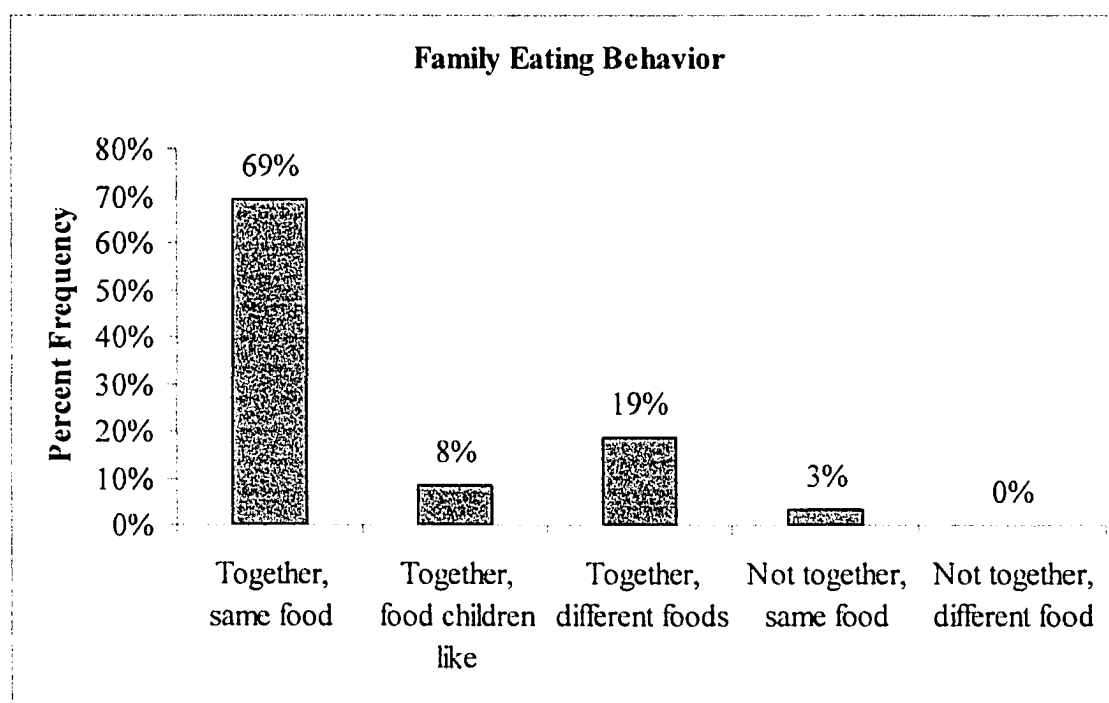
Figure 9 – Distribution of the Feeding Practices Index



5.5 Family Meal Patterns

Most of the families who responded to the survey frequently shared common meals. Family meal patterns were determined by asking parents to select one of five scenarios that best described their family at the evening meal. The greatest number of respondents (69%) selected the scenario “We usually eat together and everyone eats the same foods”. Eight percent chose “We usually eat together and plan meals around what the children will eat”, 19% chose “We usually eat together and not everyone eats the same foods”, and 3% chose “We don’t usually eat together but we eat the same foods”. No one selected the final scenario, “We don’t usually eat together and we eat different foods” (Figure 10).

Figure 10 – Percent of families engaging in each family meal pattern



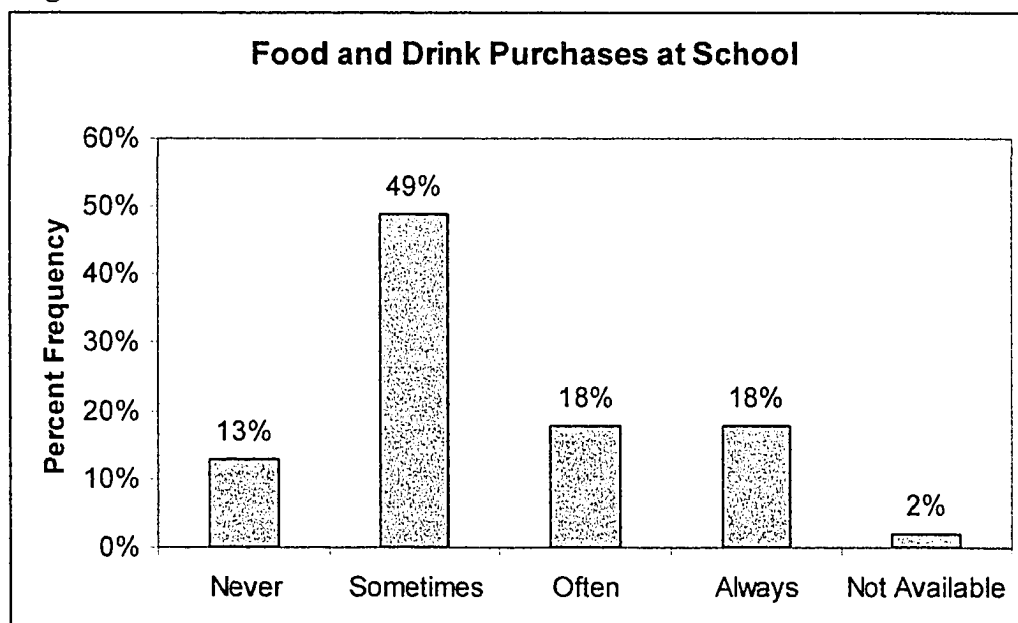
5.6 The School Environment

Only 12% of children in the sample attended schools where there are pop machines, and 16% had access to vending machines that sell snacks. Thirty percent of children could buy food from a canteen at school, and 92% attended schools with a hot lunch program. The frequency of hot lunch programs ranged from daily to weekly.

Parents were asked “How often does your child buy food or drink at school?” to determine the frequency with which children consume the foods that are available in the school environment. Possible responses were on a 5-point Likert scale and included the responses “never”, “sometimes”, “often”, “always”, and “no food or drink available at school”. The greatest number of parents (49%) answered “sometimes”. Eighteen percent of parents responded that their children “always” bought food or drink at school, and

13% answered “never”. Eighteen percent answered “often” and only 1 respondent (2%) chose the response “no food or drink available at school” (Figure 11).

Figure 11 – Frequency with which children in the sample purchased food and beverages at school



Among all children who purchase food and drink at school, the most frequently purchased foods are white milk (49% of respondents), pizza (23%), garlic fingers or garlic bread (11%), and hot dogs (10%) (Figure 12). Other commonly purchased foods and beverages are described below (Table 5).

Figure 12 – Foods and beverages most commonly purchased and consumed at school

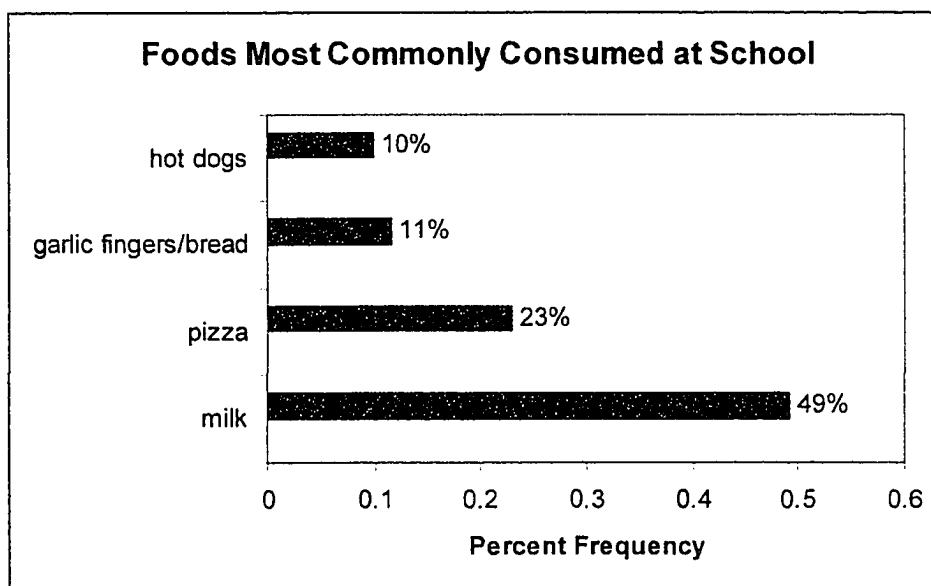


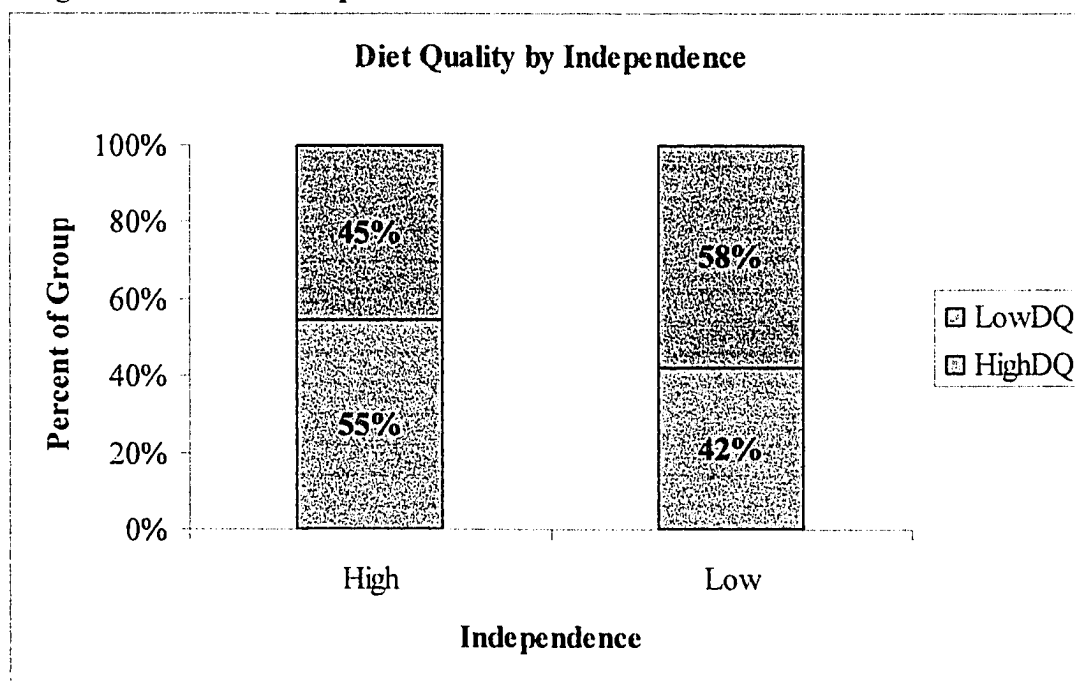
Table 5 – Foods and beverages most commonly purchased and consumed at school

Food or Beverage	Percent Frequency of Purchase	Food or Beverage	Percent Frequency of Purchase
White milk	49%	Cookies	7%
Pizza	23%	Sandwiches/subs	7%
Garlic fingers/ garlic bread	11%	Hamburger/ cheeseburger	7%
Hot dogs	10%	Salad	7%
Chocolate milk	8%	Chocolate bar	5%
Fruit juice	8%	Fruit/ fruit cup	5%
Chips	8%	Pasta dishes	5%

5.7 Trends in Diet Quality

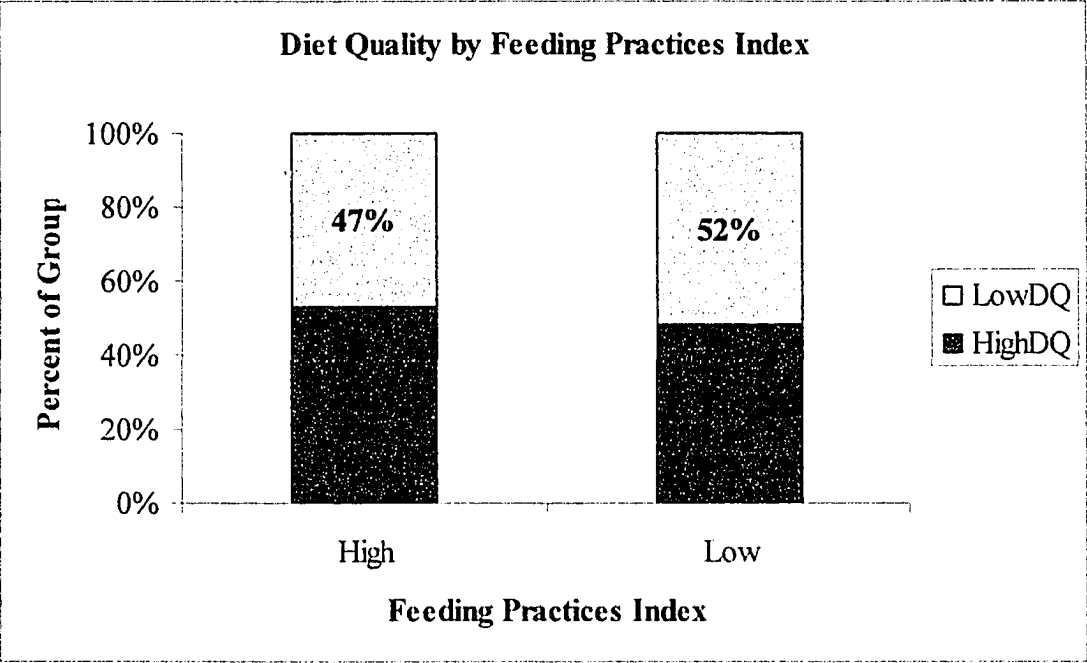
No statistically significant relationships were found among any of the variables being measured. However, two trends were evident in the sample that are of interest, although they cannot be generalized to the population level. First, children who exhibited a higher degree of dietary independence tended to have a higher diet quality. Similarly, children with lower dietary independence tended to have a lower diet quality (Figure 13).

Figure 13 – Relationship between dietary independence and diet quality among children in the sample



The second trend evident in the sample is the relationship between diet quality and parents' child-feeding practices. Parents who engaged in more positive child-feeding practices tended to have children with a higher diet quality. Likewise, parents with lower scores for child-feeding practices tended to have children with lower diet quality (Figure 14).

Figure 14 – Relationship between diet quality and child-feeding practices among families in the sample



Chapter 6: Discussion

The results of this study indicated that many New Brunswick school children did not consume diets that were consistent with the recommendations in *Canada's Food Guide to Healthy Eating*. The results for diet quality revealed several dietary shortfalls, although these were somewhat tempered by a number of favorable findings. Overall, given the relationship between diet quality and good health, these results highlight the need for intervention and education at the level of the child, the family, and the school.

The evidence also suggests that family rules have an impact on diet quality, a contention that is clearly supported in the literature. Despite a lack of statistically significant relationships, weak associations indicate that there are important relationships among diet quality, child-feeding practices, and dietary independence. Overall, the results of this research support the role of the family environment in shaping children's diet quality. However, factors external to the family also exert their influence and likely contribute to the overall quality of the diet.

6.1 Diet Quality

The information on diet quality gleaned by this research is perhaps the most important component of this study. Previously, little was known about the diet quality of children in New Brunswick. This gap in knowledge is particularly concerning given the association between diet quality and nutritional health, and the short- and long-term health consequences of consuming a chronically unhealthy diet (5, 10, 11, 12, 15, 17). Unfortunately, the results demonstrated that the diet quality of New Brunswick school children needs improvement. Very few children consumed a diet that met the minimum

number of recommended servings for all four food groups, and nearly half failed to satisfy the recommendations for more than one food group. Overall, parents, teachers, and other involved adults have reason to be concerned about the diet quality of the children for whom they are responsible.

Fruit and vegetable consumption was especially poor. An overwhelming majority of children failed to meet the minimum number of recommended servings for this food group, and average fruit and vegetable consumption was more than a full serving below the recommendations. These results were similar to those of children in Ontario and on Prince Edward Island who responded to the same food frequency questionnaire, although a smaller majority of children in these provinces failed to consume five or more daily servings of fruit and vegetables (32). New Brunswick children are therefore not unique in their failure to adequately consume fruit and vegetables. Rather, the results of this study support mounting evidence that, in general, children are not consuming fruit and vegetables in amounts that are consistent with good health (21, 32).

Intakes of grain products and meat and alternatives were marginal. Less than one half of children had adequate intakes of grain products, and only one third consumed meat and alternatives in adequate amounts. Compared to the youngest participants in the *Food Habits of Canadians* study, substantially fewer children in this sample met or exceeded the minimum recommendations for these food groups (27). Although consumption of grain products and meat and alternatives is less dramatically deficient than that of fruit and vegetables, it is clear from these results that efforts to improve diet quality must encompass all three of these food groups.

The most favorable result, in terms of diet quality, was the frequency of dairy product consumption. For this food group alone, the majority of children met or exceeded the minimum number of recommended servings. The children had a dairy product intake that was comparable to that of the youngest participants in the *Food Habits of Canadians* study (27). This positive result is partially attributable to the fact that approximately half of the children regularly purchased milk at school, suggesting that the school milk programs in District 18 have been effective. School milk programs have been shown to increase both frequency of milk consumption and intakes of calcium and vitamin D among participating students (64).

Consumption of other foods was moderate. High-energy, low-nutrient choices were selected with a frequency of approximately two servings per day. This represents a level of intake somewhat lower than the estimate that Canadian children obtain 25% of their caloric intake from other foods (27). New Brunswick children therefore exhibited a reasonable degree of indulgence in other foods; their diet quality was not significantly compromised by their consumption of energy-dense, nutrient-deficient snack foods.

These results suggest that a paradigmatic shift is necessary. Parents tend to focus on restricting snack foods rather than encouraging the consumption of healthy foods (49). Based on these results, the task of improving children's diet quality would be best served by focusing on the promotion of healthy foods from the four food groups, as opposed to concentrating on limiting snack foods. The validity of this approach is further supported by the fact that restricting other foods does not improve diet quality but rather increases children's desire for those foods, which can lead to immoderate intakes (42, 49). The dietary shortfalls evident among children in the sample resulted from their failure to

adequately consume foods from the four food groups, not from an over-consumption of other foods. A redirected focus on increasing the availability of healthy foods and encouraging their consumption would therefore be more likely to result in improvements in diet quality.

The favorable balance between nutritious and less healthy items was particularly evident in the area of beverage consumption. The children in the sample drank regular pop less often than either milk or fruit juice. This refutes the suggestion that Canadian adolescents are consuming sweetened beverages in increasing amounts (26), and that frequent pop consumption is displacing healthier beverage choices (28). This result also counters evidence from the United States that milk consumption is declining (23). It appears that generally healthy beverage choices were being made by these children and their parents.

These results also demonstrate how beverage choice can affect overall diet quality. The high reported frequency of milk consumption, particularly at school, is no doubt partially responsible for the fact that more children met the minimum number of recommended servings of dairy products than of any other food group. Similarly, fruit juice was the most commonly consumed item from the fruit and vegetables group. Without the contribution made by fruit juice, even fewer children would have met the minimum number of recommended servings for this food group. The literature suggests that unhealthy beverage choices, in the form of sweetened soft drinks, can have a detrimental impact on diet quality (26, 28). These results take this premise one step further by indicating that the selection of healthy beverages, in the form of milk and fruit

juice, can improve diet quality by helping children satisfy the recommendations in *Canada's Food Guide to Healthy Eating*.

Breakfast consumption is also associated with children's ability to adequately consume foods from the four food groups (31). Most children in the sample ate breakfast on a daily basis, and no child reported that he or she never ate breakfast. Frequency of breakfast consumption was substantially higher among these children than among children of the same age on Prince Edward Island and in Ontario with whom the same food frequency questionnaire was used (32). These results suggest that the decreasing trend in the frequency of breakfast consumption reported in the United States is not occurring among New Brunswick children (30). On the contrary, the families in the sample appear to have adopted very healthful family rules that promote daily breakfast consumption. Either these rules were successful in overcoming the barriers to regular breakfast consumption (30, 31), or these barriers were not present in these family environments.

Breakfast consumption is positively associated with diet quality and negatively associated with obesity (30). Those who skip breakfast are less likely to meet their nutritional requirements and may be more likely to engage in other unhealthy dietary practices (65). Although no statistically significant relationship was found between breakfast consumption and diet quality for this sample, based on the literature it is reasonable to assume that the high frequency of breakfast consumption had a positive effect on overall diet quality; the children's diet quality may have been even poorer had they not eaten breakfast on a regular basis.

6.2 Child-Feeding Practices

Many of the studies that demonstrate a positive association between diet quality and parental practices examine only one, or a limited number of, child-feeding practices. Associations have been found between diet quality and each of several specific child-feeding practices, including dietary restriction, dietary disinhibition, food neophobia, parental concern regarding children's weight, and parental attitudes toward nutrition and health (36, 40, 42, 45, 46, 47, 51, 52). The Feeding Practices Index (FPI) created in this study is unique in that it considers the combined effects of all of these variables. This allowed a measurement of parents' overall approach to child-feeding, rather than limiting the scope of the research to a few specific practices.

Parents who exhibited the healthiest overall child-feeding practices tended to have children with a comparatively higher diet quality. This result was not unexpected, given the well-established importance of the family environment in shaping children's diet quality. What is noteworthy about this finding is that the child-feeding practices measured by the Questionnaire for Parents were purposefully ubiquitous; these questions referred to very common, everyday child-feeding issues that would transcend most sociodemographic differences that may have existed among parents in the sample. Therefore, the key to optimizing children's diet quality may be in parents' handling of the mundane, daily and routine issues surrounding food and nutrition. There is no magic bullet solution to improving children's diet quality. Rather, parents need to adopt effective family rules that respond to everyday feeding issues in a consistent and health-oriented manner, an approach that is amenable for use by parents with varied

sociodemographic backgrounds. In this way, parents can both optimize and maximize their impact on their children's diet quality.

One such effective family rule is the sharing of common family meals. Almost all of the families in the sample usually ate the evening meal together. This result is inconsistent with the suggestion that family meals are declining; studies from the United States estimate that only one-half to one-third of pre-adolescent children habitually participate in family meals (21, 22). It would appear, therefore, that parents in New Brunswick have placed considerable value on family meals, making them a priority in their lives. Alternatively, or perhaps concomitantly, it is possible that the factors that have led to a decline in family meals in other regions are not exerting the same degree of influence on New Brunswick families. Further research in this area is needed to more fully explore the reasons for the high frequency of family meals observed among these New Brunswick families.

Frequent family meals are associated with improved diet quality among children. At shared family meals, children consume greater amounts of energy, fruit and vegetables, grain products, fiber, protein, vitamins, and minerals. They are also less likely to consume saturated fats, fried foods, and sugary beverages (21, 22). Although no statistically significant relationship between family meals and diet quality was evident, the literature in this area suggests that the high frequency of shared family meals observed in the sample likely had a positive impact on the children's overall diet quality. At the very least, it provided parents with ample opportunity to model healthy eating habits, to introduce new foods, and to discuss nutrition with their children, all of which are important for shaping future eating behaviors (21, 40, 49).

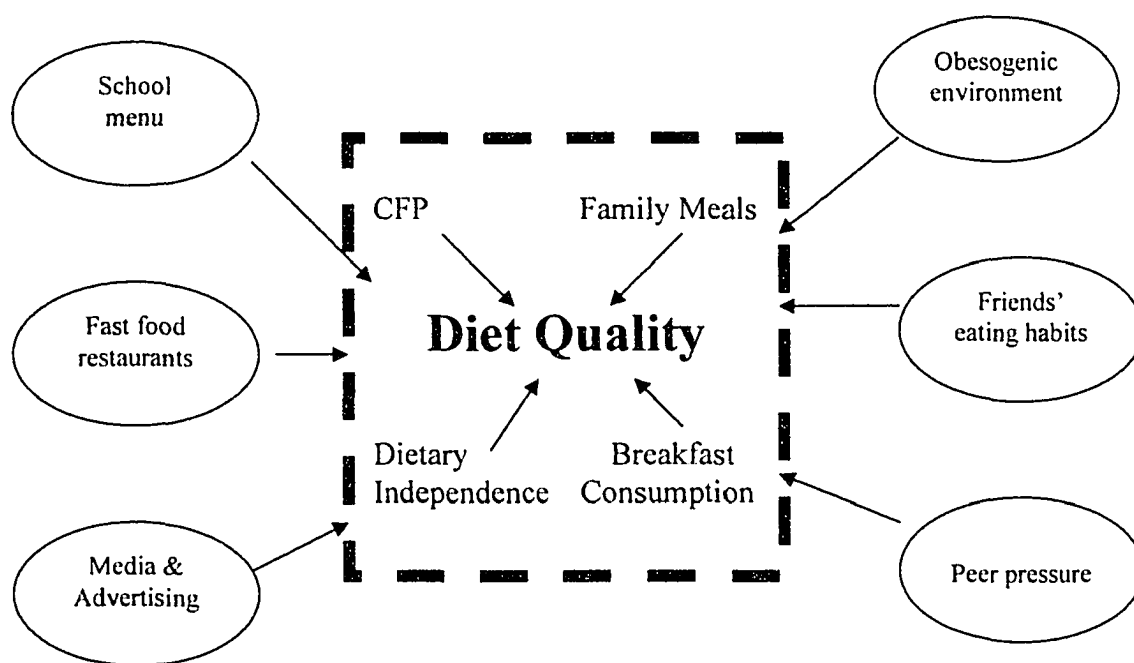
The parents in the sample received high FPI scores, demonstrating that they espoused generally positive child-feeding practices and healthful approaches to childhood nutrition. Yet despite this finding, and despite the positive relationship between child-feeding practices and diet quality, many children still failed to consume a high quality diet. This seemingly paradoxical result suggests that the influence of the family environment over diet quality is impinged upon by competing factors in the broader environment. These other factors appear to have had a detrimental effect on diet quality despite the positive child-feeding practices that were present in the family environment. This notion is supported by information gleaned from focus groups with young adolescents, who state that their parents' child-feeding practices have a lesser impact on their food selection habits than do hunger, food cravings, taste, time, convenience, and food availability (66).

While it is clear that the family environment has a powerful effect on diet quality and the development of early food habits (5, 9, 40, 45), families do not exist in a vacuum. Modern society is an obesogenic environment, where opportunities for over-consumption of unhealthy foods abound despite the high value placed on thinness (9). Environmental factors that influence children's diet quality are not limited to those that occur within the family context, but rather include factors found in both the mesosystem and the exosystem. External factors that have the potential to impact diet quality include food availability at school, peer pressure or peer group norms, media advertising, and the location of fast food restaurants and other sources of unhealthy foods (5, 33, 66).

The degree to which external factors influence diet quality may depend upon the boundary maintenance that occurs within each family system (59). According to Family

Systems Theory, some family systems have highly permeable boundaries, meaning that little or ineffective action is taken to filter out negative influences from the larger environment in which the family exists. The parents in these families may have relatively positive child-feeding practices, but that may not be enough to override the negative influences on diet quality that originate outside the family environment (Figure 15).

Figure 15 – The multiple influences on diet quality in a family system with permeable boundaries



To combat the negative environmental effects on diet quality, parents need to take proactive measures to maintain the integrity of their family boundaries. By identifying the external factors that are in conflict with the family's health goals, parents can attempt to limit the impact of these factors on their children's diet quality (59). Evidence from

this study suggests that parents who engaged in better child-feeding practices within the family environment improved their children's diet quality, but that factors external to the family system may have had deleterious effects that parents could not overcome through feeding practices alone. Parents therefore need to become more aware of which external factors from the surrounding obesogenic environment (9) are threatening their children's diet quality and nutritional health, and take appropriate action to minimize the detrimental effects of these forces.

6.3 Dietary Independence

The concept of dietary independence is relatively unexplored in recent literature. The few studies that address dietary independence do so only tangentially, suggesting that increasing autonomy is partially responsible for the decline in diet quality that occurs during the transition from childhood to adolescence; however, no direct measure of dietary independence is included in these studies. This contention is based largely on two assumptions. First, that the higher degree of general autonomy observed among adolescents, as compared to younger children, can be extrapolated to include autonomy in the area of diet and food selection. Second, that the independent food choices made by adolescents are likely to be unhealthy (5, 18).

With respect to the latter assumption, the proposed negative association between diet quality and food-related autonomy is refuted by the results of this study. A weakly positive association between dietary independence and diet quality was evident; children who displayed a higher level of dietary independence tended to consume a better quality diet. This trend is perhaps best explained by considering it conjunction with the child-

feeding practices variable: the children with the highest diet quality tended to exhibit greater dietary independence and to have parents with more positive child-feeding practices. The relationship between dietary independence and diet quality therefore appears to be mediated by food-related parenting style.

Two possible scenarios illustrate the interconnectedness of these three variables. First, the parents with the more positive child-feeding practices may have allowed their growing children to assume more dietary independence, but continue to provide guidance and support to help them make healthier food choices. Alternatively, parents may have used their positive child-feeding practices to foster the development of healthy food habits in their children. Recognizing this, the parents are comfortable affording their children a greater measure of dietary independence. These scenarios highlight the reciprocal nature of the parent-children relationship within the context of the family system. Each family member both influences and responds to the actions of the other family members with whom they interact. This circular causality characterizes the complex familial influences surrounding dietary independence.

Either scenario is consistent with an authoritative or responsive parenting style, in which parents establish clear boundaries for their children while affording them age-appropriate levels of independence (39, 40). Authoritative parenting is associated with greater fruit intake by children, which can be viewed as a proxy for diet quality (39). The association among diet quality, dietary independence, and child-feeding practices observed in the sample therefore supports the contention that the parents with the more positive child-feeding practices were likely practicing authoritative parenting.

Conversely, the children with lower diet quality tended to demonstrate less dietary independence and were more likely to have parents with poorer child-feeding practices. This suggests an authoritarian or demanding parenting style, where parents exert greater unilateral control over their children's diets (40). There is some evidence that children who grow up in authoritarian households are at risk for lower diet quality than children raised by authoritarian parents (39). The results support the supposition that greater parental control is associated with less effective child-feeding practices and, in turn, lower diet quality among children.

The association between parenting style and dietary behaviors is emerging research (39). The contention that such an association exists is strengthened by the suggestion that, in this sample, those with better child-feeding practices are engaging in authoritative parenting while those with less effective child-feeding practices are likely authoritarian parents. Although parenting style was not measured directly in this study, many of the parental behaviors that characterize authoritative and authoritarian parenting were investigated, including to what extent decision-making and control are shared between parent and child. These results therefore support the hypothesis that the relationship between child-feeding practices and diet quality is mediated by parenting style (39).

In general, the children in the sample displayed a moderate level of dietary independence. This supports the assumption that the increasing autonomy that occurs during the transition from childhood to adulthood does extend to include food-related behaviors (5, 18). As pre-adolescents who are beginning to take more responsibility for all activities of daily living, these children would be expected to exhibit an intermediate

level of dietary independence and thus have some control over their own dietary intake. As this stage of development continues, it is incumbent upon the influential and responsible adults in their environment to ensure that they are equipped and prepared to assume ultimate responsibility for their own diet quality as they reach adulthood.

In this study, measures of dietary independence included participation in the preparation of meals and snacks, making requests for special foods, selecting the restaurant when the family went out to eat, and the child spending his or her own money on snacks or edible treats. These are all examples of family rules that relate to dietary independence, but may not be an exhaustive list. Future research may identify other salient features of family life that impact children's food-related autonomy. Overall, more research is required to elucidate the nature of the relationships among dietary independence, diet quality, child-feeding practices, and parenting style.

6.4 The School Environment

Outside the family, the school environment is where children of this age spend the greatest amount of time. Every weekday, they have the opportunity to consume at least one meal and one snack at school, whether these are comprised of foods brought from home or items purchased at school. Children purchasing food and beverages at school are a captive market, their diet quality during school hours at the mercy of the nutritional value of the items on offer. Given the demonstrated short- and long-term importance of consuming a healthy diet, schools have a fiduciary duty to optimize the nutritional quality of the fare they are providing to their students.

Schools in District 18 have clearly made some effort to offer their students healthier food and beverages choices, and the results suggest this had a positive impact on diet quality. Purchasing and drinking milk at school was a very common practice among the children in the sample, which no doubt contributed to the fact that more of them met the minimum recommendations for dairy products than for any other food group. This supports the contention that there is an association between a school's food environment and the overall dietary intake of its students (33).

Such an association is worthy of even greater attention and responsiveness by District 18 schools, especially given the dietary shortfalls that were evident among children in the sample. These schools need to avail themselves, to a greater degree, of the opportunity to make a positive contribution to the diet quality of their students. Unfortunately, milk was the only healthier food among the four most commonly purchased items. Other healthy foods and beverages were available at most schools, but were purchased less frequently. The results suggest that the goal for these schools should be not only to offer more healthy choices, but also to increase the number of children who choose to purchase these items.

Schools need to strike an appropriate balance between the healthy and less healthy food choices they offer. While a quick and obvious solution would be to eliminate less healthy foods and beverages from the school menu, this is perhaps not the best approach in the long term. Offering only healthy, nutritious foods would create an artificial environment by removing the necessity for choice. In addition, restricting high-energy, low-nutrient foods is counter-productive, since it tends to increase children's desire for

those foods. This can lead to an immoderate intake of the desired foods when they become available (45, 46, 49, 50).

A preferable alternative is to ensure the availability of healthy foods while educating, encouraging and enticing children to choose these foods more often. Schools are well placed to provide nutrition education programs, which could incorporate practical instruction on identifying and choosing healthier foods and beverages from the options available at school. A school food environment where both nutritious and less healthy options are available imitates the real world, and is amenable to discussions regarding balance and moderation. But education is not enough, on its own, to elicit the adoption of healthy behaviors. There is a temporal gap between the consumption of nutritious foods and the enjoyment of their attendant health benefits; the promise of future good health is not a primary concern for children and adolescents, especially compared to the instant gratification of eating highly palatable snack foods (66).

Enticing children to purchase and consume healthy foods at school requires making those foods more appealing, whether in terms of taste, appearance, or convenience. These factors are of greater importance to youth than health considerations (66). In response to the question regarding what foods and beverages children purchased at school, one parent in the sample wrote that her child “does not like the salads because they come soft and wilted”. According to this child’s food frequency questionnaire, he eats salads 1 to 3 times per week, presumably at home. This is an example of how healthier choices, which might otherwise have been purchased, are ignored by children if they are perceived as being unappealing or of poor quality. The challenge for schools, therefore, is to prepare, package, and market healthier choices in ways that make them

appealing to their target demographic. Some simple suggestions for accomplishing this include serving raw vegetables with dip and ensuring that fruit is appropriately ripe (66).

Offering healthy foods at school could have an impact that extends beyond just the school environment. From an ecological perspective, the family and school environments are interconnected and have a relationship characterized by reciprocal determinism (5, 60), suggesting that positive changes in one environment could prompt the adoption of better health behaviors in the other. For example, the inclusion of more nutritious items on the school menu could serve to familiarize children with foods to which they may not have been exposed at home. This familiarization could lead to an increased acceptance of these foods, which could, in turn, improve diet quality (49). If children then request these foods at home, they may precipitate a change in the family environment with respect to the range of healthy foods that are available in the home.

The majority of children regularly purchased food and drinks at school, with a frequency ranging from daily to weekly. This suggests that any benefit from increasing the consumption of healthy foods at school would be gleaned by the children in District 18. This opportunity to improve dietary intake should be maximized, given the demonstrated need for better diet quality among these children. There is a role for schools in the quest to improve children's nutritional health and in the fight against childhood overweight and obesity. This can be accomplished, for example, by providing appropriate nutrition education and by striving to ensure that healthier items are an appealing and attractive choice for the many children who purchase food and beverages at school.

Chapter 7: Summation

7.1 Conclusions

Overall, these results demonstrated that the diet quality of children in New Brunswick needs improvement. Too many children did not meet the minimum number of recommended servings from the four food groups. Greater emphasis on consuming foods from the four food groups is needed. Consumption of fruit and vegetables was particularly low; this is a specific target area for improvement, especially since this food group contains many nutrient-rich, low-energy items that are conducive to general good health. A concentrated and concerted effort to improve the diet quality of growing children is necessary to improve their nutritional health and prevent the development of chronic health conditions, including overweight and obesity. Overall, the results suggest that increasingly the availability of healthy foods and actively promoting their consumption is more important than unduly restricting less healthy snack foods for this group of school children.

This research adds support to the assertion that children's diet quality is shaped, at least in part, by the family environment. Weak associations between diet quality and family rules were evident; diet quality tended to improve with better child-feeding practices and greater dietary independence. This suggests that there is a relationship between diet quality and specific family rules, one that may be mediated by parenting style. The family environment has the potential to exert considerable influence over children's diet quality, though it is not the sole factor on which diet quality is predicated. Given the multitude of competing and contradictory messages that originate from the

obesogenic environment that engulfs modern society, parents need to work even harder at strengthening the family environment to ensure their children consume a healthy diet.

Finally, the number of children who frequently consumed food and beverages at school supports the inclusion of the school environment as a contributor to diet quality. Both healthy choices and less nutritious items were offered by schools in the sample. This suggests that schools are making an effort to improve the nutritional quality of the foods and beverages they provide while continuing to offer traditional favorites. In order to optimize diet quality in the school environment, however, a greater commitment to improving the nutritional quality of the items being offered is necessary. School children should be offered a nutrition education program designed to increase both their ability and their motivation to make healthy food choices.

7.2 Limitations

There are four principle limitations to this research. First, the response rate of 24.4% was relatively low. This could have been due in part to the use of a mail-out; however, this method of reaching potential participants was most compatible with the use of random sampling in this particular study. Response rate may also have been influenced by the fact that the questionnaires were mailed toward the end of the school year, when families may have been leaving on vacation.

The potential for a low response rate was anticipated by the researcher and measures were taken to mitigate its effects. The random selection of 250 families was deliberate over-sampling with the aim of increasing the number of responses. Other strategies that have been shown to increase response rate were used, including providing

the families with a postage-paid envelope in which to return the questionnaires and sending reminders to all families in the sample in order to prompt those who had not yet responded (67). Finally, there was no cut-off date for the inclusion of responses in the final sample. Although families were asked to complete the questionnaires as soon as possible, data analysis was not completed until all responses had been received. As a result, the data collection occurred over a period of approximately eight weeks.

Second, the dietary shortfalls that were evident in the sample may be even more pronounced in the larger population, given the important differences that may exist between those families who returned the questionnaires and those who did not. Compared to non-responders, those who respond to mailed surveys tend to be better educated, come from different socioeconomic backgrounds, and have an interest in the topic being investigated (68, 69, 70). Those who respond specifically to mailed health surveys typically engage in more positive health practices and are more health-conscious than those who choose not to participate (70, 71). The parents who participated in this study likely have an interest in childhood nutrition and engage in positive health and nutrition behaviors. Their children would be more likely to receive the encouragement, and have the opportunity, to consume a higher quality diet. Although no demographic information about the families in the sample was available, it is conceivable, based on the literature, that the general population of New Brunswick school children may have an even poorer diet quality than was observed in the sample.

An extreme example of this response bias was the parent who returned the questionnaires with the following note attached to the Questionnaire for Children: "My son is tube fed on a complete liquid diet of Pediasure and is fed only at night time. This

questionnaire doesn't apply to him. Sorry.” Nonetheless, this parent responded to the few questions on the Questionnaire for Parents that were applicable to their family. This illustrates the high level of parental concern with health and nutrition that may have been present within the sample.

A third limitation is the limited geographic scope of the sampling frame. Although District 18 is relatively large in area and is comprised of both urban and rural regions, it may not be representative of all of New Brunswick. In particular, the large Francophone region of the province is not represented since District 18 is located in a primarily Anglophone area. As well, District 18 contains the city of Fredericton, which is the provincial capital and home to two universities. Residents of Fredericton may therefore differ in important ways from those of other cities or regions in New Brunswick.

Finally, there are limitations to the use of a food frequency questionnaire for dietary analysis. Participants may misrepresent the frequency with which they eat certain foods; foods perceived as healthy may be overestimated and foods perceived as unhealthy may be underestimated. This could have resulted in the over- or underestimation of the types and/or frequency of foods consumed by the children in the sample. In addition, the children may not have accurately reported the contribution made by combination foods such as soups, stews and casseroles. These mixed meals contain items from more than one food group, and their accurate inclusion in dietary assessment significantly increases the likelihood of meeting the *Canada's Food Guide* recommendations (72). There is no available data on whether children are capable of disassembling these foods into their

composite parts for inclusion on a food frequency questionnaire, but their failure to do so accurately would underestimate their intake of foods from the four food groups.

7.3 Recommendations for Future Research

Prior to this study, little was known about the nutritional health of children in New Brunswick. This is a preliminary study, which lends itself to posing recommendations for future research. Completing the picture of diet quality and other modifiable risk factors for childhood obesity in New Brunswick will require studies with greater depth and breadth of scope. Ideally, future research would examine a greater number of children of different ages from different geographical regions of the province. With a larger sample size, statistically significant relationships between diet quality and certain family rules, including child-feeding practices and dietary independence, may be detectable.

Most importantly, future research should attempt to access members of the population who are most likely to be non-responders, including families with lower socioeconomic status or those with less interest in health and nutrition. Since diet quality among children in these families is likely to be even poorer than was observed in this sample, accessing this population would give a more accurate and complete picture of the diet quality of children in New Brunswick. This, in turn, could serve as a needs assessment upon which education and intervention programs could be based. It is clear that proactive measures are necessary to improve the nutritional health of New Brunswick children; further research will afford greater insights into the magnitude of the

problem, thus allowing for the development of programs with appropriate depth and breadth of scope.

Finally, further research is needed in the area of dietary independence. Results of this study suggest that dietary independence is an aspect of the family environment with implications for diet quality, but little work has been done in this area. Specifically, what influences food choices as children gain independence? Many environmental factors could be examined for their potential impact on independent food choices, including knowledge of nutrition, education programs in schools, parental or familial influence, peer pressure, personal preferences, and the palatability of foods or beverages.

Overall, more information is needed regarding the nutritional health of children in New Brunswick. Poor nutritional habits and unhealthy weight status have the potential to perpetuate significant future costs to individuals, families, communities, and to the health care system. It is of the utmost importance that modifiable risk factors for chronic health conditions be identified and addressed during childhood. Individual quality of life can be preserved, and health care expenditures curbed, if effective prevention programs are designed and implemented early. The overarching goal of further research should be to provide health information that will lead to a decrease in the incidence and prevalence of childhood obesity and compromised nutritional status, including poor diet quality.

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Appendix A

Questionnaire for Children

1. How often do you have something for breakfast?

- ☐ Every day
- ☐ Some days
- ☐ Rarely
- ☐ Weekends only
- ☐ Never

2. How often have you eaten any of these foods in the last seven days?
For each food, please fill in the circle.

Food	At least twice a day	Once a day	4 to 6 times a week	1 to 3 times a week	Never
Milk (on cereal or alone)	☐	☐	☐	☐	☐
Cheese	☐	☐	☐	☐	☐
Yogurt and frozen yogurt	☐	☐	☐	☐	☐
Eggs	☐	☐	☐	☐	☐
Ice cream	☐	☐	☐	☐	☐
French fries	☐	☐	☐	☐	☐
Other kinds of potato	☐	☐	☐	☐	☐
Salad	☐	☐	☐	☐	☐
Other vegetables	☐	☐	☐	☐	☐

Food	At least twice a day	Once a day	4 to 6 times a week	1 to 3 times a week	Never
Beans (baked, kidney beans, lentils, tofu)	☐	☐	☐	☐	☐
Peanut butter	☐	☐	☐	☐	☐
Fruit	☐	☐	☐	☐	☐
Fruit juice	☐	☐	☐	☐	☐
Bread, bagels, pitas, English muffins, crackers, tortillas	☐	☐	☐	☐	☐
Rice	☐	☐	☐	☐	☐
Spaghetti, macaroni or other pasta	☐	☐	☐	☐	☐
Pizza	☐	☐	☐	☐	☐
Cheerios, Shreddies, Rice Krispies, Corn Flakes, Raisin Bran, Frosted Flakes and other cold cereals	☐	☐	☐	☐	☐
Oatmeal, Cream of Wheat and other cooked cereals	☐	☐	☐	☐	☐
Hamburgers, beef, pork, hot dogs, sausages, lunch meats, other meat	☐	☐	☐	☐	☐

Food	At least twice a day	Once a day	4 to 6 times a week	1 to 3 times a week	Never
Chicken, turkey or fish	☐	☐	☐	☐	☐
Cakes, cookies, pie, doughnuts	☐	☐	☐	☐	☐
Potato chips, tortilla or nacho chips, Cheesies, pretzels, other snack foods	☐	☐	☐	☐	☐
Candy, chocolate bars	☐	☐	☐	☐	☐
Regular (not diet) soft drinks	☐	☐	☐	☐	☐

Appendix B

Questionnaire for Parents

Thank you for taking the time to complete this questionnaire. Please think about the child in your family who is in grade 4 or 5 when answering these questions. This questionnaire has 4 parts.

Part 1 Please circle your answer to the following questions.

How often does your child.....

Make his or her own breakfast?

Never Sometimes Often Always Does not eat breakfast

Pack his or her own lunch for school?

Never Sometimes Often Always Does not take lunch to school

Make his or her own snacks?

Never Sometimes Often Always Does not eat snacks

Help you or other family members prepare meals?

Never Sometimes Often Always

Ask for special foods from the grocery store?

Never Sometimes Often Always

Insist on special foods at meal time?

Never Sometimes Often Always

Spend his or her own money on snacks or treats?

Never Sometimes Often Always Does not have own money

Choose the restaurant when your family goes out to eat?

Never Sometimes Often Always We don't eat out

Part 2 Do you agree or disagree with the following statements? Please circle your answer.

It is important that my child eats a healthy diet.

Strongly agree Agree Neutral Disagree Strongly disagree

I encourage my child to eat fruit and vegetables.

Strongly agree Agree Neutral Disagree Strongly disagree

I am more concerned about *how much* my child eats than about *what* he or she eats.

Strongly agree Agree Neutral Disagree Strongly disagree

I offer my child new foods to try.

Strongly agree Agree Neutral Disagree Strongly disagree

I never use food as a reward for good behavior.

Strongly agree Agree Neutral Disagree Strongly disagree

As long as my child gets enough to eat, he or she will be healthy.

Strongly agree Agree Neutral Disagree Strongly disagree

I am concerned about my child's weight.

Strongly agree Agree Neutral Disagree Strongly disagree

I don't try to control what my son or daughter eats.

Strongly agree Agree Neutral Disagree Strongly disagree

I don't expect my child to try a new food if he or she doesn't want to.

Strongly agree Agree Neutral Disagree Strongly disagree

When my child is hurt or upset, I give him or her special foods to make him or her feel better.

Strongly agree Agree Neutral Disagree Strongly disagree

I limit the amount of chips, chocolate, candy and pop that my son or daughter is allowed to eat.

Strongly agree Agree Neutral Disagree Strongly disagree

Part 3

Think about the evening meal at your house. Which one of the following statements best describes your family during this meal? Please check the box next to your answer.

- ☐ We usually eat together and everyone eats the same foods
- ☐ We usually eat meals together and plan meals around what the children will eat.
- ☐ We usually eat together and not everyone eats the same foods.
- ☐ We don't usually eat together but we eat the same foods.
- ☐ We don't usually eat together and we eat different foods.

Part 4 These questions are about the foods your child eats outside your home.
Think about the foods available at your child's school.

Does your child's school have pop machines?

Yes No Not sure

Does your child's school have vending machines?

Yes No Not sure

Does your child's school have a canteen where students can buy snacks?

Yes No Not sure

If yes, what items are available?

Does your child's school have a hot lunch program?

Yes No Not sure

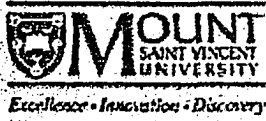
If yes, what foods or drinks are offered?

How often does your child buy food or drinks at school?

Never Sometimes Often Always No food or drink available at school

If your child buys food or drinks at school, what does he or she buy?

Appendix C



June 18, 2004

Dear Parents/Guardians,

I am a graduate student at Mount Saint Vincent University in Halifax, NS. I am working on my Masters thesis in childhood nutrition. My research will examine the diet quality of children in New Brunswick. Its purpose is to identify what influences a child's food choices. This is an important issue for children's health.

You have been contacted because your child is in grade 4 or 5 in District 18. You and your child are invited to take part in this study. To participate, you and your child will each complete a questionnaire. Each takes about 15 minutes to fill out. The instructions for completing the questionnaires follow. This study has been approved by District 18 and the Ethics Board at Mount Saint Vincent University.

Your participation is voluntary. If you wish take part, please return the completed questionnaires in the envelope provided. Please do not write your name or address on the questionnaires or envelope. Your answers are anonymous and confidential. If you return the completed questionnaires, you are consenting to participate in this study.

The outcomes of this study will be given to the District 18 office. Results may also be published.

You may contact the Chair of the University Research Ethics Board, Dr. Stephen Perrott, at (902) 457-6337 if you have any questions about the conduct of this study.

Thank you for taking the time to read this letter. Your participation in this study would be greatly appreciated.

Sincerely,

Margaret Lamrock Young, BScAHN, MScAHN candidate

Instructions for Completing the Questionnaires

Questionnaire for Parents

- This questionnaire should be filled out by the parent/guardian who usually prepares meals and does the grocery shopping
- Think about the child in your family who is in grade 4 or 5 when answering the questions. If you have more than one child in grade 4 or 5, consider only one when completing the questionnaire. Then have the same child complete the Questionnaire for Children.
- Do not write your name, address or any personal information on the questionnaire.
- Please return both questionnaires in the envelope provided by July 1, 2004.

Questionnaire for Children

- The child in grade 4 or 5 should fill out this questionnaire. It has been designed for use with this age group.
- If necessary, parents may help the child with reading and understanding the questions, but please let the child decide on his or her answers.
- Do not write the child's name or any personal information on the questionnaire.
- Please return both questionnaires in the envelope provided by July 1, 2004.

Appendix D

Reminder

By now, you will have received the childhood nutrition survey for parents and children. There is still time to participate in this important study. If you have not already done so, please complete and return the questionnaires as soon as possible.

Childhood nutrition is an important health issue for every family, every community and every province. By participating in this study, you and your child will be providing valuable information on childhood nutrition in New Brunswick. Again, all your answers are anonymous and confidential.

Thank you for your time. Have a happy and healthy summer!

Appendix E



Excellence • Innovation • Discovery

University Research Ethics Board

UNIVERSITY RESEARCH ETHICS BOARD

Certificate of Ethics Approval

Title of project : Childhood Obesity in the Family Environment:
The Impact of Family Rules on the Diet Quality of Pre-Adolescent Children

Researcher: Ms. Margaret Young/ Dr. Theresa Glanville

This document confirms that the above named study has been approved in accordance with the *Tri-Council Policy Statement* as outlined in the *MSVU Policies and Procedures: Ethical Review of Research Involving Humans*.

This certificate is valid one year from the date of issue. Renewal is contingent upon submission to the UREB of a satisfactory annual ethics report.

April 22, 2004

**Chair
UREB**

Date

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