FAMILY MEAL INFLUENCE ON DIETARY QUALITY OF STUDENTS IN GRADE SIX, SEVEN, AND EIGHT FROM ONTARIO AND NOVA SCOTIA

By

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AUTHOR'S DECLARATION FOR ELECTRONIC SUBMISSION OF A THESIS

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ABSTRACT

In 2004, Ontario's Chief Medical Officer of Health Report, *Healthy Weights, Healthy Lives* (Ministry of Health and Long Term Care, 2004) identified the family (as well as the government, food industry, workplaces, schools, and individuals) for recommendations for action. As a means to promote, achieve, and maintain healthy body weights for both parents and children, *Healthy Weights, Healthy Lives* (2004) recommended enjoying family meals whenever possible. Very little evidence, however, exists to justify the promotion of family meals within Canada. Therefore, the purpose of this thesis was to describe family meal frequency and meal environments, and to examine the associations with diet quality (as assessed using a Canadian adaptation to the Health Eating Index (HEI-C; Glanville and McIntyre, 2006), and other commonly reported food behaviours and attitudes.

The sample (males=1572 and females=1627) comprised students in grade six (n=1266), seven (n=1359), and eight (n=579) classrooms from Northern Ontario (Porcupine Region n=385), Southern Ontario (Peel Region n=1413, Region of Waterloo n=405, Toronto District n=216), and Nova Scotia (as part of the Physical Activity in Children and Youth (PACY) study n=804) participating in school surveillance-based studies. Data were collected using the web-based *Food Behaviour Questionnaire,* which included a 24 hour food recall, food frequency questionnaire, and specific questions relating to family meals.

The majority of participants reported frequent family meals (70% on 6-7 days/week, 19% on 3-5 days/week, and 11% on 0-2 days/week). Family meal frequency decreased with increasing grade (X^2=30.629 (df=4), $p<0.001$), and was significantly higher among participants from Porcupine, and lower among participants from Peel (X^2=46.815 (df=8), $p<0.001$). The mean HEI-C score across all participants was 65.1 (SD 13.2) and the majority

(73%) were rated in the *needs improvement* category. Family meal frequency, particularly between 0-2 and 6-7 days/week, was positively associated with diet quality scores (adjusted $p=0.045$) and ratings ($p=0.049$). When investigating the person(s) with whom meals were consumed, participants who ate breakfast with family members (versus alone, $p=0.012$) and/or lunch with friends (versus alone, $p=0.007$ or with family members, $p<0.001$) had a significantly greater likelihood of having a better diet quality. Participants who skipped breakfast ($p<0.001$) and/or lunch ($p<0.001$) had a greater likelihood of having a worse diet quality than those that consumed each meal.

Cluster K-means procedures were used to classify observations about the four meal environment variables (where the meal was consumed, with whom the meal was consumed, who prepared the meal, and where the food was originally purchased) into groups. A total of 3, 8, and 6 clusters of meal environments were identified for breakfast, lunch, and dinner, respectively. Diet quality was negatively associated with consuming/purchasing meals outside of the home, and skipping breakfast and/or lunch. Meal skipping had a larger impact on overall diet quality than the environmental conditions under which the meal was consumed.

Finally, associations among family meal frequency and other commonly reported food behaviours and attitudes were investigated. Higher family meal frequency was significantly associated with less pop consumption, consuming breakfast on the day of the survey, having higher self-efficacy for healthy eating when at home with family and during social times with friends.

This research, in a large, geographically diverse sample of grade six, seven, and eight students from Ontario and Nova Scotia, found that family meal frequency and specific

aspects of meal environments were positively associated with diet quality, and various healthy eating behaviours and attitudes. This research supports the growing body of literature in favour of family meals. Since the diet of most students in grade six, seven, and eight was suboptimal, strategies to promote healthy family meals should be widely encouraged.

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INTRODUCTION

1.1 Rationale

Body weight and related health issues among Canadian children and adolescents are of growing concern for health professionals. Approximately one quarter of Canadian youth are classified as either overweight or obese (Shields, 2005; Tremblay, Katzmarzyk, and Willms, 2002; Tremblay and Willms, 2000). Out of 34 countries, Canada ranked 5th for the highest prevalence of overweight and obese youth (aged 10-16 years) (Janssen, Katzmarzyk, Boyce et al., 2005). Further, high rates of disordered eating have been reported in Canada (Jones, Bennett, Olmstead, Lawson, and Rodin, 2001; Leichner, 2002; McVey, Tweed, and Blackmore, 2004) and in the United States (US) (Croll, Neumark-Sztainer, Story, and Ireland, 2002). Body weight and related health behaviours and attitudes, during childhood and adolescence, can have serious short- and long-term health consequences, including cardiovascular disease, diabetes, and cancer (Ball and McCargar, 2003; Carriere, 2003; Freedman, Khan, Dietz, Srinivasan, and Berenson, 2001; Janssen, Katzmarzyk, Srinivasan et al., 2005).

Changes in body weight result from an imbalance between energy intake and expenditure, and can be theoretically manipulated through changes in diet and physical activity. An abundance of evidence exists to advise Canadians of the benefits of a healthy lifestyle; yet, many still choose not to adopt (Canadian Fitness and Lifestyle Research Institute (CFLRI), 2005; Janssen, Katzmarzyk, Boyce et al., 2005). In addition to the contribution of excessive energy, there are concerns about nutrient intakes and unhealthy food patterns characterized by inadequate amounts of milk and dairy products (Briefel and Johnson, 2004; Garriguet, 2006; Hanning, Woodruff, Lambraki, Jessup, Driezen, and

Murphy, 2007), vegetables and fruit (Briefel and Johnson, 2004; Garriguet, 2006; Gibson, Wardle, and Watts, 1998; Hanning et al., 2007; Lowry, Wechsler, Galuska, Fulton, and Kann, 2002) and excessive consumption of foods high in fat, sugar, and salt (Garriguet, 2006; Hanning et al., 2007; Ludwig, Peterson, and Gortmaker, 2001; Phillips, Jacobs-Starkey, and Gray-Donald, 2004; Troiano, Briefel, Carroll, and Bialostosky, 2000). Furthermore, youth have reported frequent consumption of unhealthy snacks (Brown and Ogden, 2004; French, Story, Downes, Resnick, and Blum, 1999; Phillips et al., 2004; Shepherd and Dennison, 1996; Woodruff, McGoldrick, and Hanning, 2006), fast food (French, Story, Neumark-Sztainer, Fulkerson, and Hannan, 2001; Nielsen, Siega-Riz, and Popkin, 2002; Shepherd and Dennison, 1996), and sugar sweetened beverages (Hanning et al., 2004; Ludwig et al., 2001; McGoldrick, Woodruff, and Hanning, 2006; Phillips et al., 2004) in addition to frequent meal skipping (Shepherd and Dennison, 1996; Woodruff, Hanning, Lambraki, Calengor, McCargar, submitted). Suboptimal nutrition during this stage may interfere with optimal growth and development. Moreover, eating habits formed in adolescence may continue into adulthood (Centers for Disease Control and Prevention (CDC), 1997; Nicklas and Johnson, 1999; Story, Neumark-Sztainer, and French, 2002). Hence, there are reasons to explore food related behaviours of youth.

Very little is known about the influence of the family on youth food intake and behaviours even though the family is the main socializing agent until adolescence. The family directly determines the physical and social environment which can ultimately influence behaviours, habits, and attitudes through socialization and modeling (Ritchie, Welk, Styne, Gerstein, and Crawford, 2005). In 2004, Ontario's Chief Medical Officer of Health Report, *Healthy Weights, Healthy Lives* (Ministry of Health and Long Term Care,

2004) identified the family (as well as the government, food industry, workplaces, schools, and individuals) for recommendations for action. As a means to promote, achieve, and maintain healthy body weights for both parents and children, *Healthy Weights, Healthy Lives* (2004) recommended enjoying family meals whenever possible. Furthermore, a document entitled *Understanding the Forces that Influence our Eating Habits, What We Know and What We Need to Know* (Canadian Journal of Public Health, 2005), suggested that Canadian research that examines the nature of familial influences on healthy eating in children, including family food practices and the frequency of family meals, is needed. Investigating familial influence on food use, portion sizes, and food preparation methods was also suggested for future research (Taylor, Evers, and McKenna, 2005), and could be done in conjunction with research on family meals. Determining the nutritional significance of family meals for Canadian children and adolescence is important to capture. Furthermore, investigating family meal influences on other commonly reported youth food-related behaviours (e.g. fast food and pop consumption, breakfast skipping, and dieting) and attitudes (concerns over body weight and self-efficacy for healthy eating) may offer insight for future strategies to encourage healthy food intakes and body weights.

1.2 Objectives and Hypotheses

Using school survey data from five studies of Ontario and Nova Scotia grade six, seven, and eight students, the current thesis is based on the following research questions and hypotheses:

1.2.1 Study #1

Question #1: What is the current frequency of family meals (weekly frequency) and does it vary among participants by sex, grade, body weight status, and/or school surveillance study?

Hypothesis #1: More frequent family meals were expected to be reported by normal weight participants (versus overweight or obese), and among those from lower grades. No differences in family meal frequency was expected by sex or school surveillance study.

Question #2: What is the current diet quality (as assessed using the HEI-C) of participants, and does it vary by sex, grade, body weight status, school surveillance study, and/or reporting status?

Hypothesis #2: Diet quality was expected to be higher in males (than females), those from lower grades, normal weight (versus overweight and obese) participants, and among those whose energy intakes suggest the lowest underreporting.

Question #3: Is family meal frequency associated with diet quality?

Hypothesis #3: Family meal frequency was expected to be positively associated with dietary quality.

Question #4: Using 24 hour recall techniques, is the person(s) with whom participants report having meals (breakfast, lunch, and dinner) on the previous day associated with sex, grade, body weight status, school surveillance study and/or reporting status?

Hypothesis #4: It was expected that there would be no associations among whom participants consumed meals with on the previous day and sex, grade, body weight status, school surveillance study, and/or reporting status.

Question #5: Using 24 hour recall techniques, is the person(s) with whom participants report having meals (breakfast, lunch, and dinner) on the previous day associated with diet quality?

Hypothesis #5: It was expected that the participants who consumed breakfast, lunch and/or dinner with family members (one or more family members and/or including parents/guardians, brothers/sisters/and other adults such as grandparents or aunts/uncles), as opposed to by themselves or with friends, would have a higher diet quality.

1.2.2 Study #2

Question #1: Are meal environments different at breakfast, lunch, and dinner?

Hypothesis #1: It was expected that the majority of participants would consume breakfast at home, alone, prepared by themselves, from foods purchased from a grocery store. It was expected that the majority of participants would consume lunch at school, with their friends that was prepared by family members, from foods purchased from a grocery store. Finally, the majority of participants were expected to consume dinner at home, with their family that was prepared by family members, from foods purchased from a grocery store.

Question #2: Can meal (breakfast, lunch, and dinner) environments (where the meal was consumed, with whom participants consumed each meal, who prepared the meal, and where the food was originally purchased) be grouped into identifiable patterns?

Hypothesis #2: It was expected that meal (breakfast, lunch, and dinner) environments (where the meal was consumed, with whom participants consumed each meal, who prepared the meal, and where the food was originally purchased) would cluster into identifiable groups.

Question #3: Are meal environment (where the meal was consumed, with whom participants consumed each meal, who prepared the meal, and where the food was originally purchased) clusters different by sex, grade, body weight status, school surveillance study, and/or reporting status?

Hypothesis #3: No differences in meal environment clusters were expected by sex, grade, body weight status, school surveillance study, and/or reporting status.

Question #4: Are meal environment clusters associated with diet quality?

Hypothesis #4: Meal environment clusters that were generally associated with meals at home with family, prepared by family members from food bought at a grocery store were expected to be associated with higher dietary quality. Meal environment clusters that were mainly associated with foods prepared, purchased, and consumed at a restaurant or fast food outlet with friends were expected to be associated with lower diet quality.

1.2.3 Study #3

Question #1: Is family meal frequency associated with other commonly reported food behaviours (fast food and pop consumption, breakfast skipping, dieting) and attitudes (body weight concerns and self-efficacy for healthy eating)?

Hypothesis #1: Greater family meal frequency was expected to be associated with lower fast food and pop consumption, breakfast eating (versus skipping), and not dieting for weight loss. Family meal frequency was also expected to be higher among participants without (versus with) body weight concerns, and those with higher (versus lower) self-efficacy for healthy eating.

1.3 Organization

The first chapter of this thesis is a review of literature of family meal influence on dietary quality of adolescents. Chapter 2 provides a comprehensive description of the study methodology and sample. Chapters 3, 4, and 5 are based on manuscripts that will be submitted for publication in scholarly, peer reviewed journals. Chapter 3 summarizes study

1, family meal frequency associations with participant characteristics and diet quality, Chapter 4 describes study 2, meal environments and associations with participant characteristics and diet quality, and Chapter 5 describes study 3, the associations between family meal frequency and other commonly reported food behaviours and attitudes. Chapter 6 provides a general discussion and interpretation of the overall study results, limitations, and recommendations for future research.

The content of the review of literature (Chapter 1) has been accepted for publication in the *Canadian Journal of Dietetic Practice and Research*, with authors and title as follows:[1]

Woodruff SJ, Hanning RM. A review of family meal influence on dietary quality of adolescents. Can J Diet Prac Res. (Accepted January 10, 2007).

The content of Chapter 3 will be submitted for publication in the *Canadian Journal of Public Health*, with authors and title as follows:

Woodruff SJ, Hanning RM, Brown, KS. Associations of family meal frequency and Healthy Eating Index-C of grade six, seven, and eight students from Ontario and Nova Scotia.

The content of Chapter 4 will be submitted for publication in the *Journal of the American Dietetic Association*, with authors and title as follows:

Woodruff SJ, Hanning RM. Specific meal environments are associated with improved diet quality ratings in grade six, seven, and eight students from Ontario and Nova Scotia.

The content of Chapter 5 will be submitted for publication in *the Journal of Adolescent Health*, with authors and title as follows:

Woodruff SJ, Hanning RM. Family meal frequency is associated with certain food behaviours in grade six, seven, and eight students from Ontario and Nova Scotia.

[1] For uniformity purposes, citations and references for all thesis chapters conform to the style of the Publication Manual of the American Psychological Association, 5th edition, 2001.

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CHAPTER 1: A Review of Family Meal Influence on Dietary Intake of Adolescents

1.1 Abstract

Recent concerns about adolescent nutrition and unhealthy weights have prompted an examination of myriad influences on dietary intake during adolescence. The purpose of this paper was (a) to summarize the literature surrounding family influence on dietary intake, specifically during adolescence and within the family context, (b) to summarize family meal patterns, and (c) to systematically review the known influences of family meals on dietary intake. Given the complexity of families in today's society, models were developed to depict the broad context of familial influences on adolescent nutritional behaviours and attitudes and to describe what is known and not known about family meal influences on adolescent diet intake and quality. A systematic review of the literature revealed seven articles specifically related to adolescents, family meals, and dietary intake which were analyzed for strength of evidence and plausibility. In spite of data collection methods relying on self-report, results suggested that family meals were associated with improved dietary intakes. Families in today's societies are complex, nevertheless, parents have the potential to positively influence, through family meals, what food is provided, where it is provided (e.g. home, restaurant), and within what type of atmosphere it is provided. (193 Words)

1.2 Introduction

The prevalence of overweight/obesity (Shields, 2005; Tremblay et al., 2002; Tremblay and Willms, 2000) and eating disorders (Jones et al., 2001; Leichner, 2002; McVey, et al., 2004) among Canadian adolescents is high. Dietary intakes of Canadian children and adolescents have recently been characterized as containing inadequate amounts of milk and dairy products (Garriguet, 2006; Veugelers, Fitzgerald, and Johnston, 2005), and vegetables and fruit (Garriguet, 2006; Hanning et al., 2007; Veugelers et al., 2005) and excessive consumption of foods high in fat, sugar, and salt (Garriguet, 2006; Evers, Taylor, Manske and Midgett, 2001; King, Boyce, and King, 1999; Phillips et al., 2004). Inadequate nutrition during this stage may interfere with optimal growth and development. Moreover, eating habits formed in adolescence may continue into adulthood (Centers for Disease Control and Prevention, 1997; Nicklas and Johnson, 1999; Story et al., 2002).

Why individuals consume certain types of foods is highly complex (Raine, 2005; Story et al., 2002; Taylor et al., 2005). Recent Canadian reviews identified that individual factors (physiological, psychological, food preferences, perceptions of healthy eating, knowledge, and attitudes) and environmental/collective factors (physical, economic, interpersonal, and social) have potential influences on healthy eating among Canadian children and youth (Raine, 2005; Taylor et al., 2005). Within these broad frameworks, however, several gaps in our understanding of the determinants of dietary intake of adolescents were identified. In particular, very little is known about the influence of the family (as one of the environmental/collective factors) on adolescent food behaviours and attitudes.

Recently, it was suggested (Gillman et al., 2000; Neumark-Sztainer, Hannan, Story, Croll, and Perry, 2003; Veugelers et al., 2005; Videon and Manning, 2003) that family meals have a positive influence on dietary intake during childhood and adolescence. However, given the complex nature of today's family, it seems simplistic to recommend more family meals to improve dietary intake during adolescence. Therefore, the purpose of this review was (a) to summarize the literature surrounding family influence on dietary intake, specifically during adolescence and within the family context, (b) to summarize family meal patterns, and (c) to systematically review the known influences of family meals on dietary intake.

1.3 Methods

A list of articles on familial influence and adolescent food behaviours was compiled by searching electronic databases from the National Library of Medicine (Pubmed; 1963-present), and CSA Illumina (psycINFO; 1887-present) for English review and original research articles (no other limits were set). The following search terms were used (alone or in combination): *adolescen*, youth, family, nutrition, diet(ary) quality, intake, food, dinner, meals, behaviours, attitudes,* and *influence*. From the list of titles and abstracts generated by this initial literature search, almost 200 papers were reviewed (a) to place adolescent nutrition within the family context, and (b) to summarize family meal patterns. Family meals were defined as food eaten together with other members of the family, in which usually one adult is present.

An appraisal of the papers that specifically related to the subject of family meals and dietary intake (n=7) was completed using the strength of evidence criteria developed by the Public Heath Research, Education, and Development group (PHRED) for the Effective

Public Health Practice Project (PHRED, 2003) and the plausibility (likeliness to be true) criteria used for University of Waterloo best practices reviews (Cameron, Jolin, Walker, McDermott, and Gough, 2001). Only cross-sectional, descriptive studies were available because randomized controlled trials are not appropriate for observing this social phenomenon (according to the PHRED guidelines, descriptive designs would normally be classified as weak). However, to allow the appraisal to discriminate within the studies, effectiveness was ranked (weak to strong) using sample size, representativeness, and response rate as criteria. Other strength of evidence assessment criteria considered selection bias, confounders, data collection methods, intervention integrity and analyses, as per PHRED guidelines (PHRED, 2003). Finally, plausibility was evaluated based on formative evaluations/pilot testing and the theoretical foundation for the study. Based on both strength of evidence and plausibility, studies were identified overall as weak, moderate, or strong.

1.4 Results and Interpretation

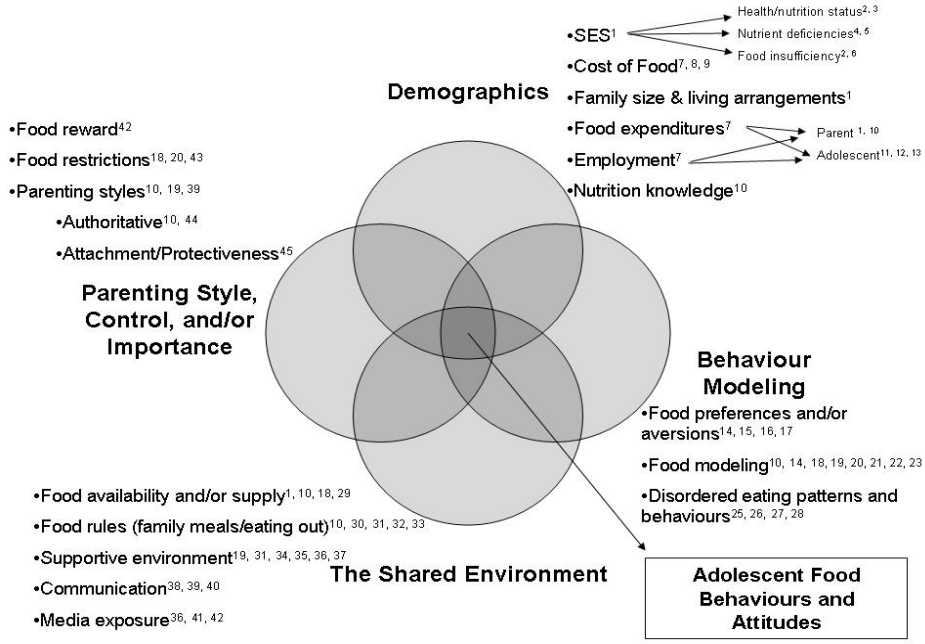
1.4.1 Adolescent Nutrition within the Family Context

Although adolescents (13-19 years) are striving to gain independence, the family retains the potential to influence the physical and social environment in which an adolescent lives. Autonomy from parents seems to increase linearly (and directly opposes peer importance) from grade 5-8 (Steinberg and Silverberg, 1986), however, emotional detachment from parents doesn't necessarily occur during this developmental period (Hill and Holmbeck, 1986). Therefore, the family has a large potential to influence adolescent eating behaviours and attitudes. Based on the literature search, Figure 1 depicts the four main categorical influences that emerged: (1) family demographics (Alaimo, Olson, Frongillo, and Briefel, 2001; Axelman, Federline, and Brinberg, 1985; Backman, Haddad,

Lee, Johnston, and Hodgkin, 2002; Contento, Manning, and Shannon, 1992; French et al., 2001; Johnson, Smicklas-Wright, and Crouter, 1993; Maurer, 1984; Minaker et al., 2006; Myres and Kroetsch, 1978; Neumark-Sztainer, Story, Perry, and Casey, 1999; Neumark-Sztainer, Story, Resnick and Blum, 1996; Serra-Majen, Ribas, Perez-Rodrigo, Garcia-Closas, and Pena-Quintana, 2002; Valois, Zullig, Heubner, and Drane, 2003; Vingilis, Wade, and Seeley, 2002), (2) behaviour modeling (Barr, 1994; Bourcier, Bowen, Meischke, and Moinpour, 2003; Brown and Ogden, 2004; Carriere, 2003; Feunekes, de Graaf, Meyboom, and van Staveren, 1998; Fisher and Birch, 1995; Hanson, Neumark-Sztainer, Eisenberg, Story, and Wall, 2005; Jones et al., 2001, Maloney, McGuire, Daniels, and Specker, 1998; Mattes, 1991; Packard and Krogstrand, 2002; Rozin, 1991; Rozin and Millman, 1987; Saelens, Ernst, and Epstein, 2000) (3) the shared environment (Archibald, Graber, and Brooks-Gunn, 1999; Coon and Tucker, 2002; Cusatis and Shannon, 1996; Gillman et al., 2000; Hill and Franklin, 1998; Levine, Smolak, and Hayden, 1994; Neumark-Sztainer, Hannan et al., 2003; Neumark-Sztainer, Wall, Story, and Fulkerson, 2004; Taveras et al., 2005; Thelen and Cormier, 1995; Vincent and McCabe, 2000; Wertheim, Paxton, Schutz, and Muir, 1997; Young, Fors, and Hayes, 2004), and/or (4) parenting style (Brown and Ogden, 2004; Kremers, Brug, de Vries, and Engels, 2003; Trombini, Baldaro, Bertaccini, Mattei, Montebarocci, and Rossi, 2003; Wertheim et al., 1997; Young et al., 2004).

Family demographics likely influence the types and quantity of food that is available and accessible in the home (Alaimo et al., 2001; Neumark-Sztainer et al., 1996; Vingilis et al., 2002), as well as potentially influencing overall nutrition knowledge (Vingilis et al., 2002). Behaviour modeling likely influences adolescent food intake and behaviours by modeling food preferences and/or aversions after another family member (Feunekes et al.,

Figure 1: *Familial Influence on Adolescent Food Behaviours and Attitudes*



[1]Story et al., 2002; [2]Alaimo et al., 2001; [3]Vingilis et al., 2002; [4]Myres and Kroetsch, 1978; [5]Serra-Majem et al,2002; [6]Neumark-Sztainer et al., 1996; [7]Neumark-Sztainer et al., 1999; [8]Backman et al., 2002; [9]Maurer, 1984; [10]Taylor et al., 2005; [11]French et al., 2001; [12]Valois et al., 2003; [13]Leslie et al., 1999; [14]Feunekes et al., 1998; [15]Mattes, 1991; [16]Rozin, 1991; [17]Rozin and Millman, 1987; [18]Birch and Fisher, 1998; [19]Hertzler, 1983; [20]Brown and Ogden, 2004; [21]Barr, 1994; [22]Carriere, 2003; [23]Hanson et al., 2005; [24]Bourcier et al., 2003; [25]Jones et al., 2001; [26]Packard and Krogstrand, 2002; [27]Fisher and Birch, 1995; [28]Saelens et al., 2000; [29]Wardle, 1995; [30]Gillman et al., 2000; [31]Neumark-Sztainer et al., 2004; [32]Taversas et al., 2005; [33]Cusatis and Shannon, 1996; [34]Neumark-Sztainer, Wall et al., 2003; [35]Hill and Franklin, 1998; [36]Levine et al., 1994; [37]Archibald et al., 1999; [38]Thelen and Cormier, 1995; [39]Young et al., 2004; [40]Vincent and McCabe, 2000; [41]Coon and Tucker, 2002; [42]Wertheim et al., 1997; [43]Hill, 2002; [44]Kremers et al., 2003; [45]Trombini et al., 2003

1998; Mattes, 1991; Rozin and Millman, 1987) as well as through the potential transmission of disordered eating behaviours/attitudes, particularly from mother to daughter (Fisher and Birch, 1995; Jones et al., 2001; Packard and Krogstrand, 2002; Saelens et al., 2000). Sharing a household environment will undoubtedly influence food intake and behaviours due to the shared food supply within the home (Neumark-Sztainer, Wall, Story, and Perry, 2003), in addition to various food rules (specific rules relating to food intake and behaviour) (Cusatis and Shannon, 1996; Gillman et al., 2000; Neumark-Sztainer, Hannan, et al., 2003; Tavaras, et al., 2005) and media exposure allowed into the home (Coon and Tucker, 2002; Levine et al., 1994; Wertheim et al., 1997). Finally, parenting style can negatively influence food

intake if parents have used or currently use food rewards or restrictions (Brown and Ogden, 2005; Wertheim et al., 1997). According to the parenting styles defined by Baumrind (1991) and Maccoby and Martin (1983), authoritat*ive* parenting was reportedly indicative of fruit intake among adolescents (Kremers et al., 2003) whereas authoritar*ian* parenting styles actually increased the preference for intake of restricted foods (Fisher and Birch, 1999).

These potentially strong and highly inter-related influences on adolescent nutritional behaviours and attitudes are difficult to interpret in isolation, and research describing interacting social influences is scarce (Fuenekes et al., 1998). Fuenekes et al. (1998) suggested that quantifying social influences on eating behaviours may be difficult because (i) it is not limited to one type, it includes behaviours of others, persuasion, availability, and attitudes which are embedded in everyday behaviours, in family rules, and within the larger culture in which we live; (ii) it takes place during different time periods, such as consuming one meal together versus cohabitation, and (iii) it is not always a conscious action that people may necessarily be aware of or willing to admit.

The family meal is one easily measured variable that may provide insight into the importance of families on adolescent food intake. Family meals have "long been considered essential for the unity of the family and a symbol for family interactions" (Story and Neumark-Sztainer, 2006, p. 261). In addition to all family members consuming similar types of foods, the family meal provides an atmosphere for communication and interaction between family members which may help promote family connectedness and improve family functioning (Alaimo et al, 2001; Stockmyer, 2001).

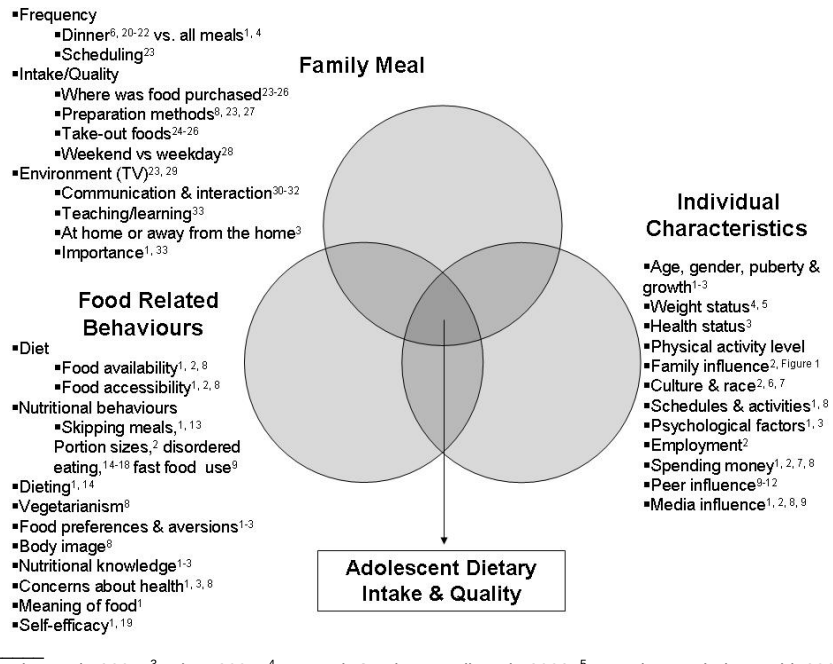
Spending time together, such as at the dinner table, may instill greater family cohesion and stability (McDaniel and Tepperman, 2000). Rituals and routines of families

often reinforce the importance of the family and its members. The family meal may provide routine and consistency (Neumark-Sztainer et al., 2004), and a time when adolescents can *check-in* with other family members. Additionally, family meals may provide a venue for learning and teaching healthy food behaviours and attitudes (Neumark-Sztainer et al., 2004), food preparation (Boutelle, Lytle, Murray, Birnbaum, and Story, 2001; Hill and Holmbeck, 1986; Neumark-Sztainer, Story, Ackard, Moe, and Perry, 2000), good manners (Neumark-Sztainer et al., 2004), and other non-food related issues (e.g. homework issues).

Within the family context, Figure 2 was developed to summarize how (1) individual characteristics of adolescents (Cohen, Evers, Manske, Bercovitz, and Edwards, 2003; Cusatis and Shannon, 1996; Feunekes et al., 1998; Field, Camargo, Taylor, Berkey, and Colditz, 1999; French et al., 2001; Garriguet, 2006; Granner, Sargent, Calderon, Hussey, Evans, and Watkins, 2004; Hanning et al., 2007; Institute of Medicine of the National Academies, 2002; Levine et al., 1994; Neumark-Sztainer et al., 1996; Neumark-Sztainer et al., 1999; Neumark-Sztainer, Hannan, et al., 2003; Paxton, Schutz, Wertheim, and Muir, 1999; Veugelers et al., 2005), (2) family meals (Boutelle et al., 2001; Clauson, 1999; Cullen, Lara, and de Moor, 2002; Eisenberg, Olson, Neumark-Sztainer, Story, and Bearinger, 2004; Lin, Gurthrie, and Frazao, 1999a 1999b; Marquis, Filion, and Degenais, 2005; McDaniel and Tepperman, 2000; Neumark-Sztainer et al., 2000; Neumark-Sztainer, Hannan, et al., 2003; Neumark-Sztainer et al., 2004; Paxton et al., 1999; Veugelers et al., 2005; Videon and Manning, 2003), and (3) food-related behaviours of adolescents (Axelson et al., 1985; Chapman and Maclean, 1993; Contento et al., 1992; French et al., 2001; Jones et al., 2001; Maloney et al., 1998; Mattes, 1991; Neumark-Sztainer et al., 1996; Neumark-Sztainer et al., 1999; Packard and Krogstrand, 2002; Woodruff et al., submitted) interact to potentially influence adolescent diet

intake and quality. Viewing family meals in relation to adolescent characteristics further illustrates the complex nature of the importance of family meals.

Figure 2: *Individual Characteristics, Food Related Behaviours, and Family Meal Influence on Adolescent Diet Quality*



[1]Story et al., 2002; [2]Taylor et al., 2005; [3]Raine, 2005; [4]Neumark-Sztainer, Wall et al., 2003; [5]Veugelers and Fitzgerald, 2005; [6]Granner et al., 2005; [7]Neumark-Sztainer et al., 1996; [8]Neumark-Sztainer et al., 1999; [9]Field et al., 1999; [10]Feunekes et al., 1999; [11]Levine et al., 1994; [12]Paxton et al., 1999; [13]Woodruff et al., submitted; [14]Jones et al., 2001; [15]Packard and Krogstrand, 2002; [16]Birch and Fisher, 1998; [17]Hertzler, 1983; [18]Maloney et al., 1998; [19]Cusatis and Shannon, 1996; [20]Videon and Manning, 2003; [21]Gillman et al., 2000; [22]Veugelers et al., 2005; [22]Granner et al., 2005; [23]Neumark-Sztainer et al., 2000; [24]Lin et al., 1999a; [25]Clauson, 1999; [26]Lin et al., 1999b; [27]Boutelle et al., 2001; [28]Cullen et al., 2002; [29]Marquis et al., 2005; [33]McDaniel and Tepperman, 2000

1.4.2 Family Meal Patterns

1.4.2.1 Frequency

Today, the past image of the blissful family eating a home cooked meal together might be replaced by an adolescent grabbing fast food on the go, or popping something in the microwave to enjoy in front of the television. Approximately 25%-57% of adolescents reported consuming meals together with their family on a regular basis (5 or more

meals/week), whereas 14%-35% consumed meals with family members only on some days or never (Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003; Neumark-Sztainer et al., 2004; Veugelers et al., 2005; Videon and Manning, 2003). Some of this large variation might be explained by age; the number of family meals consumed during a typical week seems to decline with increasing age (Gillman et al., 2000; Granner et al., 2004). Furthermore, one study (Neumark-Sztainer, Hannan, et al., 2003) found that a lower percentage of girls versus boys reported eating regular family meals. Busy schedules of adolescents (Neumark-Sztainer et al., 2000; Ritchie et al., 2005) and parents (Hill and Holmbeck, 1986), teen desire for autonomy (Neumark-Sztainer et al., 2000), family relations (Neumark-Sztainer et al., 2000), and dislikes for food being served (Neumark-Sztainer et al., 2000) are reasons proposed for not eating as a family.

Even though not everyone consumes *three square* meals a day, the dinner meal is the most frequent meal consumed by adolescents (Caroli, Argentieri, Cardone, and Masi, 2004; Mestdag, 2005). When investigating family meals, investigators have used *dinner* as the focus (Gillman et al., 2000; Granner et al., 2004; Tavaras et al., 2005; Veugelers et al., 2005; Videon and Manning, 2003), while others have included eating *breakfast* or *all meals* together (Boutelle et al., 2001; Eisenberg et al., 2004; Marquis et al., 2005; Neumark-Sztainer, Hannan et al., 2003; Neumark-Sztainer et al., 2004). This makes interpretations across studies difficult; however, there is no reason to believe that influences of eating dinner together would differ from those for eating breakfast or lunch. Interestingly, no studies have yet examined the potential differences in family meals between weekdays versus weekends in adolescents, however, seven day food records from fourth through sixth grade students from Texas demonstrated that more high-fat practices (adding butter, consuming desserts,

frying foods) and fewer low-fat practices (removing skin from chicken, using low fat products) were reported on weekend meals compared to weekday meals (Cullen, Lara et al., 2002).

1.4.2.2 Location

Family meals do not necessarily take place at home anymore as more and more families (and individuals) are consuming foods away from the home than in the past. According to the US Continuing Survey of Food Intakes by Individuals (CSFII), adolescents reported consuming 32% and 22% of meals and snacks, respectively, outside of the home (Lin et al., 1999a). From 1970 to 1998, the proportion of food budgets that America spent on food purchased outside of the home rose from 25% to 47% (Lin et al., 1999a). This large increase may be related to more working mothers, increased dual income families, higher incomes, more fast food outlets, increased advertising and promotion by large food service chains, and smaller families (Lin et al., 1999a). No such Canadian data exist surrounding adolescents, however, it is not expected that such data would differ dramatically from the US.

According to the CSFII, adolescents aged 12-18 years reported consuming food from the following locations: foods purchased/made at home (60%), restaurant/fast food (19%), school (8%), other (6%), store eaten out (bought from a store, but not eaten or brought into the home) (5%), and vending machines (1%) (Nielson et al., 2002). Recent Canadian data indicated that less than half of 4-18 year olds consumed food that was only prepared in the home on the day previous to the survey (Garriguet, 2006). Foods consumed outside the home, as opposed to those consumed/prepared in the home, have been reported to be higher in total and saturated fats, and lower in fibre and calcium (Lin et al., 1999a), in addition to

contributing more energy as a percentage of total calories (Lin et al., 1999b). No research was found, however, that investigates the dietary impact of the many different types of restaurants or food outlets (Lin et al., 1999a), in conjunction with where the food was eventually consumed (on the go, sit down at the restaurant, or taken home) (Story et al., 2002), as for example, portion sizes may be more easily controlled at home than in a restaurant, even if the food is prepared the same.

1.4.2.3 Environment

The meal environment seems to have changed, as individuals commonly report watching television during meals (Granner et al., 2004; Marquis et al., 2005). While a meal is not *chemically* different if eaten at the table with family members or in front of the television, the cultural and psychological meaning is completely different (McDaniel and Tepperman, 2000). This particular distraction may reduce/eliminate communication and interaction among family members. In some cases both the social and nutritional environments have been affected. Students in grades 6-8 who watched television while eating meals together as a family consumed higher amounts of pizza, snack foods, and soda and less fruits and vegetables than children who did not watch television while eating together (Coon, Goldberg, Rogers, and Tucker, 2001). Moreover, there may be negative effects on intake because television can distract individuals from being aware of how much they are eating in addition to being exposed to numerous food-related advertisements (Caroli et al., 2004; Halford, Gillespie, Brown, Pontin, and Dovey, 2004).

1.4.3 Family Meals and Dietary Intake

To gain further insight into the role that family meals have on dietary intake during adolescence, a systematic literature review was completed (Table 1). Of the seven articles

Table 1: *An Appraisal of the Literature on Family Meals for Strength of Evidence and Plausibility*

Ref. # & Pub Year	Authors	Purpose	Study Design / Control for Bias	Confounders	Data Collection Methods	Analysis	Plausible?	Results	OVERALL SCORE and Rating
21 2003	Neumark-Sztainer, Hannan et al. Project EAT. USA	Family meals, SES, and diet quality	STRONG N=4746; 11-18 yr, ethnically diverse. 81.5% response rate. Cross-sectional.	School	STRONG Self-reported; used valid and reliable Youth FFQ (YAQ);	Appropriate	STRONG Yes Guided by SCT[a] & focus groups. Instruments pretested, multiple revisions. Piloted twice	FMF[b] was positively associated with intake of fruits, vegetables, grains, and calcium rich foods and negatively associated with soft drink consumption. Positive associations were also seen between FMF and energy; protein (% of total kcals); calcium; iron; folate; fibre; and vitamins A, C, E, and B6. Sociodemographic characteristics associated with more frequent family meals included gender (boys), school level (middle), race (Asian American), mothers employment (not employed), and SES (high). 27% underreported, especially those reporting few family meals. Associations with FMF were similar after adjusting intake for energy underreporting.	STRONG #1
53 2004	Neumark-Sztainer et al. Project EAT USA	Family meals and disordered eating	STRONG N=4746; 11-18 yr; Ethnically diverse. 81.5% response rate. Cross-sectional.	School	STRONG Self-reported; used valid and reliable Youth FFQ (YAQ); Disordered eating questions developed (test-retest reliability completed)	Appropriate	STRONG Yes Guided by SCT & focus groups. Instruments pretested & multiple revisions. Piloted twice.	After adjusting for BMI, sociodemographic variables, and global familial factors, FMF was significantly negatively associated with extreme and less extreme weight control and chronic dieting among females. In boys, after adjusting for only BMI and sociodemographic variables, FMF was negatively associated with extreme and less extreme weight control.	STRONG #2

74 2000	Neumark-Sztainer et al. USA	Family meal patterns and characteristics	LOW-MODERATE N=171; 12 and 16 yr; 21 focus groups by sex/grade. Ethnically diverse. 55% response rate. Cross-sectional.	SES (2/3rd eligible for free or reduced school meals)	STRONG Focus groups. Questions developed by investigators. Questions pre-tested.	Appropriate	MODERATE-STRONG Yes Referred to SCT	Large variation in frequency of family meals between and within participants. Changes in family (sibling left home, family structure) and extra curricular activities mentioned as reasons for not eating together. Meal settings varied, watching TV during meals was mentioned. Mother prepared most meals. Special occasion meals reported, rituals/rules reported by some. Reasons for not eating as a family were parent and teen schedules, teen desire for autonomy, dissatisfaction with family relations, and dislikes for food served. Most adolescents thought they would eat more healthfully if they ate more often with their families. Key factors that appeared to influence healthy family meals included food availability at meals, rules around mealtimes, and health-related attitudes of family members.	MODERATE-STRONG #3
20 2000	Gillman et al. Growing up Today. USA	Family dinner and diet quality	MODERATE N=16202; 9-14 yr; 93% White. 67.5% response rate. Cross-sectional.	SES, education, health status, ethnicity	MODERATE Self-reported; FFQ validated; Other questions not validated; No reliability measures	Appropriate	WEAK Not mentioned	Older less likely to eat with family. FMF was positively associated with fruits and vegetables and negatively associated with eating fried foods away from home, and drinking any soda. Positive associations were found between FMF and several nutrients. Outcome effects did not differ after controlling for BMI, PA, TV, smoking, smoking in the home, double parent home vs. other, household income, or frequency of child making his or her own dinner.	MODERATE #4

19 2003	Videon and Manning ADD HEALTH Study. USA	Determinants of fruits, vegetables and dairy; including family meals	MODERATE-STRONG N=18177; 11-21 yr; Ethnically diverse 79% response rate. Cross-sectional.		WEAK Self-reported; Developed own survey; Validity and reliability not mentioned	Appropriate	WEAK Not mentioned	Parental presence at the evening meal was associated with lower risk of poor consumption of fruits, vegetables, and dairy foods as well as the likelihood of skipping breakfast. The beneficial effect of family meals increased as the number of meals increased.	MODERATE #5
8 2005	Veugelers et al. CLASS STUDY. CANADA	Determinants of diet quality	MODERATE N=5200; gr 5 51.5% response rate. Cross-sectional.		MODERATE Focus groups; Modified the valid and reliable Youth FFQ (YAQ). Diet Quality Index International. Behavioural questions; no validity/reliability mentioned	Appropriate	WEAK Not mentioned	Relative risk (95% CI) for having a poor diet was greater for those individuals eating dinner with family members 1-2 x/wk (0.98(0.93-1.03)) compared with $\geq$5 x/wk (0.86(0.83-0.9)).	MODERATE #6
76 2004	Granner et al. South Carolina, USA	Correlates of fruit and vegetable consumption	LOW-MODERATE N=736; 11-15 yr; 2 schools; 71.1% response rate. Black and White students. Cross-sectional.	Ethnicity	MODERATE Teachers administered the survey developed by the researchers (teachers trained by investigators). Short screener form developed from a validated FFQ used for fruit/veg consumption	Appropriate	MODERATE Discussed SCT related to self-efficacy and fruit and vegetable intake.	Black and 14/15 yr olds reported fewer family meals than White and younger adolescents, respectively. Whites = more family influence on food. Older = less family meal frequency.	MODERATE #7

[a]SCT refers to social cognitive theory. [b]FMF refers to family meal frequency

that related to family meals and dietary intake, three articles (Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003; Videon and Manning, 2003) purposely investigated family meal influence on youth dietary intake, whereas four other articles (Granner et al., 2004; Neumark-Sztainer et al., 2000; Neumark-Sztainer et al., 2004; Veugelers et al., 2005) included family meals in the analyses, though family meals were not the main focus of the study. All studies were cross-sectional, generally had large, somewhat representative samples, used self-reported behavioural and dietary data, and had overall ratings from moderate to strong.

The strongest study identified (see #1-Table 1) was by Neumark-Sztainer and colleagues (Neumark-Sztainer, Hannan et al., 2003). This research explored the associations of family meal frequency and sociodemographic characteristics and dietary intake using the Youth and Adolescent Food Frequency Questionnaire (YAQ). This food intake tool (YAQ) has been deemed reliable and valid for groups of adolescents based on test-retest reliability and comparison against the doubly labeled water methodology (Perks et al., 2000), the current gold standard for measuring energy intake. Nevertheless, Neumark-Sztainer, Hannan et al. (2003) observed underreporting, which is a known limitation when using food intake surveys (Bandini, Schoeller, Cyr, and Dietz, 1990; Livingstone et al., 1992; Vance, Woodruff, McCargar, Husted, and Hanning, submitted), especially among those reporting fewer family meals. However, adjusting for the confounding influence of probable underreporting (defined as reported energy intake being less than 0.97 of estimated basal metabolic rate) did not affect the outcomes related to family meals and dietary intake. The results of this study supported positive associations between family meal frequency and the consumption of fruits, vegetables, and dairy foods and a negative correlation to soft drink

consumption (Neumark-Sztainer, Hannan, et al., 2003). Adolescents who reported more frequent family meals also consumed slightly more total energy which included significantly higher intakes of fibre, calcium, and iron; folate; and vitamins B6, C, and E (Neumark-Sztainer, Hannan, et al., 2003).

Among the studies with overall ratings of moderate strength of evidence (see #4-#7-Table 1), family meal frequency had positive associations with the intake of fruits (Gillman et al., 2000; Videon and Manning, 2003), vegetables (Gillman et al., 2000; Videon and Manning, 2003), and dairy foods (Gillman et al., 2000; Videon and Manning, 2003), and negative associations with the consumption of fried foods (Gillman et al., 2000; Videon and Manning, 2003) and soft drinks (Gillman et al., 2000). Gillman et al. (2000) reported that those who consumed more, rather than fewer, family meals had higher total energy intakes which included increased quantities of fibre; calcium; folate and vitamins B6, B12, C, and E; less saturated and trans fat; and lower glycemic loads. However, the results reported by Gillman et al. (2000) must be interpreted carefully since 93% of the adolescent sample was Caucasian and may not be representative of the larger population given that the participants were the sons and daughters of those participating in the Nurses Health Study II. Veugelers et al. (2005), in the first Canadian study to assess family dinner frequency and dietary intake (using a modified version of the YAQ) and quality (using the Diet Quality Index (DQI)-International), illustrated that grade five students (n=5200) from Nova Scotia who consumed more, versus fewer, dinners per week with family members had a 14% lower risk of a poor diet quality.

Body weight is conceivably one outcome measure of dietary intake, and perhaps quality. It has been suggested that family meals are protective against increased body weight

(Ritchie et al., 2005; Veugelers and Fitzgerald, 2005) and disordered eating behaviours (Neumark-Sztainer et al., 2004) even with the slightly higher energy intakes observed (Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003). Additionally, family meal frequency has also been reported to decrease the likelihood of skipping breakfast (Videon and Manning, 2003) which is a known adolescent food behaviour that commonly results in decreased nutritional adequacy.

Family meal frequency has generally been assessed on a per weekly basis. However, one study that utilized focus groups to gain a broad overview of family meal patterns and characteristics (Neumark-Sztainer et al., 2000) suggested that there are large variations in frequency of family meals, not only between participants but also within participants. For example, children and adolescents who live between two separate households may experience different family meal frequencies as they may have to deal with changes in activities and/or work schedules. Gillman et al. (2000) found that living between different parent homes did not affect family meal frequency; however, there may be other impacts such as differences in food rules/guidelines that have yet to be captured in the literature.

The seven studies all used self-reported measures from the adolescent participant (e.g. one individual's account of the social occurrence). Evidence suggests, however, that adolescents and parents may have differing views of family meals (Boutelle et al., 2001; Fulkerson, Neumark-Sztainer, and Story, 2006). Fulkerson et al. (2006) reported that parents were more likely than adolescents to report eating five or more family meals per week, the importance of eating together, and scheduling difficulties. Interestingly, it was also reported that younger adolescents were more likely than older adolescents to report eating as a family

more often, higher importance of eating together, and more rule expectations at mealtimes (Fulkerson et al., 2006).

The results from this systematic review suggest that family meals may improve dietary intakes and quality among children and adolescents. However, the idea of recommending more family meals to parents and adolescents seems like a naïve attempt at trying to improve dietary intakes in youth (given the complexity of today's families compared with those studied). The evolution of the family is diverse and much different than in the past: changes in family structures and living arrangements (Neumark-Sztainer et al., 2000), employment opportunities and demands (Neumark-Sztainer et al., 1999; Neumark-Sztainer et al., 2000), roles of family members (Neumark-Sztainer et al., 2000), and after-school youth activities (Neumark-Sztainer et al., 2000) may impact how a family eats. As Figures 1 and 2 illustrate, there are many potential family influences on adolescent nutritional behaviours and attitudes and trying to place family meals within the family and adolescent context is difficult. Future research surrounding family meals needs to include more of these mediating/confounding factors. No research exists that examines the environment of family meals, such as who prepared the meal, where the food was purchased and consumed, and who it was consumed with. Furthermore, investigations are needed to quantify the associations between family meal frequency and other commonly-reported food behaviours in adolescents. This type of information would help those working with adolescents to improve overall health and body weight.

1.5 Relevance to Practice

The concept of promoting family meals to parents/adolescents and expecting improved nutrition profiles seems rather simplistic. Initial evidence supports the notion that

increased family meal frequency is associated with improved nutrition profiles and healthy body weights in adolescents. However, gaps in our understanding of family meal patterns and adolescent nutrition within the context of the family exist. Researchers need to gain a better understanding of what it is about family meals that makes it so beneficial in order to translate into practice. In the meantime however, family meals as part of other healthy eating guidelines may be recommended to families who do not currently eat together frequently, to support improved dietary intakes among adolescents.

CHAPTER 2: Study Methodology and Sample

This chapter provides a more extensive overview of the study methodology and sample used in the remaining chapters.

2.1 Survey

The current study utilized data collected from the *Food Behaviour Questionnaire* developed at the University of Waterloo (Hanning et al., 2007; Minaker et al., 2006). The survey was designed to assess nutrient intake, food behaviours, and physical activity patterns of children and adolescents through the use of a 24 hour dietary recall, food frequency questionnaire (FFQ), and other nutrition and physical activity behavioural questions. The web-based survey offers several logistical and methodological advantages versus paper-based or interview methodologies, including (1) the ability to survey a large number of geographically diverse participants, (2) the incorporation of interactive elements to increase the likelihood of proper reporting, (3) that it is fun and easy for the participants, and (4) that it provided immediate individual feedback to the participants. Furthermore, the use of the web-based tool was cost effective and allowed for direct data processing which helps to reduce recording errors.

A number of approaches have established the validity and reliability of this tool. When compared with direct observation of the noon meal from the previous day, the survey produced 87% agreement in food items selected (n=15, grade 9-10). In a more recent validation study (funded by the Ministry of Health Promotion, 2005/06), when compared with a dietitian administered food recall interview for the same 24-hour period, there was significant agreement for energy (Pearson's correlation coefficient of 0.63 and intraclass correlation of 0.58) and macronutrient intakes (Pearson's correlation coefficients >0.54 and

intraclass correlation coefficients >0.50) in 204 multiethnic, grade 6-8 students from Toronto schools (31-60% English as a second language; Hanning, Royall, Hogsden, Toews, Driezen, unpublished data). Furthermore, test-retest reliability for the FFQ completed 6.5 (SD 5.1) days apart, produced overall percentage agreements of 79% for cola intake, 73% for french fry intake, and 71% for candy intake (n=159, grade 9-10; Hanning, Jessup, Lambraki, MacDonald, and McCargar, 2003). At the present time, too few validation studies have been done on self-reported dietary assessment methodologies to advocate one particular methodology over another for use with a pediatric or adolescent population (Gibson, 2005; Livingstone and Robson, 2000; McPherson, Hoelscher, Alexander, Scanlon, and Serdula, 2000) and therefore, the *Food Behaviour Questionnaire* was deemed appropriate for use with school populations given several modes of assessment are included.

2.1.1 24 Hour Dietary Recall

Participants were asked to complete a 24 hour dietary recall of all the foods (meals and snacks) and beverages consumed on the previous day to provide measures of total energy, macronutrient, and micronutrient intake (see Appendix A for a sample screen). The 24 hour dietary recall method has been commonly used in children and adolescents (Nicklas, Elkasabany, Srinivasan, and Berenson, 2001; Gray-Donald, Jacobs-Starkey, and Johnson-Down, 2000) and has been found to accurately reflect energy intake on a group basis (Goran, 1998; McPherson et al., 2000). However, as with all methods of self-reported dietary assessments, several potential limitations including recall error (Baranowski and Domel, 1994), inaccurate estimation of portion sizes (Livinstone and Robson, 2000), providing socially desirable responses, and underreporting (Bandini et al., 1990; Briefel, Sempos, McDowell, Chein, and Alaimo, 1997; Livingstone et al., 1992) are associated with the 24

hour dietary recall methodology. The *Food Behaviour Questionnaire* was designed with these limitations in mind, building in several prompt screens and providing visuals of portion sizes to assist in accurate reporting. Furthermore, the anonymity associated with the web-based survey is thought to encourage participants to be more truthful in reporting potentially sensitive information.

The survey collects data separately for *breakfast, lunch, dinner*, and *other times*. Approximately 800 foods and beverages are listed by alphabetical order within the most appropriate food group category. In the event that participants are unable to find a particular food item they are instructed to find another food that is similar. Once a food has been chosen, prompt screens (specific to that food) allow participants to estimate the serving size (often with the assistance of photographic images) as well as report any toppings that were consumed with that food. Furthermore, if a participant does not report any beverages consumed during a meal, a prompt screen reminds them of this and asks them what they had to drink. Following food input, participants are asked to double check the selected foods on a summary screen and make any changes necessary. Upon completion of the 24 hour recall, participants receive individualized feedback according to the (then) Canada's Food Guide to Healthy Eating (CFGHE, 1992) based on portion-size definitions of the Canadian Nutrient File group (e.g. compares their diet with recommended number of food servings; Canadian Nutrient Data System, 2001)

2.1.2 Food Frequency Questionnaire

A short FFQ collects data on the usual intakes of specific foods and food behaviours (see Appendix B for the specific questions of interest for this thesis). Participants were asked *How often do you eat meals or snacks prepared away from home (from fast food restaurants*

or take out)? Possible responses included "once a day, 2-6 times a week, once a week, once a month, or rarely/never." In the case of Porcupine, Toronto, and Nova Scotia, pop consumption was determined using the question *How often do you eat the following foods [pop (non-diet)]?* In the case of Waterloo, *How often do you drink pop drinks?* was used, whereas in Peel, for non-diet drinks, *How often do you drink COLA-type soft drinks (e.g. Coke, Pepsi, Rootbeer)* and *How often do you drink NON COLA-type soft drinks (e.g. Sprite, 7up, Mountain Dew, Orange Crush)?* were combined. All pop-related questions had possible responses of "once a day, 2-6 times a week, once a week, once a month, or rarely/never."

FFQ's have been commonly used as nutrition assessment tools in children and adolescents (Neumark-Sztainer, Wall et al., 2003; Veugelers et al., 2005) and have been noted as being useful for ranking individuals by intake levels (Gibson, 2005; McPherson et al., 2000). FFQ's are known for measuring usual intakes of specific foods over time (Gibson, 2005; Livingstone and Robson, 2000) and therefore were deemed appropriate to use for the present study.

2.1.3 Food Behaviour Questions

In addition to the original food behaviour questions (as developed by R. Hanning, see Appendix C for the questions of interest for this thesis) four new questions (see Appendix D) were developed and added to the survey for the purpose of this thesis. The four new questions were developed, based on the literature (Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003) to fit within the context of the *Food Behaviour Questionnaire*. The new questions addressed family meal frequency, meal preparation, food purchasing patterns, and self-efficacy for healthy eating. These questions were tested for face and content validity,

using a think aloud process, with a convenience sample of six adolescents, as the result of which some wording changes occurred. The questions were then pre-tested, over a two week period, among grade 10 students (males=8, females=2) in a private school in Toronto, Ontario during May 2005 and were again, changed slightly based on wording. Finally, several nutrition experts (n=5) reviewed the questions for face and content validity and deemed the questions appropriate.

In addition to the question validation that I completed, a validity assessment of these four new questions was completed, as part of the larger validation study (funded by the Ontario Ministry of Health Promotion) of the *Food Behaviour Questionnaire*. The entire survey (including the four new questions) was reviewed by 11 expert methodologists, 9 girls, and 12 boys for face and content validity using cognitive interviewing techniques and think-aloud responses. No major concerns were raised regarding the four new questions (Hanning et al., unpublished data).

2.1.4 Survey Procedures

The survey data were electronically collected and stored at InterGlobal Solutions (via Clint MacDonald). Foods chosen by the participants were analyzed using ESHA Food Processor (Salem, OR, 2002) and the 2001b Canadian Nutrient File database (Canadian Nutrient Data System, 2001). All data were downloaded into Microsoft Access 2000 (Redmond, WA). Using the *rawdataextraction*, *viewExtract_HeightWeight, viewFOOD_extract_bysurveybyday_withnutrients*, and *viewFOOD_extract_bysurveybymeal_withnutrients* tables created in Access, surveys were linked by *surveyID* to create five large datasets (one for each of the school surveillance

studies: Porcupine, Peel, Waterloo, Toronto, and Nova Scotia), which were then individually imported into Minitab14 (statistical software; State College, PA).

The nutritional data were initially scanned for implausible intakes, such that participants who exceeded pre-determined energy intake ranges (<200 or >6000 kcals/day; n=24: Porcupine=6, Waterloo=6, Toronto=4, and Nova Scotia=8) and/or on visual inspection of food records that exceeded 3 times the number of recommended servings from CFGHE from one or more food groups for fallacious records (n=87: Porcupine=16, Peel=40, Waterloo=7, Toronto=8, and Nova Scotia=16), or both (n=14: Porcupine=3, Waterloo=3, Toronto=4, Nova Scotia=4) were excluded (similar to Hanning et al., 2007; Minaker et al., 2006). In total, 19, 40, 10, 8, and 20 participants from Porcupine, Peel, Waterloo, Toronto, and Nova Scotia, respectively, were excluded from further analyses based on implausible food intake records.

2.2 Data Collection

The *Food Behaviour Questionnaire* was used in school surveillance in Northern Ontario (Porcupine Region), Southern Ontario (Peel Region, Region of Waterloo, and Toronto), and Nova Scotia (PACY study) over the 2005-2006 academic school year. Each study used an identical 24 hour recall format, FFQ, and familial influence questions (some additional questions varied). Participating students from these studies formed the sample for this thesis.

Passive consent was the preferred approach for parental consent, because (1) no known or anticipated risks were associated with participation in the study, (2) the web-based method ensures complete anonymity, eliminating the difficulty of describing dietary behaviours face-to-face with a researcher, (3) passive consent ensures the likelihood of a

more representative sample, and (4) passive consent procedures substantially reduce the burden faced by the school and teachers. However, all school boards, other than Peel Region, insisted on active consent. Therefore, parental consent was actively obtained via an information letter and permission slip that was sent home with each student (see below and Appendices G-O). Only participants returning a signed permission slip to the school by the day of data collection and who were in class were surveyed. In the case of Peel (passive consent), a permission letter was mailed to parents or guardians of grade 6, 7, and 8 participants, with necessary forms and postage provided by the investigators (Appendix J). This letter explained the purpose and procedures of the study, and clearly indicated the procedures for withholding consent. Parents not wishing their child to participate were to indicate their refusal by contacting either the school contact person or study investigator. If a consent letter was returned undelivered, that student was considered ineligible to participate.

Participants provided active consent when they logged into the survey. Participants had the freedom to refuse to participate, withdraw their consent at any time, and/or refuse to answer any of the survey questions. Participants were assigned a unique identification number and password to ensure anonymity and confidentiality. Time needed to complete the survey varied as a function of the sophistication of the school's computer lab, but generally took 30-40 minutes per participant.

Study methodologies were slightly different based on the particular study objective(s), and are further outlined individually.

2.2.1 Porcupine Region

This survey is available at www.uweatwell.com using the login *phu* and password *phu* (English version) and login *phuf* and password *phuf* (French version). Ethics approval

for the study was obtained from the University of Waterloo Office of Research Ethics, the Porcupine Public Health Department, the Northeastern Catholic District School Board, the District School Board Ontario North East, Conseil scolaire catholique de district des Grandes Rivières and Conseil scolaire public de district du Nord-Est de l'Ontario. In order to ensure a representative sample and generalizibility of the findings, the Porcupine Health Unit invited all schools (English and French) with permission of the school boards to participate. The goal of this study was to recruit approximately 519 of the 1008 grade six students attending Public or Catholic school in the Porcupine Health Unit jurisdiction (43 schools in total) with adequate computing facilities to carry out the survey. An information letter was sent to school principals (English version - Appendix G) along with parent/guardian information and active consent forms (English version - Appendix H). Due to the location of data collection, participants received instruction from their classroom teachers, who were briefed from the Porcupine Public Health unit and the University of Waterloo research associates. All data were collected in June, 2006.

The total number of participating schools was 39 (out of a potential 43) due to refusal to participate by the either the school board or the individual school (school response rate=91%). Upon completion of this study, 385 participants (45% males vs. 55% females) in grade six classrooms from 20 schools completed the survey, representing a student response rate (students who were in class on the day of survey and returned a parental consent form) of 34% (or 65% of the desired sample).

2.2.2 Peel Region

This survey is available at www.uweatwell.com using the login *peel* and password *peel*. Ethics approval for the study was obtained from both the University of Waterloo Office

of Research Ethics and the Peel District School Board. Recruitment of schools took place through an information letter and summary of the project being mailed to school principals (Appendix I), which was followed up with a telephone call to determine each school's willingness to participate. Part of the purpose of this study was to follow-up with eight schools that had previously participated in a study in 2003, and therefore these eight schools were approached first. Unfortunately, five of the original eight schools refused to participate in the current study, and so 14 additional schools were approached to participate. The 14 new schools were chosen based on being located in the same ward as the original non-participating school. If there were no schools in that ward, another school was chosen from an adjacent ward. In total, 4 of the 14 schools that were newly approached agreed to participate. All schools were in urban locations with the exception of one, which took part in the original 2003 study. At the school level, the response rate was ~32% (7 participating schools out of 22 potential schools).

A University of Waterloo graduate student investigator (K. McGoldrick) was present for the data collection that took place between December, 2005 and May, 2006. Upon completion of this study, 1413 participants (54% males vs. 46% females) in grades six (30%), seven (33%), and eight (37%) from 7 schools completed the survey, representing a student response rate (students who were in class on the day of survey without any parental objection) of 98%.

2.2.3 Region of Waterloo

This survey is available at www.uweatwell.com using the login *rofw* and password *rofw*. Ethics approval was obtained from the University of Waterloo Office of Research Ethics, the Region of Waterloo Public Health Research Ethics Committee, and the Region of

Waterloo District School Board. Initially, the sampling scheme sought ~500-600 grade six students from fifteen schools, selected to represent a cross section of neighborhoods in Waterloo Region based on a comparison of socioeconomic and demographic variables from the 2001 Statistics Canada Census and the 2001 Urban Poverty data. In the fall of 2005, schools were invited to participate via an information letter that was sent to school principals (Appendix K). The target number of schools was not initially reached; therefore the remaining schools to satisfy the initial sampling scheme were actively recruited by the Waterloo Region District School Board Superintendent. After the principal accepted the invitation to participate, parent/guardian information and active consent forms (Appendix L) were sent home with each grade six student. All data were collected between November, 2005 and April, 2006 and either I or my supervisor (R. Hanning) was present.

Height and weight, without shoes, were measured by public health nurses and recorded using each student's unique identification code, which was later matched to the web-based survey. Height was measured by taping two measuring sticks directly to the wall (one directly on the ground and the other on top of the first in a straight line). Height was measured to the nearest 1.0 cm using a set square. Weight was measured using a Tanita HD314W digital scale that was zeroed before each participant. Weight was measured to the nearest 0.2 lbs. Participants were asked to stand backwards on the *platform* so that they could not read their weight. Teachers were given a small token of appreciation (bag filled with a Frisbee or other appropriate classroom games, CFGHE (1992), Canada's Physical Activity Guide for Children (2002) and Youth (2002), and other positive messages about body image and healthy eating).

A total of 405 students (48% males and 52% females) from grade six classrooms in 15 schools completed the survey, representing a student response rate (students were in class on the day of survey and returned a parental consent form) of 57%. Due to a small number (n=9) of grade five students who completed the questionnaire (as part of a grade 5/6 split classroom), these students were analyzed as grade six. This sample was used in a preliminary analysis investigating family meal frequency and the results were presented at the Canadian Society for Nutritional Sciences annual meeting in Edmonton, AB in May, 2006 (see Appendix P for a copy of the poster; Woodruff, Hanning, and Fisher, 2006).

2.2.4 Toronto

This survey is available at www.uweatwell.com using the login *mhp* and password *mhp*. Ethics approval was obtained from the University of Waterloo Office of Research Ethics. This cohort of participants was part of a larger validation study of the *Food Behaviour Questionnaire* in which 300 participants were targeted; 100 (50 males and 50 females) participants from each eligible grade (grade 6, 7, and 8). School recruitment was done via a telephone call and a supplementary information letter (Appendix M) sent to a convenience sample of school administrators (n=44) who were first-year participants to the *ACT NOW! The best you can be… Schools Program* (Creative Wellness Solutions, 2006), a school-based program employing Olympians to deliver health and wellness messaging. Schools were contacted from four school boards in the Greater Toronto Area (Toronto District School Board, Toronto Catholic District School Board, York District School Board, and York Catholic District School Board). Parental consent was obtained via active consent (Appendix N).

Height and weight, without shoes, were recorded using each student's unique identification code, which was later matched to the web-survey. Height was measured by taping a measuring tape directly to the wall. Height was measured to the nearest 0.5 cm using a set square. Weight was measured using a digital scale that was zeroed before each participant. Weight was measured to the nearest 0.1 lb. Data were collected June 2 - 23, 2006. Two research assistants from the Population Health Research Group at the University of Waterloo were present (L. Hogsden and J. Toews) in addition to the dietitians completing a separate, in person, food recall. Upon completion of this study, 216 participants (42% males vs. 58% females) from grade six (33%), seven (43%), and eight (24%) classrooms in six schools completed the survey, representing a student response rate (students who were in class on the day of survey and returned a parental consent form) of 38%. The response rate, in this case, may have been lower than the other school surveillance studies because of a dietitian interview component that was part of the validation study.

2.2.5 Nova Scotia (PACY)

This survey is available at www.uweatwell.com using the login *pacy* and password *pacy* (English version) and login *pacyfr* and password *pacyfr* (French version). Similar to an earlier study in 2001 (PACY-2001), the Nova Scotia Department of Education randomly selected schools from each of the six Sport and Recreation Commission regions in Nova Scotia. Approval for this study was obtained from the respective Research Ethics Boards at Acadia University, Cape Breton University, Dalhousie University, and St. Francis Xavier University. Approval was also obtained from all school boards and the randomly selected schools. A request was made of the principals of these randomly selected schools for permission to (1) discuss the research project with the applicable grade of students, and (2) to

use the school as the designated site to obtain anthropometric measurements, attach accelerometers, and to collect physical activity measures and web-based dietary data. If a school chose not to participate in the study, an additional school was randomly selected. Each participating school was given $250 to be used for physical education equipment purchases or physical activity or healthy eating related events. Further, the incentive for student participation was an opportunity to win a $100 gift certificate to a sports store in each of the six Sport and Recreation Regions.

Once approval from the school principal was granted, the research assistants spoke to the participants at the schools in small classroom settings and distributed packets of letters of invitation and consent forms (Appendix O). Once the consent forms were returned, 120 participants (60 male and 60 female) from each grade (grades 3, 7, and 11) and from each region (n=6) were randomly selected to participate in the objective measurement of physical activity, anthropometric measurements, and dietary data collection (desired N=2160). Since grade 3 students did not complete the *Food Behaviour Questionnaire* portion of the study and grade 11 students did not match the general age of the present sample, only grade seven students were used.

Data collection took place between October, 2005 and June, 2006. A data collection team of two individuals (one male and one female situated at each of Acadia, Cape Breton, Dalhousie, and St. Francis Xavier Universities) was present. Upon completion of the study, 804 participants (45% males and 55% females) from grade seven classrooms in 38 schools completed the survey, representing a student response rate (students who were in class on the day of the survey with a signed parental consent form) of 39%. Height and weight were measured by a same sex research team member, in order to reduce any possible discomfort to

the participant. Height was measured as standing stature and recorded to the nearest 0.1 cm. Weight was measured on a calibrated electronic scale and recorded to the nearest 0.1 Kg. Participants were not able to see their height or weight measurements.

2.3 Calculations

2.3.1 Measure of Dietary Quality

Over the past several decades, researchers have struggled with how to define healthy diets among the population. Several different types of methodologies, such as (1) factor and cluster analyses, (2) nutrient inadequacies, and (3) dietary quality indexes have been proposed. Factor and cluster analyses identify food consumption models or patterns in the dataset (e.g. similar food intakes among a group of individuals) yet do not allow for comparisons against current dietary recommendations (Dubois, Girard, and Bergeron, 2000). Measures of nutrient inadequacies compare an individual's nutrient intake to national recommendations, yet multiple days of food intake are needed to determine usual intake levels (Garriguet, 2006; Nusser, Carriquiry, Dodd, and Fuller, 1996). Finally, dietary quality indices evaluate the combination of different nutrients, foods, or dietary constituents on specific health outcomes (Dubois et al., 2000; Kant, 1996; Veugelers et al., 2005). Numerous diet quality indices exist (Kant, 1996), yet must be chosen with a specific population and health index in mind to ensure the comprehensiveness and suitability of the index.

Within Canada, dietary quality indices have been used with adults (Dubois et al., 2000; Shatenstein, Nadon, Godin, and Ferland, 2005) and children and adolescents (Glanville and McIntyre, 2006; Veugelers et al., 2005). Dubois et al. (2000) adapted three different measures of dietary quality with the 1990 Canadian nutrition recommendations, to analyze

the Québec Nutrition Survey data (n=2103 males and females aged 18-74 years). The authors adapted the (1) Dietary Quality Index (DQI; Patterson, Haines, and Popkin, 1994), (2) the Healthy Eating Index (HEI; Kennedy, Ohls, Carlson, and Fleming, 1995), and (3) the Healthy Diet Indicator (HDI; Huijbregts, Fesken, and Rasanen, 1997). The results suggested the HEI was the best indicator for their dataset, as strong correlations existed between the HEI and the mean adequacy ratio (MAR, which averages the proportion of dietary recommendations met by an individual for each nutrient) (Spearman correlation = 0.197, $p<0.001$). Furthermore, Dubois et al. (2000) concluded that because the HEI measure is a continuous measure (versus discreet), it is easy to interpret, and it allows for a greater variety of statistical analyses.

Recently, Glanville and McIntyre (2006) adopted the HEI (Kennedy et al., 1995) to compare the diets of low-income, single mothers (n=129) and their children and adolescents (n=82 1-3 years, n=147 4-8 years, and n=74 9-14 years) from Atlantic Canada to the recommended number of food servings from CFGHE and other current recommendations. The variety score and sodium category were changed from the original HEI (Glanville and McIntyre, 2006). The variety score was manipulated to a score based on consuming at least one serving from each food group, rather than the total number of different foods consumed. The sodium category was changed to the number of servings consumed from the *other* food group according to CFGHE (all foods that do not fit into the other four categories). Based on the Canadian modifications to the USDA-derived HEI index, Glanville and McIntyre (2006) termed their measure the HEI-C (Glanville and McIntyre, 2006). Possible scores range from 0-100, with 100 points referring to a *perfect* diet quality. Participant's diets can also be categorized as *poor* (≤50 HEI-C score), *needs improvement* (HEI-C score 50-80), or *good*

(HEI-C score >80). Due to ease of computation, and degree to which it measures diet quality, the HEI-C was chosen as a measure of diet quality for this thesis. For a full description on how to calculate the HEI-C refer to Appendix F.

2.3.2 Body Weight Status

Height and weight (measured and self-reported) measurements were used to calculate body weight status using the Body Mass Index (BMI) formula (BMI = weight (Kg)/height $(m)^2$). Participants were classified as normal weight, overweight, or obese according to Cole, Bellizzi, Flegal, and Dietz (2000) (see Appendix E for cut-off values). Cole cut-offs have been commonly used in Canada to measure body weight status of children and adolescents (Shields, 2005; Veugelers and Fitzgerald, 2005) and are the method of choice from the International Obesity Task Force (http://www.iotf.org/). Measured heights and weights were used to calculate BMI, when available (Waterloo, Toronto, and Nova Scotia), whereas self-reported height and weights were used when measured data were not available (Porcupine and Peel). In the case of using self-reported measures (Porcupine and Peel), a scan of BMI values was done to check for implausible values (those with values ±3 SD beyond the age and sex-adjusted mean BMI values (Kuczmarski et al., 2000) were excluded from further analyses. This procedure was similar Berkey et al. (2000) and to recent theses projects by V. Vance (2004) and K. McGoldrick (2004) (using the *Food Behaviour Questionnaire)*, all of which used self-reported height and weight measures. A total of 25 (6%) and 92 (6%) participants from Porcupine and Peel, respectively, were excluded based on implausible BMI records.

2.3.3 School Region Socioeconomic Status

Negative associations between food intake and various measures of SES (such as household income, parent level education, and/or school region SES) are commonly reported in adults (Garriguet, 2006) and children and adolescents (Crawford et al., 1995; Johnson-Down, O'Loughlin, Koski, and Gray-Donald, 1997; Minaker et al., 2006), which may be confounded with overall dietary intake. Therefore for each participant, a measure of regional socioeconomic status (SES) for each school was calculated based on the postal code (forward sortation areas) of the school and the 2001 Canadian Census of Population data. School region SES was categorized as <40K, 40K-50K, 50K-60K, 60K-70K, 70K-80K, and >80K (similar to Minaker et al., 2006). This type of measure recognizes that SES could vary among individuals within the same school; however, schools are generally thought to be representative of the community in which the school is situated (Minaker et al., 2006). The median school region SES was $53547, $72557, $71451, $53266, and $43834 for Porcupine, Peel, Waterloo, Toronto, and Nova Scotia participants, respectively.

2.3.4 Reporting Status

Researchers using self-reported food intake data commonly describe underreporting among adolescents (Bandini et al., 1990; Livingstone et al., 1992), primarily by females (Briefel et al., 1997; Vance et al., submitted) and overweight/obese individuals (Bandini et al., 1990; Champagne, DeLany, Harsha, and Bray, 1996; Vance et al., submitted). Neumark-Sztainer, Hannan et al. (2003), in their study assessing the associations of family meal frequency and dietary intakes of adolescents, used a dichotomous measure of reporting status as a covariate in the statistical analyses, as the result of which no differences in outcome measures were reported with and without taking into account underreporting. The methods

for accounting for underreporting are not agreed upon in the literature, and because underreporting may also be indicative of under-eating and/or dieting (as seen in Vance et al., submitted), it was decided that reporting status be used as a covariate in the analyses regarding food intake in the current thesis.

Reporting status was calculated for each participant using the same methodology as Vance et al. (submitted). Specifically, reporting status was identified using a ratio of energy intake (EI) to basal metabolic rate (BMR) ($EI:BMR_{est}$) (Black, 2000; Johnson-Downs et al., 1997). Energy intake was taken from the 24 hour recall, and BMR was estimated using age- and sex-specific formulae, adjusting for individual weight, as outlined by the World Health Organization (WHO, 1985; see Appendix Q for calculations). The WHO equations were chosen based on the predictive accuracy for this age group (Tverskaya, Rising, Brown, and Lifshitz, 1998). An $EI:BMR_{est}$ ratio of <1.74 has been considered as underreporting in the past (Black, 2000; Johnson-Down et al., 1997; Vance et al., submitted), yet has not been well documented in the literature. Therefore, it was felt that underreporting should be used in the current thesis as a continuous measure, rather than dichotomous. Thus lower reporting status ratio values (versus higher) represent more underreporting.

After removing participants with implausible food intakes (n=97), a general linear model analysis found that the reporting status ratio was significantly lower among females (adjusted $p=0.003$), grade eight (compared to grade six; adjusted $p=0.008$), overweight (adjusted $p<0.001$) and obese (adjusted $p<0.001$), and higher among participants from Waterloo (compared to all other school surveillance studies; $p<0.001$) in the current sample.

2.4 Statistical Considerations

2.4.1 Sample Size Calculations for Statistical Power

Minimal data were available using the HEI-C to assess diet quality in children and adolescents. Mean HEI-C scores of 63.3 (SD=9.1) and 61.7 (SD=10.4) were reported for 9-14 years (n=74) and 4-8 years (n=147), respectively, with the majority of 9-14 years (84.9%) and 4-8 years (85.5%) falling between 51-80 points, representing a *needs improvement* diet quality rating (Glanville and McIntyre, 2006). Therefore, using a conservative estimate of an expected HEI-C of 5 points to show a difference in diet quality and an expected population standard deviation of approximately 10 points (based on Glanville and McIntyre, 2006), a one-way ANOVA, with a desired power of 0.8, resulted in a required sample of 79 participants (for each of the three levels of family meal frequency) (completed using Minitab Statistical software, College State, PA).

Based on the primary objectives of this thesis (e.g. being able to detect differences in HEI-C scores by family meal frequency), it was estimated that there was an adequate number of participants (N=3223). Based on previous literature (Gillman et al., 2000; Neumark-Sztainer, Hannan, et al., 2003), approximately 25%-57% of adolescents consume family meals on most days of the week, whereas 14%-35% consume meals with family on some days or never. Therefore, based on conservative estimates of 50% consuming dinners on most (6-7 days/week), and 30% on some (3-5 days/week), and 20% never (0-2 days/week), it is expected that there would be an adequate sample (n=645) in the smallest group (e.g. 0-2 days/week). Further, based on the general rule that an additional 10 participants are needed per covariate (in this case: sex with 2 levels, grade with 3 levels, body weight status with 3 levels, and school surveillance study with 5 levels) an additional 130 participants were

needed within each group. Therefore, 204 participants were needed for each of the three levels of family meal frequency to be able to detect differences by sex, grade, and body weight status, and school surveillance study, and therefore, this study is adequately powered.

2.4.2 Study Sample

Preliminary analyses were completed to determine differences between the school surveillance studies. Table 2 includes a breakdown of the total sample, by school surveillance studies and sex, body weight status, grade, school region SES, and reporting status. Chi-square analyses revealed that differences between the school surveillance studies were observed for sex ($p<0.001$), grade ($p<0.001$), body weight status ($p<0.001$), and school region SES ($p<0.001$). A one-way ANOVA revealed that reporting status was also significantly different ($p<0.001$) among the school surveillance studies. School surveillance study and school region SES were significantly correlated (Pearson's correlation = -0.588, $p<0.001$), and therefore, to reduce multicolinearity among the variables, school surveillance study was chosen as the factor to explain the variation between the studies (rather that school region SES which could only explain some of the variations).

Table 2: *Characteristics[a] of those Completing the Food Behaviour Survey*

		Porcupine N=385		Peel N=1413		Waterloo N=405		Toronto N=216		Nova Scotia N=804		Total (N=3223)	
		N	%	N	%	N	%	N	%	N	%	N	%
Sex*	Males	172	45	755	54	190	48	90	42	365	45	1572	49
	Females	210	55	645	46	209	52	124	58	439	55	1627	51
Grade*	Six	371	100	418	30	405	100	72	33			1266	40
	Seven			463	33			92	43	804	100	1359	42
	Eight			527	37			52	24			579	18
Body	Normal weight	203	73	659	82	291	74	144	70	509	67	1806	74
Weight	Overweight	60	21	122	15	77	19	46	23	176	23	481	20
Status[b]*	Obese	17	6	22	3	28	7	14	7	80	10	161	6
School	<40K									153	19	153	5
Region	40K-50K									449	57	449	14
SES*	50K-60K	322	84			128	32	204	94	114	15	768	24
	60K-70K	63	16	581	41	44	11	12	6			700	22
	70K-80K			128	9	143	35			70	9	341	10
	>80K			704	50	90	22					794	25
Reporting	EI:BMR_{est}, X	1.38		1.59		1.76		1.39		1.26		1.50	
Status[c]*	(SD)	(1.72)		(0.95)		(0.85)		(0.67)		(0.63)		(0.84)	

[a]n=3223, [b]After removing implausible BMI values for Porcupine (n=25) and Peel (n=92), n=3106, [c]After removing participants with implausible food records (Porcupine=19, Peel=40, Waterloo=10, Toronto=8, Nova Scotia=20), n=3126, *statistically different between the school surveillance studies (Chi-square analyses used for categorical variables, 1-way ANOVA was used for reporting status), $p<0.001$

CHAPTER 3: Healthy Eating Index-C is Positively Associated with Family Meal Frequency of Grade Six, Seven, and Eight Students from Ontario and Nova Scotia

The work presented in this chapter will be submitted to the *Canadian Journal of Public Health* as:

Woodruff SJ, Hanning RM, Brown, KS. Healthy Eating Index-C is positively associated with family meal frequency of grade six, seven, and eight students from Ontario and Nova Scotia.

3.1 Abstract

A review of the literature has indicated that the family, or more specifically the family meal, is an appropriate venue to promote healthy food choices to children and adolescents. Little Canadian evidence exists, however, to support the promotion of family meals for improved diet quality. The purpose of this study was to describe the associations between family meal frequency and diet quality using the *Food Behaviour Questionnaire* that was used in school surveillance studies in Northern Ontario (Porcupine Region), Southern Ontario (Peel Region, Region of Waterloo, Toronto District), and Nova Scotia (as part of the PACY study) in grade six, seven, and eight classrooms over the 2005-2006 academic school year. Diet quality was calculated using the HEI-C, a recently modified diet quality index that compares an individual's diet intake to the recommended number of food servings from CFGHE and nutrient intakes in relation to current recommendations. The majority of participants (n=3015) reported frequent family meals (70% on 6-7 days/week, 19% on 3-5 days/week, and 11% on 0-2 days/week). Family meal frequency decreased with increasing grade (X^2=30.629 (df=4), $p<0.001$), and was significantly higher in participants from Porcupine and lower in participants from Peel (X^2=46.815 (df=8), $p<0.001$). The mean HEI-C score across all participants was 65.1 (SD 13.2) and the majority (73%) were rated in the

needs improvement category. Family meal frequency, particularly between 0-2 and 6-7 days/week, was positively associated with diet quality scores (adjusted $p=0.045$) and ratings ($p=0.049$). Participants who ate breakfast with family members (versus alone, $p=0.012$) and/or lunch with friends (versus alone, $p=0.007$ or family members, $p<0.001$) had a significantly greater likelihood of having a better diet quality rating. Breakfast ($p<0.001$) and/or lunch ($p<0.001$) skipping also had negative associations with diet quality. This is the first Canadian study to specifically investigate the associations between family meal frequency and diet quality among a large, geographically diverse sample of students in grade six, seven, and eight.

3.2 Introduction

The rising prevalence of childhood obesity is a dominant concern for schools, families, health care professionals, and government. Poor nutritional behaviours (Garriguet, 2006; Hanning et al., 2007) and lack of physical activity (Bar-Or et al., 1998; CFLRI, 2002) are at the core of this problematic health issue; researchers and clinicians are striving to gain a better understanding of risk factors and other influences to inform feasible strategies for future interventions. In 2004, Ontario's Chief Medical Officer of Health Report, *Healthy Weights, Healthy Lives* (Ministry of Health and Long Term Care, 2004) identified the family (as well as the government, food industry, workplaces, schools, and individuals) for recommendations for action. As a means to promote, achieve, and maintain healthy body weights for both parents and children, *Healthy Weights, Healthy Lives* (2004) recommended enjoying family meals whenever possible.

Very little evidence, however, exists regarding family meals within Canada. Therefore the purpose of this study was to describe family meal frequency (objective #1) and

diet quality (objective #2) among a large sample of grade six, seven, and eight students from Ontario and Nova Scotia. Both family meal frequency and diet quality were described according to sex, grade, body weight status, school surveillance study, and reporting status. It was expected that participants reporting higher family meal frequencies would also have higher diet quality (objective #3), based on studies of younger students from Nova Scotia (Veugelers et al., 2005) and US adolescents (Gillman et al., 2000; Neumark-Sztainer, Hannan, et al., 2003; Videon and Manning, 2003). Finally, the social aspects of meals (e.g. with whom each meal was consumed) and diet quality was investigated (objective #4). It was expected that participants who consumed breakfast and dinner with family members and lunch with friends would have a higher diet quality.

3.3 Methods

The web-based *Food Behaviour Questionnaire* (Hanning et al., 2007; Minaker et al., 2006) was used in grade six, seven, and eight school surveillance in Northern Ontario (Porcupine Region), Southern Ontario (Peel Region, Region of Waterloo, and Toronto), and Nova Scotia (PACY study) over the 2005-2006 academic school year. Due to a small number (n=9) of grade five students who completed the questionnaire (as part of a grade 5/6 split classroom), these students were analyzed as grade six. Each of the five school surveillance studies used an identical 24 hour diet recall format based on a menu of ~800 foods, FFQ, and familial influence questions. The survey took approximately 30-40 minutes to complete. The final screen summed each participants own intake, relative to (then) CFGHE (1992), based on portion-size definitions of the Canadian Nutrient File group (the standard reference database of nutrients in foods commonly consumed in Canada; Canadian Nutrient Data System, 2001).

This research was approved by the respective research ethics boards at University of Waterloo, Acadia University, Cape Breton University, Dalhousie University, and St. Francis Xavier University, in addition to each participating school board. Active parental consent was used in all studies, with the exception of Peel, which used passive parental consent procedures. Student response rates (e.g. in class on the day of the survey with parental consent) from recruited classes were approximately: 34% from Porcupine, 98% from Peel, 57% from Waterloo, 38% from Toronto, and 39% from Nova Scotia.

Measured (Waterloo, Toronto, Nova Scotia) and self-reported (Porcupine and Peel) height and weight values were used to calculate body weight status using the Body Mass Index (BMI) formula (BMI = weight (Kg)/height $(m)^2$). Participants were classified as normal weight, overweight, or obese according to International guidelines (Cole et al., 2000).

Nutrients were analyzed using ESHA Food Processor (Salem, OR) and the 2001b Canadian Nutrient File Database (Canadian Nutrient Data System, 2001). Foods that were not part of the four CFGHE (1992) food groups were classified in the *other* food group. Diet quality was calculated using the HEI-C, a recently modified diet quality index that compares an individual's diet intake to the recommended number of food servings from CFGHE and nutrient intakes in relation to current recommendations (Glanville and McIntyre, 2006). Possible scores range from 0-100, with 100 points referring to *perfect* diet quality (Kennedy et al., 1995). Participant's diets were categorized as *poor* (≤50 HEI-C score), *needs improvement* (HEI-C score 50-80), or *good* (HEI-C score >80) (Glanville and McIntyre, 2006).

Family meal frequency was assessed from the question *Typically, how many days per week do you eat dinner or supper with at least one parent?* and categorized as 0-2, 3-5, and

6-7 days/week. With whom participants consumed meals was assessed from the question *Who did you eat with yesterday [at breakfast, lunch, and dinner]?* Possible responses included "Myself, family (whole family, my Mom or Dad, brother(s) and/or sister(s), relative(s), grandparent(s), uncles/aunts), friends, or did not eat." Reporting status, a potential confounding influence of self-reported food intake surveys, was calculated for each participant, similar to Vance et al. (submitted). Reporting status (as a continuous variable) was identified using a ratio of self-reported energy intake (EI) to basal metabolic rate (BMR_{est}), as estimated using the age- and sex-specific formulae outlined by the World Health Organization (1985).

Participant characteristics (sex, grade, and body weight status) were compared by school surveillance study using bivariate chi-square analyses. Differences between family meal frequency categories and participant characteristics (separately) were completed using chi-square (categorical variables: sex, grade, body weight status, and school surveillance study) and one-way ANOVA (reporting status as a continuous measure) (objective #1) to determine the general trend of family meal frequency. Differences among diet quality scores (as a continuous variable) and descriptor variables (sex, grade, body weight status, and school surveillance study) were completed using general linear model (GLM) procedures (objective #2). Differences among diet quality ratings (as a categorical variable) and descriptor variables (sex, grade, body weight status, and school surveillance study) were completed using an ordinal logistic regression analysis (objective #2). In order to determine the association between diet quality scores and ratings and family meal frequency (objective #3), family meal frequency was added as a factor into the GLM and ordinal logistic regression analyses as described for objective #2. With whom participants consumed

breakfast, lunch, and dinner (separately) was described using chi-square analyses (categorical variables: sex, grade, body weight status, and school surveillance study) and a one-way ANOVA with reporting status as a continuous measure. In order to account for the associations of with whom each participant consumed breakfast, lunch, and dinner, each meal was entered as a factor into a GLM (for diet quality scores) or an ordinal logistic regression model (for diet quality ratings) along with the descriptor variables (sex, grade, body weight status, and school surveillance study).

Finally, all GLM and ordinal logistic regression analyses were completed with and without reporting status as a factor to determine the potential influence on overall diet quality scores and ratings. In all cases, the inclusion of reporting status did not change the outcomes, and in effect, helped to describe the data better (when diagnostic plots were examined). Therefore, all reported results include reporting status as a factor to account for potential underreporting among the sample. All post hoc test comparisons were done using Tukey's family error rate method of pairwise comparisons to avoid making a type 1 error. All statistical procedures were completed using Minitab 14 (State College, PA) with the level of significance set at 0.05.

3.4 Results

3.4.1 Sample

The total number of participants (N=3223) included 385 students from 20 schools in Porcupine Region, 1413 students from 7 schools in Peel Region, 405 students from 15 schools in Waterloo Region, 216 students from 6 schools in Toronto, and 804 students from 38 schools in Nova Scotia. Some participants (n=97) were excluded from further analysis due to implausible energy intakes (<200 kcal or >6000 kcal; n=24), and/or food group

intakes (on visual inspection of any record with >3 times the upper servings recommendation; n=87), or both (n=14). In addition, some participants from Porcupine (n=25) and Peel (n=92) were excluded from further the analyses because the self-reported BMI values fell greater or less than three times the standard deviation for age- and sex-adjusted mean BMI values (Kuczmarski et al., 2000). Finally, 10 participants (3 from Peel, 1 from Waterloo, 1 from Toronto, and 5 from Nova Scotia) were excluded from further analyses due the calculated HEI-C being an outlier (e.g. values between 1.5 and 3 times away from the middle 50% of the data are outliers; in this case, HEI-C scores less than 26.1 were excluded). The final sample (n=3015) included males (n=1451) and females (n=1541) in grade six (n=1178), seven (n=1294), and eight (n=538) (see Table 3 for characteristics of participants).

Table 3: *Participant Characteristics*

		Porcupine (n=342)		Peel (n=1293)		Waterloo (n=394)		Toronto (n=207)		Nova Scotia (n=779)		Total (n=3015)	
		n	%	n	%	n	%	n	%	n	%	n	%
Sex*	Males	149	44	681	53	185	48	84	41	352	45	1451	49
	Females	190	56	600	47	203	52	121	59	427	55	1454	51
Grade*	Six	342	100	372	29	394	100	70	34	0	0	1178	39
	Seven	0	0	429	33	0	0	84	41	779	100	1294	43
	Eight	0	0	487	38	0	0	51	25	0	0	538	18
Body Weight Status*	Normal weight	194	73	637	82	282	73	140	71	492	66	1745	74
	Overweight	55	21	120	15	75	19	44	22	171	24	465	20
	Obese	17	6	22	3	28	7	13	7	78	11	158	6

Note. n=3015, *Significantly different among school surveillance studies, $p<0.001$

3.4.2 Family Meals

Most participants reported consuming dinners together with at least one parent on 6-7 days/week (70%) with smaller numbers reporting family meals on 0-2 days/week (11%) or 3-

5 days/week (19%). Table 4 describes the differences in family meal frequency by sex, grade, body weight status, school surveillance study, and reporting status.

Table 4*: Prevalence of Family Meal Frequency*

		0-2 Family Meals/wk	3-5 Family Meals/wk	6-7 Family Meals/wk
Sex	Males (n=1063)	11%	18%	71%
	Females (n=1231)	12%	19%	69%
Grade*	Six (n=832)	12%	14%	74%
	Seven (n=1054)	10%	19%	71%
	Eight (n=416)	15%	25%	60%
Body Weight Status	Normal weight (n=1351)	11%	17%	72%
	Overweight (n=363)	9%	22%	69%
	Obese (n=123)	13%	20%	67%
School Surveillance Study*	Porcupine (n=195)	6%	15%	79%
	Peel (n=985)	15%	20%	65%
	Waterloo (n=318)	11%	12%	77%
	Toronto (n=135)	12%	17%	71%
	Nova Scotia (n=673)	8%	20%	72%
Reporting Status	EI:BMR_{est} X (SD) (n=2225)	1.57 (0.97)	1.43 (0.85)	1.54 (0.85)

Note. Unadjusted, *different among family meal frequency categories, $p<0.001$

3.4.3 Diet Quality

The mean HEI-C score across all participants was 65.1 (SD 13.2). The general linear model analysis (Appendix R) revealed that HEI-C scores were not significantly related to sex, grade, or body weight status, yet were significantly higher in participants from Waterloo (HEI-C=69.8 (SD 12.9), $p<0.001$) and Toronto (HEI-C=67.7 (SD 12.7), $p=0.016$), and lower in participants from Porcupine (HEI-C=64.1 (SD 13.1), $p=0.011$). Table 5 describes the individual components of the HEI-C score by school surveillance study.

When HEI-C scores were classified into diet quality rating categories, the majority of participants fell into the diet *needs improvement* category (73% versus 13% who had a *poor* diet and 14% who had a *good* diet). Ordinal logistic regression analyses (Appendix R) revealed no differences in diet quality ratings by sex, grade, and body weight status. However, diet quality ratings were likely to be higher in participants from Waterloo (OR 1.88 (95% CI: 1.33, 2.67), p<0.001) and Toronto (OR 1.70 (95% CI: 1.07, 2.68), p=0.024) versus Porcupine.

Table 5: *Component Scores of the HEI-C by School Surveillance Study*

	Porcupine	Peel	Waterloo	Toronto	Nova Scotia
Grains**	5.2 (2.9)	5.7 (2.8)^{A}	5.7 (2.8)^{A}	5.5 (2.6)	5.0 (2.8)^{B}
Veg/Fruit**	6.9 (6.4)^{A}	7.1 (6.2)^{A}	9.6 (6.3)^{B}	8.3 (6.5)^{A}	7.3 (6.4)
Milk**	7.6 (3.5)^{A}	7.3 (3.6)^{A}	8.7 (2.7)^{B}	7.7 (3.4)^{A}	7.7 (3.4)^{A}
Meat & Alt.**	6.9 (3.7)	6.4 (3.9)^{A}	6.7 (3.7)	7.5 (3.4)^{B}	6.8 (3.6)
Other*	7.9 (3.3)	7.6 (3.4)^{A}	8.3 (2.9)^{B}	7.6 (3.4)	7.7 (3.4)
T Fat**	6.9 (3.4)	7.3 (3.3)^{A}	7.4 (3.2)^{A}	7.6 (3.1)^{A}	6.3 (3.6)^{B}
Sat. Fat**	5.7 (4.0)	6.2 (4.0)^{A}	5.7 (3.9)	6.1 (3.9)	5.3 (4.1)^{B}
Cholesterol	8.6 (3.2)	8.7 (3.1)	8.8 (2.9)	8.5 (3.2)	8.9 (2.9)
Variability**	8.3 (1.7)^{A}	8.2 (1.9)^{A}	8.8 (1.4)^{B}	8.7 (1.5)^{B}	8.3 (1.8)^{A}
Total**	64.1 (13.1)^{A}	64.5 (12.9)^{A}	69.8 (12.9)^{B}	67.7 (12.7)^{B}	63.3 (13.2)^{A}

*Different among school surveillance studies, p<0.01, **different among school surveillance studies, p<0.001, differing superscript letters indicate that the components are different among specific school surveillance studies

3.4.4 Diet Quality and Family Meal Frequency

The mean diet quality scores were 63.5 (SD 13.2), 63.0 (SD 13.2), and 66.1 (SD 13.0) for participants who reported family meals on 0-2, 3-5, and 6-7 days/week, respectively (p<0.001). The GLM analysis (Appendix R) revealed positive associations between diet quality and family meal frequency. Post hoc Tukey's pairwise comparisons (adjusted for sex, grade, body weight status, school surveillance study, and reporting status) revealed that

HEI-C scores increased by 2.3 points (95% CI: 0.05, 4.7) as family meal frequency increased from 0-2 days/week to 6-7 days/week (adjusted p=0.045). When HEI-C diet quality ratings were analyzed, similar type of results were observed, such that diet quality ratings were likely to be lower among participants who reported family meals on 0-2 days/week (versus 6-7 days/week; OR 0.71 (95% CI: 0.51, 1.00), p=0.049) (Appendix R).

3.4.5 Diet Quality and With Whom Participants Ate Meals

With whom participants consumed breakfast (Table 6), lunch (Table 7), and dinner (Table 8), by sex, grade, body weight status, school surveillance study, and reporting status was described. The majority of participants consumed breakfast with family members (58% versus 34% who ate alone, 3% who ate with friends, and 5% who did not eat breakfast), lunch with friends (73% versus 9% who ate alone, 16% who ate with family members, and 2% who did not eat lunch), and dinner with their family (88% versus 7% who ate alone, 3%

Table 6: *With Whom Participants Ate Breakfast: Prevalence by Sex, Grade, Body Weight Status, School Surveillance Study, and Reporting Status*

		Family	Alone	Friends	Did Not Eat
Sex*	Males (n=1344)	51%	42%	2%	5%
	Females (n=1407)	52%	33%	3%	12%
Grade*	Six (n=1062)	58%	34%	3%	5%
	Seven (n=1209)	50%	38%	2%	10%
	Eight (n=497)	42%	45%	1%	12%
Body Weight Status	Normal weight (n=1622)	53%	38%	2%	7%
	Overweight (n=419)	51%	36%	2%	11%
	Obese (n=144)	53%	33%	2%	12%
School Surveillance Study*	Porcupine (n=283)	50%	39%	5%	6%
	Peel (n=1201)	47%	41%	2%	10%
	Waterloo (n=375)	67%	29%	1%	3%
	Toronto (n=172)	59%	33%	1%	7%
	Nova Scotia (n=742)	50%	38%	3%	10%
Reporting Status*	$EI:BMR_{est}$ X (SD) (n=2661)	1.62 (0.87)	1.54 (0.99)	1.56 (0.99)	1.05 (0.66)

*Differences with whom breakfast was consumed were observed, p<0.001

Table 7: *With Whom Participants Ate Lunch: Prevalence by Sex, Grade, Body Weight Status, School Surveillance Study, and Reporting Status*

		Friends	Alone	Family	Did Not Eat
Sex**	Males (n=1353)	73%	13%	11%	3%
	Females (n=1426)	75%	14%	7%	4%
Grade**	Six (n=1074)	73%	16%	9%	2%
	Seven (n=1220)	73%	13%	10%	4%
	Eight (n=502)	79%	8%	8%	5%
Body Weight Status*	Normal weight (n=1635)	76%	13%	7%	3%
	Overweight (n=422)	74%	13%	10%	3%
	Obese (n=145)	68%	13%	5%	3%
School Surveillance Study**	Porcupine (n=283)	49%	37%	11%	2%
	Peel (n=1225)	79%	8%	9%	4%
	Waterloo (n=378)	85%	6%	8%	1%
	Toronto (n=171)	78%	12%	9%	1%
	Nova Scotia (n=744)	70%	17%	10%	4%
Reporting Status**	$EI:BMR_{est}$	1.55	1.56	1.52	1.09
	X (SD) (n=2689)	(0.86)	(0.84)	(1.29)	(1.10)

*Differences with whom lunch was consumed were observed, $p<0.05$, **differences with whom lunch was consumed were observed, $p<0.01$

Table 8: *With Whom Participants Ate Dinner: Prevalence by Sex, Grade, Body Weight Status, School Surveillance Study, and Reporting Status*

		Family	Alone	Friends	Did Not Eat
Sex*	Males (n=1369)	87%	9%	3%	1%
	Females (n=1436)	86%	8%	4%	2%
Grade**	Six (n=1078)	89%	7%	3%	1%
	Seven (n=1230)	86%	9%	5%	1%
	Eight (n=514)	82%	12%	3%	3%
Body Weight Status	Normal weight (n=1645)	87%	8%	4%	1%
	Overweight (n=427)	87%	8%	4%	1%
	Obese (n=144)	88%	8%	0%	4%
School Surveillance Study**	Porcupine (n=286)	87%	7%	6%	1%
	Peel (n=1243)	84%	11%	3%	2%
	Waterloo (n=378)	93%	5%	2%	0%
	Toronto (n=175)	85%	9%	6%	1%
	Nova Scotia (n=745)	86%	7%	5%	1%
Reporting Status**	$EI:BMR_{est}$	1.55	1.46	1.48	0.96
	X (SD) (n=2714)	(0.87)	(1.29)	(0.99)	(0.56)

*Differences with whom dinner was consumed were observed, $p<0.05$, **differences with whom dinner was consumed were observed, $p<0.01$

who ate with friends, and 1% who did not eat dinner). The GLM analysis (Appendix R) revealed that with whom breakfast ($p<0.001$) and lunch ($p<0.001$) were consumed was associated with diet quality scores. An analysis of the coefficients, however, revealed that diet quality was not necessarily associated with the social aspect of the meal, but rather with participants who skipped breakfast ($p<0.001$) and/or lunch ($p=0.001$).

When diet quality was analyzed using the HEI-C rating categories, the ordinal logistic regression analysis (Appendix R) illustrated that participants who ate breakfast alone (versus with family members) were likely to have a lower diet quality rating (OR 0.76 (95% CI: 0.61, 0.94), $p=0.012$). For lunch, participants who ate alone (OR 0.66 (95% CI: 0.48, 0.89), $p=0.007$) or with family members (OR 0.52 (95% CI: 0.36, 0.74), $p<0.001$) were more likely to have a worse diet quality than if lunch was consumed with friends. No differences in diet quality ratings were observed for the social aspects of eating dinner (e.g. family, friends, or alone). Yet, the ordinal logistic regression analysis results also suggested similar negative associations by meal skipping, whereby participants who skipped breakfast (OR 0.30 (95% CI: 0.21, 0.44), $p<0.001$) and/or lunch (OR 0.30 (95% CI: 0.18, 0.51), $p<0.001$) were likely to have a worse diet quality rating than if they had consumed breakfast with family members and lunch with friends.

3.5 Discussion

Nutrient intakes and dietary patterns of students in grade six, seven, and eight from Northern and Southern Ontario and Nova Scotia were described through the use of the *Food Behaviour Questionnaire*. Although this large, geographically diverse sample is a collection of various smaller studies, each study used an identical 24 hour recall format, FFQ, and familial influence questions.

Participants in this study reported consuming more family dinners per week than has been previously reported by grade five students from Nova Scotia (57% reported 5 or more times/week; Veugelers et al., 2005) and younger adolescents (43% reported eating family meals everyday; Gillman et al., 2000) and adolescents (who reported 25%-48% consumed family meals 6 or more times/week; Neumark-Sztainer, Hannan, et al., 2003; Videon and Manning, 2003) from the US. The differences in family meal prevalence in the current study may be attributed to the manner in which family meals were assessed. Gillman et al. (2002) described eating with other members of the family (versus at least one parent, as in the current study) everyday, on most days, or never/somedays, as opposed to 6-7, 3-5, and 0-2 days/week. Neumark-Sztainer et al. (2000, 2003, 2004) investigated the frequency when all or most of the family members ate together in the last seven days (included all meals, rather than specifically looking at dinner/supper) and analyzed it by >7 times, 3-6 times, 1-2 times, or never.

The association of a decrease in family meal frequency with increasing age observed in the present study is similar to US data (Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003; Videon and Manning, 2003). The decrease may be attributed to increased independence from parents, part-time employment, and/or after school activities. Future research should investigate what barriers prevent frequent family meals, and how to overcome such barriers, among older children and adolescents.

Finally, differences between school surveillance studies were observed: Porcupine participants reported the highest prevalence of family meals on 6-7 days/week whereas Peel reported the highest prevalence on 0-2 days/week. It is possible that the age of Peel participants (grades 6-8) influenced this finding. It is also possible that the

geographical/rural location of Porcupine region promotes a more family-centred atmosphere, whereas the metropolitan/urban lifestyle of Peel families may make family meals more difficult to have on a frequent basis. Moreover, the meal frequency reported by participants from Peel region may be more representative of the larger population. The Peel study was the only study in which passive parental consent procedures were used (versus active in Porcupine, Waterloo, Toronto, and Nova Scotia). Dent et al. (1993) reported that participants who were omitted from participating in research due to lack of parental consent (when active procedures are used) were more likely to have parents who smoked, had decreased education levels, were from one-parent households, and placed lower priority on health. The differing student response rates (e.g. students had to be in class on the day of the survey and have parental consent) between school surveillances studies when using active procedures (Porcupine=34%, Waterloo=57%, Toronto=38%, and Nova Scotia=39%) versus passive (Peel=98%) may, in fact, be confounding the differing prevalence of family meals across the school surveillance studies. A lower family meal frequency was observed when passive parental consent was used (Peel Region) versus active parental consent (Porcupine, Waterloo, Toronto, and Nova Scotia combined).

No differences between family meal frequency and sex were observed, which is similar to others from the US (Gillman et al., 2000; Videon and Manning, 2003). The present study, however, did not find an association between family meal frequency and body weight status, which has often been reported by others (Gable et al., 2007; Sen, 2006; Veugelers and Fitzgerald, 2005). Gable et al. (2007) and Veugelers and Fitzgerald (2005) calculated body weight status using measured heights and weights on all participants. A potential limitation of the present study was that BMI was the sole indicator of body weight

status and that measured heights and weights were taken for students participating in the Waterloo, Toronto, and Nova Scotia studies, whereas self-reported values were used for Porcupine and Peel students. It is possible that students from Porcupine and Peel region overestimated their height and underestimated their weight, thus lowering the overall prevalence of overweight and obesity in Porcupine and Peel. This may have, in turn, influenced the results between family meal frequency and body weight status. Further, different methodological techniques have been used to classify overweight and obesity prevalence between the studies. Gable et al. (2007) and Sen (2006) calculated body weight status using the CDC's cutoff's based on BMI percentiles. In the present study, Cole et al. (2000) cut-offs, based on international standards, were chosen as the preferred methodology to be able to compare body weight status to other Canadian research (Shields, 2005; Veugelers and Fitzgerald, 2005).

In order to examine the association between family dinner frequency and dietary quality, HEI-C scores were calculated. This is the first time that HEI-C scores have been calculated on a large group of Canadian students in grade six, seven, and eight. The HEI-C scores observed (mean=65.1 SD=13.2) were similar to those observed in young adolescents (9-14 years) from Nova Scotia living in households with a single mother below the poverty line (mean=63.3, SD=9.1; Glanville and McIntyre, 2006). Even though the present sample reflects higher school region SES (see section 2.3.3 or Table 2) than Glanville and McIntyre (2006), diet quality ratings were similar. The current study observed significantly higher diet quality (confirmed when using both scores and ratings) in participants from Waterloo and Toronto and lower in Porcupine region (e.g. reflecting in part, a positive association between SES and diet quality, refer to section 2.3.3). However, there are numerous other potential

explanations that may account for the school surveillance study differences, such that the Porcupine study was administered by classroom teachers, rather than researchers (as was done in all other studies), potentially influencing the motivation of participants to answer more truthfully. However, reporting status ratios were not different between Porcupine and Toronto participants, thus other factors (e.g. environmental or family dynamics) not measured in this study may have influenced the differences.

The present study did not, surprisingly, find any associations between diet quality scores or ratings by sex, grade, and/or body weight status. It was originally hypothesized that males (versus females), those from lower grades (versus higher grades), and more normal weight (versus overweight or obese) participants, would have higher diet quality ratings. Males typically report higher diet quality because they generally consume more food, thus increasing overall levels of macronutrient and micronutrient intake. The null finding may be explained by how the HEI-C was calculated (Glanville and McIntyre, 2006), as it takes into account total energy intake (e.g. total number of servings are pro-rated for consumption levels of <1600 kcals/day, 1600-2200 kcals/day and >2200 kcals/day) thus equalizing total energy intake between males and females. It was also originally hypothesized that participants in higher grades would have a lower diet quality because they might have more access to fast food, have higher spending allowances (and purchasing freedom), and/or independence from their parents. The implication of not finding such a difference in diet quality may suggest that students in grade six, seven, and eight are more homogeneous than originally thought. Finally, the results indicating a null association between diet quality and body weight status may be again related to how diet quality was calculated. The energy

intake was accounted for when calculating the HEI-C, thus not necessarily distinguishing between under and over eating.

The present study found a positive association between improved HEI-C scores and ratings and more frequent family meals (versus less), particularly between 0-2 days/week and 6-7 days/week. Positive associations between family meals and diet quality have also been reported by students in grade five (n=5200) from Nova Scotia (Veugelers et al., 2005), as assessed using the DQI-International which takes into account dietary variety, adequacy, moderation, and balance. Further, studies from the US (Gillman et al., 2003; Neumark-Sztainer, Hannan et al., 2003; Videon and Manning, 2003) have shown that increased family meal frequency was positively associated to the consumption of fruits, vegetables, and dairy foods (all of which were assessed using the HEI-C) and a negative association with soft drink consumption and fried foods.

A unique aspect of the present study was the ability to investigate the social aspects of meals. The findings did not support the original hypothesis, as differences were generally observed by sex, grade, body weight status, school surveillance study, and reporting status for whom participants ate breakfast, lunch, and/or dinner. A higher prevalence of females and grade eight students did not eat the breakfast meal. In addition, a higher prevalence of grade six students and those from Waterloo consumed breakfast with family members. For the lunch meal, a higher prevalence of males consumed with family members and a higher prevalence of grade six students and those from Porcupine region consumed lunch alone. For the dinner meal, a lower prevalence of six students ate alone and a lower prevalence of students from Waterloo consumed dinner with friends. In all cases, skipping meals was

associated with reporting status, suggesting that energy intake levels are not compensated for at other times during the day.

By investigating family meals (or the social aspect of meals) in this manner (e.g. one random day vs. a frequency measure), the potential confounding influence of within subject variability of family meals (such as participants living between two households) was disregarded. The overall social impact and diet quality scores, however, revealed that a negative association primarily exists between breakfast and lunch skipping and diet quality, rather than whether or not the meal was consumed with friends, family, or alone. However, when diet quality ratings were analyzed (rather than scores), participants who ate breakfast alone (versus family members), lunch alone (versus friends), and/or lunch with family members (versus friends) had an increased likelihood of having worse diet quality ratings. De Castro (1990 and 1991a) previously illustrated that the presence of others at meals increases the length of the meal and the amount of food consumed, regardless of the time of day, weekend versus weekday, setting (home, restaurant, or elsewhere), or the presence of alcohol. Perhaps the increased amount of food consumed with others provides more nutrients to satisfy diet quality. It is possible, however, that individuals may remember what they ate better in the context of social eating versus eating alone. It was also interesting to note that participants who consumed lunch with family, rather than friends, had an increased likelihood of having a worse diet quality rating. This surprising finding is difficult to explain, however, may be associated with meal locations, food purchasing, and/or food preparation methods (as in Chapter 4).

Finally, and perhaps a more significant finding of the social aspect of meal analyses, was the negative association between diet quality and meal skipping (in this case, versus

consuming meals with family members or friends). Although the manner for measuring meal skipping is different than others (Cohen et al., 2003; Evers et al., 2001), meal skipping, particularly breakfast, tends to be commonly used as a weight loss strategy in adolescents (Jones et al., 2001; McVey et al., 2004) which can have negative consequences on diet quality (Neumark-Sztainer, Wall, et al., 2003; Woodruff et al, submitted). Intervention strategies aimed at healthy food intake among children and adolescents should be aware of the negative association of meal skipping and diet quality.

This study is not without limitations. There are numerous familial factors which can influence overall food intake, including demographics, behaviour modeling, the shared environment, and parenting style which may or may not be associated with family meals (Chapter 1: Figure 2). It is possible that families who currently eat together are also families who are more likely to be family-centred and focused on proper nutritional intakes and other health issues. It is not possible to make any conclusions about what aspects of family dynamics/characteristics may be driving the dietary differences.

The use of the HEI-C as a measure of diet quality surely does not capture all aspects of the diet (Kant, 1996). It was expected, however, that the HEI-C would provide an adequate and comprehensive measure of dietary intake, rather than trying to investigate macronutrients and micronutrients individually. Finally, body weight status was calculated using measured (Region of Waterloo, Nova Scotia, and Toronto) and self-reported (Peel and Porcupine Region) height and weight. It may have been more appropriate to adjust the self-reported values from Porcupine and Peel students to accommodate the differences from measured values, however, the variability between measured versus self-reported heights and weights for Waterloo, Toronto, and Nova Scotia did not support a single correction factor.

Measured heights and weights for all participants would have provided more reliable data; however, this was not possible due to the large scale nature of the data collections.

In summary, this study indicates that the diet quality of only 14% of participants would be rated as *good*. Although diet quality did not relate to body weight, it is nevertheless a concern regarding the health of children and adolescents. This study found associations between diet quality and family meal frequency. Moreover, it went beyond frequency to indicate that eating meals in a social context versus alone supported diet quality.

CHAPTER 4: Specific Meal Environments are Associated with Improved Diet Quality Ratings in Grade Six, Seven, and Eight Students from Ontario and Nova Scotia.

The work presented in this chapter will be submitted to the *Journal of the American Dietetic Association* as:

Woodruff SJ, Hanning RM. Specific meal environments are associated with improved diet quality ratings in grade six, seven, and eight students from Ontario and Nova Scotia.

4.1 Abstract

Family meals have recently been associated in the literature with improved dietary quality in children and adolescents, yet very little is known about family meals beyond their frequency. The purpose of this study was to describe and compare specific aspects of the breakfast, lunch, and dinner meal environments and to investigate the associations with total daily diet quality. The web-based *Food Behaviour Questionnaire* was used to obtain data on food intake and meal environments in Northern Ontario (Porcupine Region), Southern Ontario (Peel Region, Region of Waterloo, Toronto District), and Nova Scotia (as part of the PACY study) grade six, seven, and eight classrooms over the 2005-2006 academic school year. The specific aspects of the meal environments described were (1) where the meal was consumed, (2) with whom participants consumed each meal, (3) who prepared the meal, and (4) where the food was originally purchased. Cluster K-means procedures were used to classify observations about the four meal environment variables into groups. A total of 3, 8, and 6 clusters of meal environments were identified for breakfast, lunch, and dinner, respectively. Diet quality was negatively associated with consuming/purchasing meals outside of the home, and skipping breakfast and/or lunch. This was the first study to describe specific meal environments of Canadians in grades six, seven, and eight.

4.2 Introduction

Higher (versus lower) frequencies of family meals have recently been associated with healthier diets (Chapter 3; Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003; Veugelers et al., 2005) and healthy body weights (Gable et al., 2007; Sen, 2006; Veugelers and Fitzgerald, 2005) among children and adolescents. However, no research to date has described other aspects of family meals in relation to dietary intake. Stroebele and de Castro argued in a recent review (2004), that meal environmental factors (such as where, when, and with whom food consumption takes place) may influence food intake. Within the literature, there seems to be a great deal of information related to the physiological mechanisms of controlling food intake, while the influence of other situational and social factors has largely been ignored (Meiselman, 1992).

Meal environments are different than they were in the past. Food preparation and consumption does not always take place in the home anymore. According to the recently published Canadian Community Health Survey (CCHS), Cycle 2.2 (Garriguet, 2006), fewer than half of 4-18 year olds consumed food that was only prepared in the home on the day surveyed. Foods that are prepared outside of the home, versus inside the home, have larger portion sizes (Ello-Martin, Ledikwe, and Rolls, 2005; Guthrie, Biing-Hwan, and Frazao, 2002; Nielsen and Popkin, 2003), and are reportedly higher in total and saturated fats, and lower in fibre and calcium (Lin et al., 1999a).

Therefore, the purpose of this study was to investigate specific aspects of the meal environment that may be associated with diet quality among students in grade six, seven, and eight from Ontario and Nova Scotia. Using 24 hour recall techniques (Hanning et al., 2007), the first aim of this study was to describe selected aspects of meal environments (where the

meal was consumed, with whom the meal was consumed, who prepared the meal, and where the food was originally purchased) at breakfast, lunch, and dinner. Differences between breakfast, lunch, and dinner were anticipated, such that the majority of participants were expected to consume breakfast at home, alone, prepared by the participants themselves, and bought at a grocery store; lunch was expected to be consumed at school, with friends, prepared by family members, and bought at a grocery store; and dinner was expected to be consumed at home, with family members, prepared by family members, and purchased from a grocery store. The second objective of this study was to determine if meal environments could be clustered into identifiable patterns and whether these clusters were different by sex, grade, body weight status, school surveillance study, and/or reporting status. It was expected that meal environments would cluster into identifiable patterns but no differences would be observed by any of the descriptor variables. The final objective was to determine whether the clusters of meal environments (separately for breakfast, lunch, and dinner) were associated with overall diet quality, as assessed using the recently modified Canadian adaptation of the HEI (Glanville and McIntyre, 2006). It was expected that meals consumed at home with family members, prepared by family members, and bought at a grocery store would be associated with higher diet quality, whereas food prepared, purchased, and consumed at a restaurant or fast food outlet with friends was expected to be associated with lower diet quality.

4.3 Methods

4.3.1 Data Collection

The web-based *Food Behaviour Questionnaire* (Hanning et al., 2007; Minaker et al., 2006) was used in surveillance of grade six (n=1266), seven (n=1359), and eight (n=579)

classes from a sample of schools in Northern Ontario (Porcupine Region), Southern Ontario (Peel Region, Region of Waterloo, and Toronto District), and Nova Scotia (students participating in the PACY study) over the 2005-06 academic school year. The schools were recruited to represent a cross section of the region (Nova Scotia), regional SES (Waterloo), or a convenience sample (Peel, Porcupine, and Toronto).

This research was approved by the respective research ethics boards at the University of Waterloo, Acadia University, Cape Breton University, Dalhousie University, and St. Francis Xavier University, in addition to each participating school board. Active parental consent was used in all studies, with the exception of Peel, which used passive parental consent procedures. The overall student response rates (e.g. in class on the day of the survey with parental consent) from selected classes were: 34% from Porcupine, 98% from Peel, 57% from Waterloo, 38% from Toronto, and 39% from Nova Scotia.

4.3.2 Measures

4.3.2.1 Diet Intake and Quality. Participants used identical procedures to complete 24 hour diet recalls based on a menu of ~800 foods and meal environment questions. A final screen provided feedback on each participants own intake, relative to (then) CFGHE (1992), based on portion-size definitions of the Canadian Nutrient File group (Canadian Nutrient Data System, 2001). Diet quality was calculated using the HEI-C, a recently modified diet quality index that compares an individual's diet intake to the recommended number of food servings from CFGHE (1992) and nutrient intakes in relation to current recommendations; possible scores range from 0-100, with 100 points referring to *perfect* diet quality (Kennedy et al., 1995). Participant's diets were categorized as *poor* (≤50 HEI-C score), *needs*

improvement (HEI-C score 50-80), or *good* (HEI-C score >80) (Glanville and McIntyre, 2005).

4.3.2.2. Meal Environment. Participants selected the most appropriate response to each of four specific meal environment questions. *Who did you eat with yesterday [at breakfast, lunch, and dinner]?* Possible responses included "Myself, family (whole family, my Mom or Dad, brother(s) and/or sister(s), relative(s), grandparent(s), uncles/aunts), friends, or did not eat." *Where did you eat [breakfast, lunch, and dinner] yesterday?* Possible responses included "At home (including at another home), between places, school, restaurant or fast food outlet, or did not eat." *Who prepared the food (e.g. cooked, put together, or assembled your sandwich) that you ate yesterday [at breakfast, lunch, and dinner]?* Possible responses included "Myself, family (including parents or other family members), friends, restaurant (including cafeteria or other), or did not eat." *Where did you or your family buy the food that you ate yesterday [at breakfast, lunch, and dinner]?* Possible responses included "Grocery store, restaurant or cafeteria, convenience store/vending machine/other, or did not eat."

4.3.2.3 Reporting Status. A measure of dietary reporting status was calculated for each participant (similar to Vance et al., submitted) to adjust for potential underreporting, a common concern associated with self-reported dietary intake surveys. Reporting status (as a continuous variable) was identified using a ratio (Black, 2000; Johnson-Down et al., 1997) of self-reported energy intake (EI) to basal metabolic rate (BMR_{est}) as estimated using the age- and sex-specific formulas as outlined by the World Health Organization (1985). Lower reporting status ratios (versus higher) are indicative of more underreporting.

4.3.3 Statistical Analyses

Meal environments were described using bivariate descriptive statistics. Chi-square analyses were used to determine differences among categorical variables (e.g. sex, grade, body weight status, and school surveillance study), and one-way ANOVA was used for continuous variables (e.g. reporting status). Based on the results of Chapter 3 regarding the possible confounding influence of reporting status on diet quality, it was decided that this variable should remain as a factor in the present study.

Cluster K-means procedures were used to classify observations about the four meal environment variables into groups, as the groups were not initially known. This procedure uses non-hierarchical clustering of observations according to MacQueen's algorithm (Johnson and Wichern, 1992). A cluster analysis was performed separately for breakfast, lunch, and dinner. For ease of the computation and interpreting the results, participants who reported that they did not eat at that meal (from at least one of the four environment questions) were excluded from the cluster analyses for that particular meal. However, because of the known importance of meal skipping on diet quality (Chapter 3; Cohen et al., 2003; Rampersaud, Pereira, Girard, Adams, Metzl, 2006; Videon and Manning, 2003; Woodruff et al., submitted), those who skipped meals were added back after computation of the clusters, as a separate cluster themselves. All meal environment variables were standardized (by subtracting the variable mean and dividing by the variable standard deviation before the distance matrix was calculated) to account for differences in response units (Minitab 14, State College, PA). To determine the most appropriate cluster solution, comparisons of cluster membership across increasingly larger cluster solutions (beginning at

2 clusters) were completed until the maximum number of clusters whereby each cluster contained at least 4% of the total sample was reached (similar to Duffey and Popkin, 2006).

Ordinal logistic regression analyses were used to determine whether descriptor variables (sex, grade, body weight status, school surveillance study, and reporting status) and cluster membership was associated with HEI-C rankings (*poor, needs improvement*, and *good*) for breakfast, lunch, and dinner, separately. All statistical procedures were completed using Minitab 14 (State College, PA), with a level of significance set at 0.05.

4.4 Results

The total number of participants (N=3223) included 385 students from 20 schools in Porcupine Region, 1413 students from 7 schools in Peel Region, 405 students from 15 schools in Waterloo Region, 216 students from 6 schools in Toronto, and 804 students from 38 schools in Nova Scotia. Some participants (n=97) were excluded from further analysis due to implausible energy intakes (<200 kcal or >6000 kcal; n=24), and/or food group intakes (on visual inspection of any record with >3 times the upper servings recommendation; n=87), or both (n=14). In addition, some participants from Porcupine (n=25) and Peel (n=92) were excluded from the analyses because the self-reported BMI was greater or less than three times the standard deviation based on the age- and sex-adjusted mean BMI values (Kuczmarski et al., 2000). Finally, 10 participants (3 from Peel, 1 from Waterloo, 1 from Toronto, and 5 from Nova Scotia) were excluded from further analyses due the calculated HEI-C being an outlier (e.g. values between 1.5 and 3 times away from the middle 50% of the data are outliers; in this case, HEI-C scores less than 26.1 were excluded). The final sample (n=3015) included males (n=1451) and females (n=1541) in grade six (n=1178), seven (n=1294), and eight (n=538) (see Table 3 for participant characteristics).

4.4.1 Meal Environments

4.4.1.1 Breakfast. Among all participants (n=3015), the majority consumed breakfast at home (88% versus 9% who didn't eat, and 1% ate at a restaurant/fast food outlet, between places, or at school), with family members (52% versus 38% who ate alone, 8% who didn't eat, and 2% ate with friends), prepared by themselves (48% versus 42% by family members, 8% who didn't eat, and 1% by friends or a restaurant/fast food outlet), and purchased at a grocery store (86% versus 8% who didn't eat, 5% from a convenience store/vending machine/other, and 1% from a restaurant/fast food outlet). After removing participants with missing values on any of the four breakfast environment questions, the cluster K-means analysis resulted in three clusters whereby each cluster contained >4% of the sample. The first cluster contained participants who mainly ate breakfast at home with family that was either self-prepared or prepared by family members (n=2085), the second cluster contained participants who consumed breakfast at home that was purchased from a convenience store/vending machine/other (n=128), and the third cluster contained participants who skipped breakfast (n=235) (see Table 9). The three breakfast environment clusters were different by sex ($p<0.001$), grade ($p=0.002$), body weight status ($p=0.010$), school surveillance study ($p<0.001$), and reporting status ($p<0.001$) (Table 10).

4.4.1.2 Lunch. Among all participants (n=3105), the majority consumed lunch at school (69% versus 22% ate at home, 5% ate at a restaurant/fast food outlet, 3% didn't eat, and 1% ate between places), with their friends (74% versus 14% with family members, 9% ate alone, and 3% didn't eat), prepared by family members (57% versus 28% by themselves, 7% by a restaurant/fast food outlet, 5% by friends, and 3% didn't eat), and purchased at a grocery store (82% versus 10% from a restaurant/fast food outlet, 6% from a convenience

Table 9: *Distribution of Participants*[a] *in Each Breakfast Cluster*

Factor	Category	Cluster 1	Cluster 2	Cluster 3
		Home with family (n=2085)	Home, bought at a conv/vend/other (n=128)	Skipped breakfast (n=235)
Where	Home (97%)	90%	5%	2%
	Between places (1%)	1%	<1%	0%
	School (1%)	1%	<1%	<1%
	Rest/FF (1%)	1%	<1%	<1%
Who	Family (57%)	53%	3%	1%
	Alone (41%)	37%	2%	2%
	Friends (2%)	2%	<1%	<1%
Who Prepared	Myself (53%)	49%	2%	2%
	Family (45%)	40%	3%	1%
	Friends (1%)	<1%	<1%	<1%
	Rest/FF/Other (1%)	1%	<1%	<1%
Purchased	Grocery Store (94%)	91%	0%	3%
	Rest/FF (1%)	<1%	1%	<1%
	Conv/Vend/Other (5%)	0%	5%	<1%

[a]n=2448, % by factor

store/vending machine/other, and 2% didn't eat). After removing participants who had missing values for any of the four lunch environment questions, the cluster K-means analysis resulted in eight clusters whereby each cluster contained >4% of the sample. The first cluster contained mostly participants who ate lunch at school with friends prepared by family members (n=900), the second cluster contained those participants who consumed lunch with friends prepared and purchased from a restaurant/fast food outlet/other (n=168), the third cluster contained participants who ate lunch at home with family members (n=299), the fourth cluster contained participants who mainly ate lunch at school, purchased from a convenience store/vending machine/other (n=177), the fifth cluster contained mostly

Table 10: *Breakfast Cluster Membership by Sex, Grade, Body Weight Status, School Surveillance Study, and Reporting Status*

		Home with family (n=2085)	Home, bought at a conv/vend/other (n=128)	Skipped breakfast (n=235)
Sex**	Males (n=1169)	88%	6%	6%
	Females (n=1261)	83%	4%	13%
Grade*	6 (n=958)	87%	6%	7%
	7 (n=1068)	84%	5%	11%
	8 (n=418)	83%	5%	13%
Body weight status*	Normal weight (n=1450)	86%	6%	8%
	Overweight (n=368)	86%	3%	11%
	Obese (n=125)	82%	3%	15%
School surveillance**	Porcupine (n=252)	81%	10%	9%
	Peel (n=1021)	83%	6%	12%
	Waterloo (n=344)	94%	3%	3%
	Toronto (n=163)	90%	4%	6%
	Nova Scotia (n=668)	85%	4%	11%
Reporting status**	$EI:BMR_{est}$ (n=2349), X (SD)	1.57 (0.84)	1.64 (0.89)	1.07 (0.60)

Note. Chi-square analyses were used to determine differences among categorical groups whereas one-way ANOVA was used to determine differences by reporting status (as a continuous measure), *different among clusters, $p<0.01$, **different among clusters, $p<0.001$

participants who ate lunch at school that was self-prepared (n=368), the sixth cluster contained participants who ate lunch at home with friends (n=135), the seventh cluster contained participants who ate lunch at school alone (n=146), and finally, the eighth cluster contained participants who skipped lunch (n=129) (see Table 11). Lunch environment clusters differed by sex ($p<0.001$), grade ($p<0.001$), body weight status ($p=0.023$), school surveillance study ($p<0.001$), and reporting status ($p<0.001$) (Table 12).

Table 11: *Distribution of Participants*[a] *in Each Lunch Cluster*

Factor	Category	Cluster 1 School, with friends, prepared by family (n=900)	Cluster 2 With friends at rest/ff/other (n=168)	Cluster 3 Home, with family (n=299)	Cluster 4 School purchased from a conv/vend/ other (n=177)	Cluster 5 School, self-prepared (n=368)	Cluster 6 Home, with friends (n=135)	Cluster 7 School alone (n=146)	Cluster 8 Skipped lunch (n=129)
Where	Home (22%)	0%	<1%	13%	2%	0%	6%	0%	1%
	Between places (1%)	<1%	<1%	<1%	<1%	<1%	0%	<1%	<1%
	School (71%)	39%	4%	0%	6%	16%	0%	5%	1%
	Rest/FF (6%)	1%	3%	0%	1%	<1%	0%	1%	<1%
Who	Friends (76%)	40%	6%	0%	7%	16%	6%	0%	1%
	Family (14%)	0%	1%	8%	1%	0%	0%	3%	1%
	Alone (10%)	0%	<1%	5%	1%	0%	0%	4%	<1%
Who Prepared	Myself (29%)	0%	0%	5%	3%	16%	2%	2%	1%
	Family (58%)	38%	0%	8%	4%	0%	3%	4%	1%
	Friends (5%)	2%	1%	<1%	1%	0%	1%	<1%	<1%
	Rest/FF/Oth (8%)	0%	7%	<1%	0%	0%	<1%	0%	<1%
Purchased	Grocery Store (84%)	40%	1%	13%	0%	16%	6%	6%	2%
	Rest/FF (10%)	0%	5%	1%	3%	0%	<1%	<1%	1%
	Conv/Vend/Other (6%)	0%	1%	0%	5%	0%	0%	0%	<1%

[a]n=2323, % by factor

Table 12: *Lunch Cluster Membership by Sex, Grade, Body Weight Status, School Surveillance Study, and Reporting Status*

		School, with friends, prepared by family (n=900)	With friends at rest/ff/other (n=168)	Home, with family (n=299)	School purchased from a conv/vend/ other (n=177)	School, self-prepared (n=368)	Home, with friends (n=135)	School alone (n=146)	Skipped lunch (n=129)
Sex**	Males (n=1091)	39%	8%	14%	9%	12%	5%	7%	5%
	Females (n=1213)	38%	7%	12%	6%	19%	6%	6%	6%
Grade**	6 (n=944)	40%	6%	11%	7%	17%	6%	6%	6%
	7 (n=944)	38%	6%	16%	8%	15%	5%	8%	5%
	8 (n=430)	37%	13%	9%	7%	16%	9%	3%	7%
Body weight status*	Normal weight (n=1376)	41%	7%	12%	8%	16%	5%	5%	6%
	Overweight (n=331)	35%	5%	13%	7%	18%	8%	9%	5%
	Obese (n=114)	42%	4%	18%	4%	12%	4%	11%	5%
School surveillance**	Porcupine (n=233)	17%	8%	21%	9%	15%	4%	10%	15%
	Peel (n= 1043)	40%	11%	10%	8%	15%	6%	4%	6%
	Waterloo (n=344)	50%	3%	6%	5%	24%	5%	6%	1%
	Toronto (n=168)	55%	7%	11%	5%	11%	2%	8%	1%
	Nova Scotia (n=535)	34%	3%	21%	9%	14%	7%	8%	5%
Reporting status**	EI:BMR_{est} (n=2235), X (SD)	1.58 (0.83)	1.60 (0.90)	1.49 (0.84)	1.67 (0.97)	1.59 (0.91)	1.55 (0.70)	1.43 (0.79)	1.14 (0.68)

Note. Chi-square analyses were used to determine differences among categorical groups whereas a one-way ANOVA was used to determine differences of reporting status (continuous measure), *different among clusters, p=0.023, **different among clusters, p<0.001

4.4.1.3 Dinner. Among all participants (n=3015), the majority of participants consumed dinner at home (93% versus 5% at a restaurant/fast food outlet, 1% ate at school or didn't eat, and <1% ate between places), with family members (87% versus 9% who ate alone, 3% ate with friends, and 1% didn't eat), prepared by family members (84% versus 9% by themselves, 4% by a restaurant/fast food outlet, 2% didn't eat, and 1% by friends), and purchased at a grocery store (87% versus 7% from a restaurant/fast food outlet, 5% from a convenience store/vending machine/other, and 1% didn't eat). After removing participants who had missing values on any of the four dinner environment questions, the cluster K-means analysis resulted in six clusters whereby each cluster contained >4% of the sample. The first cluster contained mostly participants who ate dinner at home with, and prepared, by family members (n=1774), the second cluster contained those who ate dinner at home, with family members, that was prepared by the participants themselves (n=176), the third cluster contained participants who ate dinner at home, with their family, that was purchased from a convenience store/vending machine/other (n=100), the fourth cluster contained participants who ate dinner at home, alone (n=190), the fifth cluster contained participants who ate at a restaurant/fast food outlet with family members (n=145), and finally, the sixth cluster contained those participants who skipped dinner (n=79) (see Table 13). Dinner environment clusters differed by grade ($p<0.001$), school surveillance study ($p<0.001$), and reporting status ($p=0.003$) (Table 14).

Table 13: *Distribution of Participants[a] in Each Dinner Cluster*

Factor	Category	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
		Home with family, prepared by family (n=1774)	Home with family, self-prepared (n=176)	Home, with family, purchased from conv/vend /other (n=100)	Home, alone (n=190)	Rest/FF with family (n=145)	Skipped dinner (n=79)
Where	Home (94%)	73%	7%	4%	7%	1%	2%
	Between places (<1%)	<1%	0%	0%	0%	<1%	<1%
	School (1%)	0%	<1%	<1%	<1%	<1%	<1%
	Rest/FF (5%)	0%	0%	<1%	<1%	5%	1%
Who	Family (88%)	73%	5%	4%	0%	5%	1%
	Alone (8%)	0%	2%	1%	5%	<1%	<1%
	Friends (4%)	0%	0%	0%	3%	1%	<1%
Who Prepared	Myself (9%)	0%	7%	1%	<1%	<1%	<1%
	Family (86%)	73%	0%	3%	6%	3%	1%
	Friends (1%)	<1%	0%	<1%	1%	<1%	0%
	Rest/FF/Other (4%)	<1%	0%	<1%	1%	3%	0%
Purchased	Grocery Store (88%)	70%	7%	0%	7%	2%	2%
	Rest/FF (7%)	2%	<1%	0%	1%	3%	<1%
	Conv/Vend/Other (5%)	0%	0%	4%	<1%	<1%	<1%

[a]n=2464, % by factor

Table 14: *Dinner Cluster Membership by Sex, Grade, Body Weight Status, School Surveillance Study, and Reporting Status*

		Home with family, prepared by family (n=1774)	Home with family self-prepared (n=176)	Home, with family, purchased from conv/vend/other (n=100)	Home, alone (n=190)	Rest/FF with family (n=145)	Skipped dinner (n=79)
Sex	Males (n=1171)	71%	7%	5%	8%	6%	2%
	Females (n=1275)	73%	8%	3%	7%	5%	4%
Grade**	6 (n=947)	69%	8%	5%	7%	7%	5%
	7 (n=1073)	75%	7%	4%	8%	4%	2%
	8 (n=440)	71%	6%	2%	9%	8%	4%
Body weight status	Normal weight (n=1452)	73%	6%	4%	8%	6%	3%
	Overweight (n=361)	71%	9%	4%	7%	6%	3%
	Obese (n=126)	76%	9%	4%	3%	2%	6%
School surveillance**	Porcupine (n=233)	40%	21%	6%	7%	12%	14%
	Peel (n=1061)	71%	5%	4%	9%	7%	3%
	Waterloo (n=342)	84%	3%	2%	5%	5%	0%
	Toronto (n=170)	75%	8%	3%	8%	5%	1%
	Nova Scotia (n=658)	77%	7%	4%	7%	2%	2%
Reporting status*	EI:BMR_{est} (n=2365), X (SD)	1.55 (0.33)	1.33 (0.72)	1.55 (0.79)	1.54 (1.08)	1.59 (0.69)	1.27 (0.80)

Note. Chi-square analyses were used to determine differences among categorical groups whereas a one-way ANOVA was used to determine differences of reporting status (continuous measure), *different among clusters, p=0.003, **different among clusters, p<0.001

4.4.2 Diet Quality and Meal Environment

The mean HEI-C score across all participants was 65.1 (SD 13.2), falling into the *needs improvement* category (73% versus 13% who had a *poor* diet and 14% who had a *good* diet). As previously reported (Chapter 3), diet quality ratings were likely to be higher among participants from Waterloo (OR 1.88 (95% CI: 1.33, 2.67), p<0.001) or Toronto (OR 1.70 (95% CI: 1.07, 2.68), p=0.024) versus Porcupine. Ordinal logistic regression analyses, with descriptor variables (sex, grade, body weight status, school surveillance study, and reporting status) and breakfast clusters (Appendix S) revealed that participants were likely to have a worse diet quality rating if they belonged to cluster #2 (e.g. ate at home, purchased from a convenience store/vending machine/other; OR 0.59 (95% CI: 0.37, 0.94), p=0.027) or cluster #3 (e.g. skipped breakfast; OR 0.38 (95% CI: 0.26, 0.54), p<0.001) versus cluster #1 (e.g. ate breakfast at home with family). Ordinal logistic regression analyses, with descriptor variables (sex, grade, body weight status, school surveillance study, and reporting status) and lunch clusters (Appendix S) revealed that participants were likely to have a worse diet quality if they belonged to cluster #2 (e.g. ate with friends, prepared and purchased from a restaurant/fast food/other; OR 0.56 (95% CI: 0.36, 0.88), p=0.011), cluster #3 (e.g. ate lunch at home with family members; OR 0.62 (95% CI: 0.44, 0.87), p=0.006), cluster #7 (e.g. ate lunch at school alone; OR 0.55 (95% CI: 0.35, 0.87), p=0.010), or cluster #8 (e.g. skipped lunch; OR 0.41 (95% CI: 0.26, 0.67), p<0.001) rather than cluster #1 (e.g. ate lunch at school with their friends). Ordinal logistic regression analyses, with descriptor variables (sex, grade, body weight status, school surveillance study, and reporting status) and dinner clusters (Appendix S) revealed that participants were likely to have a worse diet quality if they belonged to cluster #5 (e.g. ate a restaurant/fast food outlet with family members; OR 0.53

(95% CI: 0.34, 0.82), p=0.004) rather than cluster #1 (e.g. ate dinner at home with their family, prepared by their family).

4.5 Discussion

Specific meal environments and diet quality of students in grade six, seven, and eight from Ontario and Nova Scotia were described through the use of the *Food Behaviour Questionnaire*. This is the first time that specific aspects of meal environments have been described among a large, diverse Canadian sample.

As expected, the majority of participants reported lunch at school, with their friends, prepared by family members, and bought at a grocery store, and dinner at home, with family members, prepared by family members, and purchased at a grocery store. For breakfast, however, the majority of participants ate with family members instead of, as expected, alone. The cluster K-means analyses for breakfast, lunch, and dinner resulted in 3, 8, and 6 meal environment clusters. For breakfast, the predominant differences were seen among those who skipped (e.g. a higher prevalence of females, grade 8, obese, Nova Scotia and Peel, and those with lower reporting status ratios were in cluster #3 compared to cluster #1 and #2). The differences noted among breakfast skippers is comparable to the literature which suggests that frequent breakfast skipping is generally associated with females (Cohen et al., 2003), overweight/obese status (Berkey, Rockett, Gillman, Field, and Colditz, 2003; Siega-Riz, Popkin, and Carson, 1998), older children and adolescents (Evers et al., 2001), and those that are concerned with a high body weight and/or dieting (Woodruff et al., submitted; Young and Fors, 2001; Zullig, Ubbes, Pyle, and Valois, 2006).

Among the lunch clusters, it was interesting to note that the prevalence of grade 8 participants was higher in cluster #2 (e.g. eating lunch with friends at a restaurant/fast food

outlet/other), and that the prevalence of obese participants was higher in cluster #3 (e.g. eating lunch at home with family) and cluster #7 (e.g. eating at home alone). Further, differences in cluster membership were observed particularly for Porcupine participants, such that the prevalence was lower for cluster #1 (e.g. ate lunch at school with friends, prepared by family members), and higher for eating lunch at home (cluster #3 and #7) and skipping lunch altogether (cluster #8). The differences observed for the Porcupine study may be attributed to the proximity of the home to the school, parent employment, family dynamics, and/or other individual factors not measured in the current study.

Among dinner clusters, a lower prevalence of grade seven students belonged in cluster #5 (e.g. eating at a restaurant/fast food outlet with family members). Differences were again noted for participants from Porcupine, such that a lower prevalence was observed in cluster #1 (e.g. ate at home with, and prepared by, family members), and a higher prevalence observed in cluster #2 (e.g. ate at home with family that was self-prepared), cluster #5 (e.g. ate at a restaurant/fast food outlet with family members), and cluster #6 (e.g. skipped dinner). Again, the differences may be attributed to parental employment (e.g. shift work), family dynamics, and/or other individual factors not measured in the current study.

This is the first study that has investigated the associations between specific aspects of meal environments and diet quality among Canadian students. The analyses, by meal, suggested that certain meal environments are associated with worse diet quality. It was interesting to note that participants who tended to purchase and/or consume meals at a convenience store/vending machine/other or restaurant/fast food outlet for breakfast (cluster #2), lunch (cluster #2), and/or dinner (cluster #5) had a greater likelihood of having a worse diet quality. This study is in agreement with those from the US (Cullen, Bishop, and de

Moor, 2002; Gonzales, Marshall, Heimendinger, Crane, and Neal, 2002; Guthrie et al., 2002; Lin et al., 1999a) who suggest that food consumed in the home from grocery items, versus food consumed or prepared outside of the home, is associated with improved dietary profiles. Moreover, fast food used for family meals has been associated with significantly less vegetables and milk being served with meals at home (Boutelle, Fulkerson, Neumark-Sztainer, Story, and French, 2007). The negative association between diet quality and fast food, in particular, was also seen among adolescents participating in the Project EAT study, which described positive associations between fast food frequency and intakes of total energy, percent energy from fat, daily servings of soft drinks, cheeseburgers, french fries, and pizza, and negative associations with daily servings of fruit, vegetables and milk (French et al., 2001). Most of these factors were assessed with the HEI-C.

Interestingly, the current data showed fewer participants consuming a meal from a fast food outlet than was recently described in the CCHS Cycle 2.2 (12% of males and 13% of females versus 23% of males and 19% of females, respectively; Garriguet, 2006). However, the lower prevalence is probably reflected in that only meals (breakfast, lunch, and dinner) were examined whereas the CCHS Cycle 2.2 (Garriguet, 2006) investigated meals, in addition to snacks. Moreover, the current study reflects mainly school days (96%) rather than weekends (4%). Most of the current data were collected Tuesday through Friday, although a small number of recalls in Peel Region were completed on Monday (n=109 or 8% of the Peel sample), thus introducing some weekend data. Within this particular sample (data not shown), there were no differences in diet quality ratings or family meal frequency between weekends versus weekday data collection, and therefore the weekend data were

combined with the weekday data. Future research, however, should investigate the associations between weekday and weekend family meals and diet quality.

The current data also suggests a negative association between breakfast and lunch skipping and diet quality, even after adjusting for sex, grade, body weight status, and reporting status. According to the cluster analyses, a higher number of participants reported skipping breakfast (10%) over lunch (6%) or dinner (3%). The current prevalence of breakfast skipping is lower than has been reported by others (Cohen et al., 2003; Evers et al., 2001). The current study measured meal skipping using the participants responses from the four environment questions (e.g. if participants chose that they did not eat for any one of the four environment questions they were classified as a skipper), which limits comparisons to other studies. However, breakfast skipping has been associated with poor nutrient intakes in the past (Cohen et al., 2003; Rampersaud et al., 2006; Videon and Manning, 2003; Woodruff et al., submitted). The issue of a negative association between meal skipping and diet quality is problematic, and seems to have a larger impact (e.g. lower odds ratios) on overall diet quality than the environmental conditions under which the meal was consumed. Health promotion strategies aimed at healthy food behaviours among students in grade six, seven, and eight need to be aware of this potentially harmful behaviour.

This study is not without limitations. The cluster K-means analyses grouped participants that were similar based on four meal environment questions. The failure to detect a difference in HEI-C ratings may have been influenced by the number of participants who reported similar environments (e.g. prevalence of eating breakfast and dinner at home was ~90%, and the majority (~85%) of participants reported that dinner was consumed with and prepared by family members). In some cases, in particular breakfast, the cluster analysis

did not separate out certain variables (e.g. participants preparing their own breakfast versus family members), which limited the ability to examine separate influences. Further, participants were only able to select one response for the four meal environment questions (e.g. participants had to choose the most appropriate response for where the meal was consumed, who the meal was consumed with, who prepared the meal, and where the food was purchased). The results are, therefore, limited to the dominant response and may not have adequately captured meals that were prepared from food purchased from multiple locations.

The use of the HEI-C as a measure of diet quality may not have captured all aspects of the diet (Kant, 1996). However, it was expected that the HEI-C would provide an adequate and comprehensive measure of dietary intake, rather than trying to investigate macronutrients and micronutrients individually. Finally, there are inherent limitations in any nutritional survey. Self-reported survey data have the potential for recall error (Baranowski, and Domel, 1994; Livingstone and Robson, 2000), inaccurate estimation of portion sizes (Livingstone and Robson, 2000), systematic bias in dietary reporting (Bandini et al., 1992; Briefel et al., 1997), and providing socially desirable answers. The web-based survey was designed to minimize these limitations, with built-in prompts to assist participant memory and visuals to assist in portion size estimation. Nevertheless, underreporting was suggested in the present study, as calculated using the EI:BMR_{est} ratio. The procedures for adjusting for reporting status, or more particularly underreporting, has not been agreed upon among researchers; however, it was felt due to the variations in reporting status among the present sample (refer to section 2.3.4 for details), that reporting status should be a factor in the

analyses involving diet quality. No differences in outcomes were observed when reporting status was added or removed from the analyses.

In summary, this is the first time that particular meal environments have been described among a large, diverse Canadian sample of grade six, seven, and eight students. The knowledge surrounding family meals has been expanded beyond the frequency, to include specific meal environmental factors. Diet quality was found to be negatively associated with consuming/purchasing meals outside of the home, and skipping breakfast and/or lunch.

CHAPTER 5: Family Dinner Frequency is Associated with Specific Food Behaviours and Attitudes in Grade Six, Seven, and Eight Students from Ontario and Nova Scotia.

The work presented in this chapter will be submitted to the *Journal of Adolescent Health* as:

Woodruff SJ, Hanning RM. Family dinner frequency is associated with certain food behaviours in grade six, seven, and eight students from Ontario and Nova Scotia.

5.1 Abstract

Family meal frequency has recently been associated in the literature with improved dietary profiles and healthy body weight in children and adolescents. However, it is not known whether family meals are associated with other commonly reported food behaviours (fast food and pop consumption, breakfast skipping, and dieting) and attitudes (body weight concerns and self-efficacy for healthy eating) among Canadian students in grade six, seven, and eight. The *Food Behaviour Questionnaire* was used in school surveillance studies in Northern Ontario (Porcupine Region), Southern Ontario (Peel Region, Region of Waterloo, Toronto District), and Nova Scotia (as part of the PACY study) over the 2005-2006 academic school year. Higher family meal frequency was significantly associated with less pop consumption, consuming breakfast on the day of the survey, having higher self-efficacy for healthy eating when at home with family and during social times with friends. Researchers and clinicians should be aware of these associations when planning family based healthy eating strategies.

5.2 Introduction

The recently released CCHS Cycle 2.2 (Garriguet, 2006) and other food behaviour studies in children and adolescents (Hanning et al., 2007; Phillips et al., 2004; Veugelers et al., 2005) have reported low intake levels of vegetables, fruit, and milk products, and high

levels of snacking, fast food, and pop consumption. Furthermore, unhealthy body weight (Sheilds, 2005; Tremblay et al., 2002), and poor body weight management strategies (Jones et al., 2001; McVey et al., 2004; Woodruff et al., submitted) are prevalent during childhood and adolescence. Meal skipping, or more specifically breakfast skipping, is also commonly reported for this age group, especially among females (Cohen et al., 2003), those who are overweight/obese (Berkey et al., 2003; Siega-Riz et al., 1998), older children and adolescents (Evers et al., 2001), and those who are concerned with a high body weight and/or dieting (Woodruff et al., submitted; Young and Fors, 2001; Zullig et al., 2006). Unhealthy food behaviours during childhood and adolescence are likely to influence long-term food behaviours (Story et al., 2002; Taylor et al., 2005; Wardle, 1995), and potentially chronic diseases (Ball and McCargar, 2003; Carriere, 2003; Freedman et al., 2001; Janssen, Katzmarzyk, Srinivasan et al., 2005).

In 2004, Ontario's Chief Medical Officer of Health Report, *Healthy Weights, Healthy Lives* (Ministry of Health and Long Term Care, 2004) identified the family (as well as the government, food industry, workplaces, schools, and individuals) for recommendations for action. As a means to promote, achieve, and maintain healthy body weights for both parents and children, *Healthy Weights, Healthy Lives* recommended enjoying family meals whenever possible. Family meals have been associated with improved nutrient intakes (Chapter 3; Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003; Veugelers et al., 2005) and healthy body weight (Gable et al., 2007; Sen, 2006; Veugelers and Fitzgerald, 2005) in children and adolescents. However, it is unknown whether family meals are associated with other commonly reported food behaviours and attitudes among Canadian students in grade six, seven, and eight.

Specifically, the objective of this study was to examine associations among family meal frequency and fast food frequency, pop consumption, breakfast skipping, dieting for weight loss, concerns of a high body weight, and self-efficacy for healthy eating during certain situations (at home with family, at school with friends, during social times with friends, and alone). Self-efficacy is a particularly important construct, based in social cognitive theory, that has been used to measure an individual's confidence in his or her ability to perform a specific behavior, such as practicing healthy eating behaviors, rather than measuring the behaviour itself (Foreyt and Goodrick, 1994; Granner et al., 2004; Young et al., 2004). It was expected that higher family meal frequency would be associated with lower fast food frequency, and less pop consumption and breakfast skipping. Family meal frequency was also expected to be associated with participants expressing no body weight concerns, those currently not dieting, and those with high self-efficacy for healthy eating.

5.3 Methods

5.3.1 Data Collection

5.3.1.1 Research Design. The web-based *Food Behaviour Questionnaire* (Hanning et al., 2007; Minaker et al., 2006) was used in surveillance of grade six (n=1266), seven (n=1359), and eight (n=579) classes from a sample of schools in Northern Ontario (Porcupine Region, n=20 schools), Southern Ontario (Peel Region, n=7 schools; Region of Waterloo n=15 schools; and Toronto District, n=6 schools), and Nova Scotia (n=38 schools participating in the PACY study) over the 2005-06 academic school year. The web-based survey was designed to assess nutrient intake, food behaviours, and physical activity patterns of children and adolescents through the use of a 24 hour dietary recall, FFQ, and other nutrition and physical activity behavioural questions.

This research was approved by the respective research ethics boards at the University of Waterloo, Acadia University, Cape Breton University, Dalhousie University, and St. Francis Xavier University, in addition to each participating school board. Active parental consent was used in all studies, with the exception of Peel, which used passive parental consent procedures. The overall student response rates (e.g. students were in class on the day of data collection with parental consent) from selected classes were: 34% from Porcupine, 98% from Peel, 57% from Waterloo, 38% from Toronto, and 39% from Nova Scotia.

5.3.2 Measures

Participants were asked to select the most appropriate response of the following questions: *Typically, how many days per week do you eat dinner or supper with at least one parent?* Possible responses included "0 to 7" and were collapsed into categorical variables 0-2, 3-5, and 6-7 days/week. *How often do you eat meals or snacks prepared away from home (from fast food restaurants or take out)?* Possible responses included "once a day, 2-6 times a week, once a week, once a month, or rarely/never." In the case of Porcupine, Toronto, and Nova Scotia, pop consumption was determined using the question *How often do you eat the following foods [pop (non-diet)]?* In the case of Waterloo, *How often do you drink pop drinks?* was used, whereas in Peel, for non-diet drinks, *How often do you drink COLA-type soft drinks (e.g. Coke, Pepsi, Rootbeer)* and *How often do you drink NON COLA-type soft drinks (e.g. Sprite, 7up, Mountain Dew, Orange Crush)?* were combined. All pop-related questions had possible responses of "once a day, 2-6 times a week, once a week, once a month, or rarely/never." Breakfast skipping was determined using the question *At what times did you eat anything yesterday?* Participants had to choose that they ate "before school or breakfast." Body weight concerns and dieting status were assessed with, *Are you concerned*

that your weight is too high? and *Are you eating less than usual to try and lose weight?* Possible responses included "yes or no" from Peel and Waterloo surveys, and "strongly disagree, disagree, neither, agree, or strongly agree" from Porcupine, Toronto, and Nova Scotia surveys, which were collapsed into yes (agree and strongly agree) or no (neither, disagree, and strongly disagree). Finally, self-efficacy for healthy eating during certain situations was assessed with, *How sure are you that you could choose to eat healthy foods when you are eating [at home with your family, at school with your friends, during social times with your friends, and alone]?* Possible responses included "1 (very sure) to 6 (not sure)" and were collapsed into sure (1 and 2), neutral (3 and 4), and not sure (5 and 6).

5.3.3 Statistical Analysis

Bivariate chi-square analyses were used between family meal frequency and food behaviours (fast food and pop consumption, breakfast skipping, and dieting) and attitudes (weight concerns and self-efficacy for healthy eating). An ordinal logistic regression analysis was used to determine the associations between family meal frequency, descriptor variables (sex, grade, body weight status, school surveillance study, and reporting status), and all food behaviours and attitudes to determine the dominant behaviours and attitudes associated with family meal frequency. Each dominant association was then entered as an individual factor, with descriptive variables (sex, grade, body weight status, and school surveillance study), in separate ordinal logistic regression analyses. Specifically for breakfast consumption, however, dieting status and concerns of a high body weight were added as factors to account for the known associations with breakfast skipping. The level of significance was set at 0.05. All statistical procedures were completed using Minitab 14 (State College, PA).

5.4 Results

The participants (N=3223) included 385 students from Porcupine Region, 1411 students from Peel Region, 405 students from Waterloo Region, 216 students from Toronto, and 804 students from Nova Scotia (refer to Table 2 for participant characteristics). Some participants (n=97) were excluded from further analysis due to implausible energy intakes (<200 kcal or >6000 kcal; n=24), and/or food group intakes (on visual inspection of any record with >3 times the upper servings recommendation; n=87), or both (n=14). This exclusion procedure was used in previous studies and was expected to remove participants with fallacious records even though no food records were used in the present study. In addition, some participants from Porcupine (n=25) and Peel (n=92) were excluded from the analyses because the self-reported BMI was greater or less than three times the standard deviation based on the age- and sex-adjusted mean BMI values (Kuczmarski et al., 2000). Data (n=3025) were available for males (n=1454) and females (n=1548) in grades 6 (n=1179), 7 (n=1302) and 8 (n=539) from Ontario (n=2241) and Nova Scotia (n=784).

As previously described (Chapter 3), the majority of participants reported frequent family meals (70% on 6-7 days/week, 19% of 3-5 days/week, and 11% on 0-2 days/week). Family meal frequency decreased with increasing grade (X^2=30.629 (df=4), $p<0.001$), and was significantly higher among participants from Porcupine and lower among participants from Peel (X^2=46.815 (df=8), $p<0.001$). The specific food behaviours and attitudes of interest for this study are presented in Table 15 by family meal frequency and the relationships between the selected food behaviours and attitudes and family meal frequency are presented in Table 16 (see also Appendix T).

Table 15: *Prevalence of Specific Food Behaviours and Attitudes by Family Meal Frequency*

Behaviour or attitude		Family Meal Frequency		
	% (n)	6-7 days/wk	3-5 days/wk	0-2 days/wk
Fast food frequency*				
>once/day	3% (58)	64%	22%	14%
2-6 times/week	7% (145)	61%	24%	15%
Once/week	25% (544)	67%	20%	13%
Once/month	41% (901)	73%	18%	9%
Rarely/never	24% (519)	72%	15%	13%
Pop consumption**				
>once/day	22% (482)	61%	23%	16%
2-6 times/week	16% (363)	68%	21%	11%
Once/week	25% (540)	74%	15%	11%
Once/month	17% (378)	72%	20%	8%
Rarely/never	20% (438)	74%	16%	10%
Eat breakfast?**				
No	22% (509)	57%	27%	16%
Yes	78% (1805)	73%	16%	11%
Dieting?**				
No	80% (1765)	72%	18%	10%
Yes	20% (499)	61%	12%	16%
Concern re high weight?**				
No	73% (1591)	72%	17%	11%
Yes	27% (587)	63%	23%	14%
Self-efficacy for healthy eating at home**				
Sure	65% (1459)	75%	15%	10%
Neutral	26% (585)	64%	25%	11%
Not sure	9% (194)	48%	26%	26%
Self-efficacy for healthy eating at school**				
Sure	30% (676)	76%	14%	10%
Neutral	46% (1010)	72%	19%	9%
Not sure	24% (539)	58%	24%	18%
Self-efficacy for healthy eating during social events**				
Sure	22% (498)	77%	14%	9%
Neutral	45% (987)	72%	19%	9%
Not sure	33% (728)	62%	21%	17%
Self-efficacy for healthy eating when alone*				
Sure	40% (875)	72%	16%	12%
Neutral	31% (694)	70%	20%	10%
Not sure	29% (637)	66%	21%	13%

Note. Unadjusted, *differences observed among family meal frequency categories, $p<0.05$, **differences observed among family meal frequency categories, $p<0.001$.

Table 16: *Ordinal Logistic Regression Analysis Examining the Associations between Family Meal Frequency and Specific Demographic Variables, Food Behaviours, and Attitudes*

	Odds Ratio (95% Confidence Intervals)
Sex	
Males	1.00
Females	0.94 (0.74, 1.19)
Grade	
Six	1.00
Seven	1.07 (0.67, 1.69)
Eight	0.99 (0.64, 1.54)
Body weight status	
Normal weight	1.00
Overweight	0.97 (0.71, 1.32)
Obese	1.01 (0.62, 1.65)
School surveillance study	
Porcupine	1.00
Peel	0.44 (0.24, 0.80)*
Waterloo	0.62 (0.35, 1.11)
Toronto	0.57 (0.27, 1.22)
Nova Scotia	0.62 (0.31, 1.24)
Fast food frequency	
>once/day	1.00
2-6 times/week	0.73 (0.30, 1.73)
Once/week	0.99 (0.44, 2.22)
Once/month	1.28 (0.57, 2.86)
Rarely/never	1.30 (0.57, 2.95)
Pop consumption	
>once/day	1.00
2-6 times/week	1.31 (0.90, 1.90)
Once/week	1.51 (1.06, 2.14)*
Once/month	1.29 (0.87, 1.91)
Rarely/never	1.16 (0.79, 1.71)
Eat breakfast?	
No	1.00
Yes	1.71 (1.29, 2.25)**
Dieting?	
No	1.00
Yes	0.84 (0.60, 1.17)
Concern re high weight?	
No	1.00
Yes	0.74 (0.54, 1.01)
Self-efficacy for healthy eating at home	
Sure	1.00
Neutral	0.72 (0.54, 0.96)*
Not sure	0.39 (0.25, 0.62)**

Self-efficacy for healthy eating at school with friends	
Sure	1.00
Neutral	1.18 (0.84, 1.66)
Not sure	0.97 (0.63, 1.50)
Self-efficacy for healthy eating during social events	
Sure	1.00
Neutral	0.73 (0.50, 1.07)
Not sure	0.62 (0.40, 0.95)*
Self-efficacy for healthy eating when alone	
Sure	1.00
Neutral	1.08 (0.80, 1.46)
Not sure	1.26 (0.92, 1.73)

Note. An ordinal regression analysis adjusts for all other variables in the table. *$p<0.05$, **$p<0.001$

After determining the dominant associations (e.g. family meal frequency was significantly associated with pop consumption, eating breakfast, and self-efficacy for healthy eating at home and during social times with friends), a secondary analysis specifically investigated family meal frequency and each dominant covariate was computed separately (see Appendix T). Participants consuming pop 2-6 times/week (OR 1.56 (95% CI: 1.12, 2.17), $p=0.008$), once/week (OR 1.85 (95% CI: 1.37, 2.51), $p<0.001$), once/month (OR 1.84 (95% CI: 1.31, 2.58), $p<0.001$), or rarely/never (OR 1.67 (95% CI: 1.21, 2.31), $p=0.002$) were likely to have a higher family meal frequency compared to participants consuming pop at least once/day. For breakfast consumption, participants who consumed breakfast (versus skipped) were likely to have a higher family meal frequency (OR 1.80 (95% CI: 1.41, 2.30), $p<0.001$) even after adjusting for dieting status and concerns regarding a high body weight. Participants who reported being neutral (OR 0.63 (95% CI: 0.49, 0.80), $p<0.001$) or unsure (OR 0.29 (95% CI: 0.21, 0.41), $p<0.001$) of their self-efficacy for healthy eating at home with their family were likely to have a lower family meal frequency than those participants

who were sure. Finally, participants who reported being unsure of their self-efficacy for healthy eating during social times with their friends were likely to report a lower family frequency than those participants who were sure (OR 0.47 (95% CI: 0.35, 0.63), $p<0.001$).

5.5 Discussion

This is the first time that associations among family meal frequency and various food behaviours and attitudes have been described for grade six, seven, and eight students from Ontario and Nova Scotia. Family meal frequency was associated with pop consumption, eating breakfast, higher self-efficacy for healthy eating at home with family and during social times with friends.

Approximately 63% of participants reported consuming pop at least once a week (with 38% reporting more than once a week). Pop consumption has increased dramatically over the recent decades (French, Biing-Hwan, and Guthrie, 2003), which may have negative effects on body weight status (Ludwig et al., 2001; Troiano et al., 2000), and (arguably) may compromise nutrient intakes by replacing other nutrient-dense beverages such as milk and 100% fruit juice (Johnson and Frary, 2001). Participants who reported consuming pop 2-6 times/week (OR 1.56), once/week (OR 1.85), once/month (OR 1.84), or rarely/never (OR 1.67) were likely to have a higher family meal frequency compared to participants consuming pop at least once/day. Other studies from the US (Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003) have also found negative associations between family meal frequency and pop consumption. It is possible that participants who consume more frequent family meals may also have family meal rules that may prevent children and adolescents from consumpting pop during meals, thus lowering overall pop consumption.

Breakfast skipping is a commonly reported food behaviour among individuals within this age group, especially among females (Cohen et al., 2003), those who are overweight/obese (Berkey et al., 2003; Siega-Riz et al., 1998), older children and adolescents (Evers et al., 2001), and those who are concerned with a high body weight and/or dieting (Woodruff et al., submitted; Young and Fors, 2001; Zullig et al., 2006). Results of this study observed a lower breakfast skipping prevalence (22%) than has been reported by others (Cohen et al., 2003; Evers et al., 2001); however, the present study measured whether or not the participants consumed breakfast on the day of the survey, rather than breakfast frequency (which reflects habitual consumption). The strength of the association between family meal frequency and breakfast eating (versus skipping) is important to note (OR 1.80) especially after the ordinal logistic regression model adjusted for sex, grade, body weight status, dieting status, and concerns over high body weight, which have all been associated with breakfast skipping in the literature. Families who are more likely to eat dinner together may also be more likely to consume breakfast together. It is also possible that family meals are a time to teach/learn about the importance of healthy food behaviours (Gillespie and Achterberg, 1998), thus carrying over to the importance of consuming breakfast.

Self-efficacy is a potentially useful construct that has previously been used to measure an individual's confidence in his or her ability to perform a specific behavior, such as practicing healthy eating behaviors, rather than measuring the behaviour itself (Foreyt and Goodrick, 1994; Granner et al., 2004; Young et al., 2004). In the present sample, it was interesting to note that participants have the highest self-efficacy for healthy eating when at home with their family (65%), followed by when they are alone (40%), when they are at school with their friends (30%), and finally during social times with their friends (22%). It

was not surprising that self-efficacy for healthy eating was lowest during social times, as previous research indicates that the presence of others increases food intake regardless of time of day, weekend versus weekday, setting (home, restaurant, or elsewhere), or the presence of alcohol (de Castro, 1990 and 1991a). Participants who reported being neutral (OR 0.63) or unsure (OR 0.29) that they could chose to eating healthy foods when they were at home with their family were also likely to have less frequent family meals. The implications of this finding is particularly interesting, as it may suggest that if participants are served healthy foods at home, then they are more likely to be sure that they can choose to eat healthy food (further strengthening the argument for home availability of healthy foods). A second association of self-efficacy and family meal frequency was also noted between being unsure of healthy eating during social times with friends and reporting less frequent family meals (OR 0.47). It has been suggested that family meals may provide a venue for learning and teaching healthy food behaviours, attitudes, and food preparation (Boutelle et al., 2001; Gillespie and Achterberg, 1998; Neumark-Sztainer et al., 1999; Neumark-Sztainer et al., 2004) that may potentially cross over into other social situations and/or situations when participants have to make their own food choices.

There were no associations between fast food frequency and family meal frequency, as originally hypothesized. The majority of participants (41%) reported consuming fast food once a month, which is perhaps lower than expected (Garriguet, 2006; Veugelers et al., 2005). This may be reflective of the age of the participants, as fast food consumption tends to increase with increasing age into adolescence (Garriguet, 2006). In terms of family meals, Gillman et al. (2000) reported a negative association between family meals and consuming

fried food away from the home, however, they did not specifically investigate fast food frequency, thus making comparisons to the present study difficult.

Dieting (Jones et al., 2001; McVey et al., 2004) and concerns regarding body weight (Cooper and Goodyer, 1997) are commonly reported among older children and adolescents. The prevalence of dieting and being concerned with a high body weight was 20% and 27% in the present sample, respectively. The current study did not find any associations between family meal frequency and dieting status or the presence of being concerned over a high body weight. Associations between disordered eating patterns and family meals have been previously been reported in the US (Ackard and Neumark-Sztainer, 2001; McDermott and Jaffa, 2005; Neumark-Sztainer et al., 2004), based on for example, unhealthy weight control behaviors, binge eating, chronic dieting, or clinically diagnosed eating disorders. However, the purpose of the present study was not to assess disordered eating patterns, and therefore used different, and perhaps less intense measures, thus not being able to distinguish an association.

This study is not without limitations. The present study inferred family meal frequency from the question *Typically, how many days per week do you eat dinner or supper with at least one parent?* This question was asked in this manner to recognize differences in today's families and not take the stereotypical nuclear family perspective. It was assumed that eating with at least one parent for dinner or supper would be adequate to describe family meals. Moreover, dinner is thought to be the most socially significant and largest meal of the day, and therefore, the least likely meal to be consumed alone (Sobal, 2000). However, it must be noted that the conclusions of the present study are reflective of family dinner meals, and not all meals. Secondly, there were many comparisons made within this study (n=30),

which may have influenced the outcomes (e.g. it could be expected that with so many comparisons at a level of significance set at 0.05, that one or two of the observed differences may, in fact, be false). The strongest associations, and those with the greatest amount of confidence of being true, were seen between family meal frequency and pop consumption, breakfast eating, and self-efficacy for healthy eating at home with family.

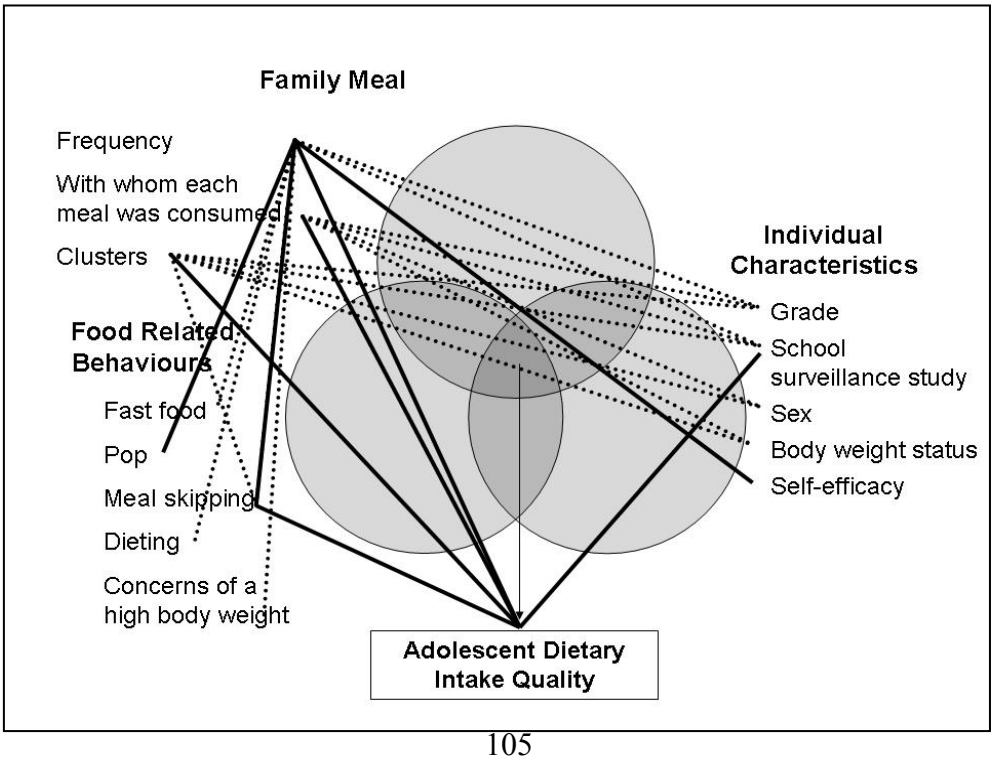
In summary, greater family meal frequency was associated with less pop consumption, eating breakfast on the day of the survey, higher self-efficacy for healthy eating at home with family, and during social events with friends. The cross-sectional nature of this research allows only for the associations between family meal frequency and food behaviours and attitudes to be measured, yet can not establish causality. Researchers and clinicians should be aware of these associations when planning family based healthy eating strategies.

CHAPTER 6: General Discussion and Recommendations

6.1 Overall Findings

The studies described in this thesis assessed the associations among family meal frequency, diet quality, meal environments, and other commonly reported food behaviours and attitudes among grade six, seven, and eight students from Ontario and Nova Scotia. Referring back to the original model (Figure 2) depicting how individual characteristics, food-related behaviours, and family meals potentially influence adolescent dietary intake and quality, Figure 3 highlights the various associations found among the three studies combined. The dark lines represent the associations between overall diet quality and family meal factors and family meal factors and food related behaviours and attitudes after adjusting for grade, sex, body weight status, and school surveillance study, whereas the dotted lines represent bivariate (associations without adjusting for covariates).

Figure 3: *The Combined Associations of Studies One, Two, and Three*



The main findings of this research were that family meal frequency was positively associated with diet quality, and that certain meal environments (particularly those associated with restaurants/fast food outlets and meal skipping) were associated with worse diet quality. Further, family meal frequency was positively associated with less pop consumption, eating breakfast on the day of the survey, and higher self-efficacy for healthy eating at home with family and during social times with friends. The cross-sectional nature of this research allows only for the associations between to be measured, and can not establish causality and/or the true nature of the arrow direction.

6.1.1 Family Meal Frequency

Most participants reported consuming dinners together with at least one parent on 6-7 days/week (70%) with smaller numbers reporting family meals on 0-2 days/week (11%) or 3-5 days/week (19%). Participants reported consuming more family dinners per week than has been previously reported by grade five students from Nova Scotia (57% reported 5 or more times/week; Veugelers et al., 2005) and younger adolescents (43% reported eating family meals everyday; Gillman et al., 2000) and adolescents (who reported 25%-48% consumed family meals 6 or more times/week; Neumark-Sztainer, Hannan, et al., 2003; Videon and Manning, 2003) from the US. The differences in family meal prevalence in the current study may be attributed to the manner in which family meals were assessed. Gillman et al. (2002) described eating with other members of the family (versus at least one parent, as in the current study) everyday, on most days, or never/somedays, as opposed to 6-7, 3-5, and 0-2 days. Neumark-Sztainer et al. (2000, 2003, 2004) investigated the frequency when all or most of the family members ate together in the last seven days (included all meals, rather than specifically looking at dinner/supper) and analyzed it by >7 times, 3-6 times, 1-2 times,

or never. The present study inferred family meal frequency from the question *Typically, how many days per week do you eat dinner or supper with at least one parent?* This question was asked in this manner to recognize differences in today's families and not take the stereotypical nuclear family perspective. It was assumed that eating with at least one parent for dinner or supper would be adequate to describe family meals. Dinner is thought to be the most socially significant and largest meal of the day (Sobal, 2000) and therefore, the least likely meal to be consumed alone. However, the inference made throughout this thesis for family meals is, in reality, the association of family dinners.

Family meal frequency was significantly associated with grade and school surveillance study. The association of a decrease in family meal frequency with increasing age observed in the present study is similar to US data (Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003; Videon and Manning, 2003). The decrease may be attributed to increased independence from parents, part-time employment, and/or after school activities. Future research should investigate what barriers prevent frequent family meals, and how to overcome such barriers, among older children and adolescents. Further, differences between school surveillance studies were observed: Porcupine students reported the highest prevalence of family meals on 6-7 days/week whereas Peel reported the highest prevalence on 0-2 days/week. It is possible that the geographical/rural location of Porcupine region promotes a more family-centred atmosphere, whereas the metropolitan/urban lifestyle of Peel families may make family meals more difficult to have on a frequent basis. It is also possible that the meal frequency reported by participants from Peel region is more representative of the larger population. The Peel study was the only study in which passive parental consent procedures were used (versus active in Porcupine, Waterloo, Toronto, and Nova Scotia).

Dent et al. (1993) reported that participants who were omitted from participating in research due to lack of parental consent (when active procedures are used) were more likely to have parents who smoked, had decreased education levels, were from one-parent households, and placed lower priority on health. The differing student response rates (e.g. students had to be in class on the day of the survey and have parental consent) between school surveillance studies when using active procedures (Porcupine=34%, Waterloo=57%, Toronto=38%, and Nova Scotia=39%) versus passive (Peel=98%) may, in fact, be confounding the differing prevalence of family meals across the school surveillance studies. A lower family meal frequency was observed when active parental consent was used (Peel Region) versus passive parental consent (Porcupine, Waterloo, Toronto, and Nova Scotia combined). However, there are numerous other potential explanations (e.g. shift work, family characteristics, after school activities, individual characteristics) that could also influence differences among family meal frequency and school surveillance studies.

No differences between family meal frequency and sex were observed, which is similar to others from the US (Gillman et al., 2000; Videon and Manning, 2003). The present study, however, did not find an association between family meal frequency and body weight status, which has often been reported by others (Gable et al., 2007; Sen, 2006; Veugelers and Fitzgerald, 2005). Gable et al. (2007) and Veugelers and Fitzgerald (2005) calculated body weight status using measured heights and weights on all participants. A potential limitation of the present study was that BMI was the sole indicator of body weight status and that measured heights and weights were taken for students participating in the Waterloo, Toronto, and Nova Scotia studies, whereas self-reported values were used for Porcupine and Peel participants. No differences and significant intraclass correlations

between measured and self-reported heights (Waterloo ICC=0.44 and Toronto ICC=0.44) and weights (Waterloo ICC=0.82 and Toronto ICC=0.70) were observed when both measured and self-reported height and weight were available in Waterloo and Toronto. However, significant differences between self-reported and measured height and weight from participants in Nova Scotia were found. It is possible that participants from Porcupine and Peel region overestimated their height and underestimated their weight, thus lowering the overall prevalence of overweight and obesity in Porcupine and Peel. This may have, in turn, influenced the results between family meal frequency and body weight status. Further, different methodological techniques have been used to classify overweight and obesity prevalence between the studies. Gable et al. (2007) and Sen (2006) calculated body weight status using the CDC's cutoff's based on BMI percentile. In the present study, Cole et al. (2000) cut-offs, based on international standards, were chosen as the preferred methodology to be able to compare body weight status to other Canadian research (Shields, 2005; Veugelers and Fitzgerald, 2005).

6.1.2 Diet Quality

This is the first time that HEI-C scores have been calculated on a large group of Canadian students in grade six, seven, and eight. The mean HEI-C score across all participants was 65.1 (SD 13.2) falling into the diet *needs improvement* category (73% versus 13% who had a *poor* diet and 14% who had a *good* diet). It was not surprising that the HEI-C ratings were described as *needs improvement* for this sample, given light of recent food intake studies of children and adolescents (Briefel and Johnson, 2004; Garriguet, 2006; Hanning et al., 2007), who reported, on average, inadequate amounts of milk and dairy products, vegetables and fruit, and excessive consumption of foods high in fat, sugar, and salt

(some of which are assessed by the HEI-C in the present thesis). Clearly, the need to find ways to improve the diets of young Canadians is critical.

The HEI-C scores observed were similar to those observed in young adolescents (9-14 years) from Nova Scotia living in households with a single mother below the poverty line (mean=63.3, SD=9.1) (Glanville and McIntyre, 2006), even though the present sample reflects higher school region SES (see section 2.3.3). However, the present study differs from Glanville and McIntyre (2006), in that food intake was reported by the children and adolescents mothers and not the participants themselves. The current study also observed significantly higher diet quality (confirmed when using both scores and ratings) in participants from Waterloo and Toronto and lower in Porcupine Region (e.g. reflecting in part, a positive association between SES and diet quality; see Section 2.3.3 or Table 2). However, there are numerous other potential explanations that may account for the school surveillance study differences, such that the Porcupine study was administered by classroom teachers, rather than researchers (as was done in all other studies), potentially influencing the motivation of participants to answer more truthfully. However, reporting status ratios were not different between Porcupine and Toronto participants, thus other factors (e.g. environmental or family dynamics) not measured in this study may have influenced the differences.

The present study did not, surprisingly, find any associations between diet quality scores or ratings by sex, grade, and/or body weight status. It was originally hypothesized that males (versus females), those from lower grades (versus higher grades), and more normal weight (versus overweight or obese) would have higher diet quality ratings. Males typically report higher diet quality because they generally consume more food, thus increasing overall

levels of macronutrient and micronutrient intake. The null finding may be explained by how the HEI-C was calculated as it takes into account total energy intake (e.g. total number of servings are pro-rated for consumption levels of <1600 kcals/day, 1600-2200 kcals/day and >2200 kcals/day) thus equalizing total energy intake between males and females. It was also originally hypothesized that participants in higher grades would have a lower diet quality because they might have more access to fast food, have higher spending allowances (and purchasing freedom), and/or independence from their parents. The implication of not finding any differences in diet quality by grade may suggest that students in grade six, seven, and eight are more homogeneous than originally thought. Throughout much of the literature (Garriguet, 2006; Hanning et al., 2007; Neumark-Sztainer, Hannan et al., 2003) middle school grades (e.g. grades 6-8/9 or ages 9-13 years) are often grouped together without breaking down grade or age. Finally, the results indicating a null association between diet quality and body weight status may be again related to how diet quality was calculated. The energy adjustments that were made when calculating the HEI-C may not necessarily distinguish between over and under eating. Further, significantly higher reporting status ratios were observed among normal weight participants (1.51, SD 0.74) compared to overweight (1.20, SD 0.64) and obese (1.05, SD 0.58) participants ($p<0.001$), suggesting that overweight and obese participants tended to underreported food intake, thus potentially effecting the overall diet quality measure.

6.1.3 Family Meals and Diet Quality

The mean diet quality scores were 63.5 (SD 13.2), 63.0 (SD 13.2), and 66.1 (SD 13.0) for participants who reported family meals on 0-2, 3-5, and 6-7 days/week, respectively. After adjusting for sex, grade, body weight status, school surveillance study, and reporting

status, HEI-C scores increased by approximately 2.3 points (95% CI: 0.05, 4.7) as family meal frequency increased from 0-2 days/week to 6-7 days/week (adjusted p=0.045). When HEI-C diet quality ratings were analyzed, similar type of results were observed, such that diet quality ratings were likely to be lower among participants who reported family meals on 0-2 days/week (versus 6-7 days/week; OR 0.71 (95% CI: 0.51, 1.00), p=0.049).

Positive associations between family meals and diet quality have also been reported by students in grade five (n=5200) from Nova Scotia (Veugelers et al., 2005), as assessed using the DQI-International which takes into account dietary variety, adequacy, moderation, and balance. Further, studies from the US (Gillman et al., 2003; Neumark-Sztainer, Hannan et al., 2003; Videon and Manning, 2003) have shown that increased family meal frequency was positively associated to the consumption of fruits, vegetables, and dairy foods (all of which were assessed using the HEI-C) and a negative association with soft drink consumption and fried foods.

A unique aspect of the present study was the ability to investigate the social aspects of meals. By investigating meals in this manner (e.g. one random day versus a frequency measure), the potential confounding influence of within subject variability of family meals was disregarded. The findings did not support the original hypothesis that no associations among whom participants consumed meals with on the previous day would be observed by sex, grade, body weight status, school surveillance study, and/or reporting status. For the breakfast meal, a higher prevalence of females and grade eight students did not eat. In addition, a higher prevalence of grade six students and those from Waterloo reported consuming breakfast with family members. For the lunch meal, a higher prevalence of males consumed with family members, and a higher prevalence of grade six students and those

from Porcupine region consumed lunch alone. For the dinner meal, a lower prevalence of six students ate alone, and a lower prevalence of participants from Waterloo consumed dinner with friends. In all cases, skipping meals was associated with reporting status, suggesting that energy intake levels are not compensated for at other times of the day. The overall social impact and diet quality scores revealed that a negative association primarily exists between breakfast and lunch skipping and diet quality, rather than whether or not the meal was consumed with friends, family, or alone. Even though the HEI-C adjusts for energy intake, it is clear that quality as well as quantity is affected by meal skipping. However, when diet quality categorical ratings were analyzed (rather than scores), participants who ate breakfast alone (versus family members), lunch alone (versus friends) and/or lunch with family members (versus friends) were likely to have worse diet quality ratings. The surprising negative association between consuming lunch with family members and diet quality ratings is difficult to explain, yet might be reflected in the location of where lunch was consumed (e.g. lunch clusters from Chapter 4 reveal that participants who ate at home with family members were more likely to have a worse diet quality than those at school with friends).

De Castro (1990 and 1991a) has previously illustrated that the presence of others at meals increases the length of the meal and the amount of food consumed, regardless of the time of day, weekend versus weekday, setting (home, restaurant, or elsewhere), or the presence of alcohol. In terms of the amount of food consumed during family meals, Gillman et al. (2000) and Neumark-Sztainer, Hannan et al. (2003), found that students with a greater family meal frequency consumed more total daily energy, than those with fewer family meals. While the HEI-C was chosen as the measure of dietary intake in this thesis and not energy per se, total energy consumed was greater among participants with the highest family

meal frequency ($F=4.62$, $p=0.010$). What is interesting, however, is that even though participants consumed more total energy per day with increased family meal frequency, they also had the highest diet quality (Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003; and in this sample: $F=9.01$, $p<0.001$). Perhaps the increased amount of food provides more nutrients to satisfy diet quality, and given that there is no observed compensation in increased body weight, it may suggest that families who eat together are also active together. However, it may also suggest that individuals may remember what they ate better in the context of social eating versus eating alone.

Meals are generally consumed in a structured format (time, place, and sequence) bound by social rules (Douglas and Nicod, 1974; Marshall and Anderson, 2002). Sobal (2000) addressed the issue of sociability, arguing that facilitation (how people's eating is influenced by others), interaction (the social interchanges that occur at meals), and commensality (how eating partners are selected and/or excluded) can impact meals. These three aspects, which vary greatly from meal to meal and also person to person, potentially influenced the diet quality of the present sample. Throughout much of the literature, shared meals are often discussed in terms of family meals, yet Makela (2000) found that eating together promotes a feeling of community and solidarity among people with no family relations (such as eating lunch with friends at school or those at work). In the present study, lunch was most often consumed with friends (76% versus 14% with family members, 10% ate alone) because the majority ate at school. The results from study #1 (Chapter 3) suggested that participants who ate breakfast and lunch alone (versus with family members for breakfast and lunch with friends) were likely to have a worse diet quality. Perhaps, the

sense of community and/or familiarity of others, regardless of whether the meal was consumed with family or friends, helped to improved diet quality ratings.

The manner in which family meals are consumed may influence diet quality. Placement at the dinner table reveals who is head of household (usually parents sit at opposing ends of the table) and who is secondary (children are usually placed along the sides of the table). The organization of who sits where and who sits next to whom may be influenced by sex, age, economic contribution, birth order, body size, and/or health (Gittelsohn, 1991). This pattern is perhaps most tested when regular members are absent or guests are in attendance, as the shuffle of seating arrangements can be a play at social hierarchy. Furthermore, who serves the food (parents versus children), the order of serving (children or adults first), qualities of food served, quantities of food served, and method of serving (automatic, by request, or self-serving) can influence what is consumed during a meal (Gittelsohn, 1991). While social hierarchy and meal dynamics were beyond the scope of this thesis, this study clearly showed that the majority of meal preparers for lunch (56%) and dinner (84%) were family members. Unfortunately, further distinctions can not be made regarding who exactly prepared the meal, as it could be the head of household, a sibling, a grandparent, or another relative. Future research surrounding family meals and diet quality may want to include the potential influence of social hierarchy and meal dynamics to determine its association with diet quality.

Socially, eating communicates information about what, how, when, where, and with whom a person ate (Sobal, 2000). With the exception of breakfast (it is the least formal and smallest meal of the day), eating alone, particularly in restaurants, is generally seen as abnormal or undesirable (Sobal, 2000). Meal settings may change (home, restaurant, friends

house, work) and the formality of the meal may change (weekday, weekend, holiday, celebrations), yet, eating together is still *public* eating (Zdrodowski, 1996) that is associated with various routines and rituals. Approximately 34%, 9%, and 9% of the current sample reported consuming breakfast, lunch, and dinner alone. Based on the results of the first study (Chapter 3), when only investigating with whom meals were consumed, participants who ate breakfast and lunch alone were more likely to have a worse diet quality, than if consumed with family members for breakfast and friends for lunch. Results from the second study (Chapter 4), revealed a similar pattern, whereby participants in lunch cluster #7 (e.g. participants who consumed lunch at school, alone) were likely to have a worse diet quality (OR 0.55) than consuming with friends (cluster #1). Interestingly, 94%, 52%, and 93% of participants who consumed breakfast, lunch, or dinner, respectively, alone were at home and not in a public forum to be observed. Future research should investigate how we determine with whom and where we eat, and its potential association with diet quality.

It has been argued (Meiselman, 2000) that the conveniences of modern life (e.g. microwaves and frozen dinners) may be further helping to promote individual meals over family meals. In the past, it was difficult to cater to everyone's likes and dislikes and usually everyone would eat what was served by the main food preparer. However, families may now have one member who is health conscious, another who prefers chicken fingers and french fries, and/or one who is a strict vegan (which may in itself influence inclusion or exclusion from eating together). In order to cater to these individual preferences, the family meal preparer may find it too difficult to prepare a meal or dish that everyone will enjoy, and therefore chooses to cater to individual preferences, rather than the collective family. It would have been beneficial to determine whether or not the participants actually liked the

food that was served and consumed and how that impacted their diet quality. Further, it would be beneficial in the future to investigate who decides what types of food are served. In the present study, 53%, 29%, and 9% of the participants themselves were the main food preparer for breakfast, lunch, and dinner, respectively. The results from study #2 (Chapter 4) suggested that there were no differences in diet quality between who prepared lunch (e.g. between clusters #1 and #5) or dinner (e.g. between clusters #1 and #2). However, potentially confounding these conclusions may be the complexity of meal preparation, which was not currently studied.

6.1.4 Meal Environments and Diet Quality

This is the first time that specific aspects of meal environments (where each meal was consumed, with whom each meal was consumed, who prepared each meal, and where the meal was purchased) and diet quality associations have been investigated among students in grade six, seven, and eight from Ontario and Nova Scotia. As expected, the majority of participants reported lunch at school, with their friends, prepared by family members, from food purchased at a grocery store, and dinner was consumed at home, with family members, prepared by family members, from food purchased at a grocery store. For breakfast, however, the majority of participants ate with family members instead of, as expected, alone.

In the second study (Chapter 4), cluster K-means procedures were used to classify observations about the four meal environment variables into discrete groups. A total of 3, 8, and 6 clusters of meal environments were identified for breakfast, lunch, and dinner, respectively. The majority of cluster membership was different by sex, grade, body weight status, school surveillance study, and reporting status, which opposed the original hypothesis. For breakfast, the predominant differences were seen among those who skipped breakfast

(e.g. a higher prevalence of females, grade 8, obese, Nova Scotia and Peel, and those with lower reporting status ratios were in cluster #3 compared to cluster #1 and #2). The differences noted among breakfast skippers is comparable to the literature which suggests that frequent breakfast skipping is generally associated with females (Cohen et al., 2003), those who are overweight/obese (Berkey et al., 2003; Siega-Riz et al., 1998), older children and adolescents (Evers et al., 2001), and those that are concerned with a high body weight and/or dieting (Woodruff et al., submitted; Young and Fors, 2001; Zullig et al., 2006).

Among the lunch clusters, it was interesting to note that the prevalence of grade 8 participants was higher in cluster #2 (e.g. eating lunch with friends at a restaurant/fast food outlet/other), and that the prevalence of obese participants was higher in cluster #3 (e.g. eating lunch at home with family) and cluster #7 (e.g. eating at home alone). Further, differences in cluster membership were observed particularly for participants from Porcupine, such that the prevalence was lower for cluster #1 (e.g. ate lunch at school with friends, prepared by family members), and higher for eating lunch at home (cluster #3 and #7) and skipping lunch (cluster #8). The differences observed for the Porcupine study may be attributed to the proximity of the home to the school, parent employment, family dynamics, and/or other individual factors not measured in the current study.

Among dinner clusters, a lower prevalence of grade seven students were in cluster #5 (e.g. eating at a restaurant/fast food outlet with family members). Differences were again noted for participants from Porcupine, such that a lower prevalence was observed in cluster #1 (e.g. eating dinner at home with, and prepared by, family members), and a higher prevalence observed in cluster #2 (e.g. participants who ate at home with family and prepared the meal themselves), cluster #5 (e.g. ate at a restaurant/fast food outlet with family

members), and cluster #6 (e.g. skipped dinner). Again, differences may be attributed to parental employment (e.g. shift work), family dynamics, and/or other individual factors that were not measured in this study.

Specific clusters of meal environments were associated with improved diet quality ratings. It was interesting to note that participants who tended to purchase and/or consume meals at a convenience store/vending machine/other or restaurant/fast food outlet for breakfast (cluster #2), lunch (cluster #2), and/or dinner (cluster #5) had a greater likelihood of having a worse diet quality. This is in agreement with studies from the US (Cullen, Bishop et al., 2002; Gonzales et al., 2002; Guthrie et al., 2002; Lin et al., 1999a) who suggest that food consumed in the home from grocery items, versus food consumed or prepared outside of the home, is associated with improved dietary profiles. The negative association between diet quality and fast food, in particular, was also seen among adolescents participating in the Project EAT study from the US, which described positive associations between fast food frequency and intakes of total energy, percent energy from fat, daily servings of soft drinks, cheeseburgers, french fries, and pizza, and negative associations with daily servings of fruit, vegetables and milk (French et al., 2001). Most of these factors were assessed with the HEI-C in the present study.

Interestingly, the current data showed fewer participants consuming a meal from a fast food outlet than data recently described in the CCHS Cycle 2.2 (12% of males and 13% of females versus 23% of males and 19% of females, respectively; Garriguet, 2006). However, the lower prevalence observed is probably reflected in that only meals (breakfast, lunch, and dinner) were examined, whereas the CCHS Cycle 2.2 (Garriguet, 2006)

investigated meals, in addition to snacks (e.g. snacking patterns were not consistently measured across the school surveillance studies).

It was also interesting to note that the majority of participants consumed dinner at home (93%), with family members (87%), composed of foods purchased from a grocery store (87%), and prepared by family members (84%). The dinner meal is thought to be the most social and provides individuals with the most amount of energy (Fiese, 2006; Meiselman, 2000). The high prevalence of consuming dinner at home with family members is encouraging, given the recent attention to healthy eating in the research literature and current media stories directed at individuals, families, and schools. Further, it may also indicate that more participants of this age eat with their family than the literature previously suggested. Family meal investigations (Gillman et al., 2000; Neumark-Sztainer et al., 2003; Videon and Manning, 2003) have generally been comprised of children and adolescents with a much larger age range (9-22 years) than the current study, and the older age may have confounded their results.

A particularly important finding of the second study (Chapter 4) was that participants in the clusters that skipped breakfast, lunch, and/or dinner were likely to have a worse diet quality than those that consumed these meals, even after adjusting for sex, grade, body weight status, and underreporting status. A higher number of participants belonged in the clusters that skipped breakfast (10%) over lunch (6%) or dinner (3%). This breakfast skipping prevalence is lower than has been reported in the literature (Cohen et al., 2003; Evers et al., 2001) and in chapter 5 which used a different measure of breakfast skipping. Meal skipping in Chapter 4 was measured using the participants responses from the four environment questions (e.g. if participants chose that they did not eat for any one of the four

environment questions they were classified as a skipper), which limits comparisons to other studies. However, meal skipping, in particular breakfast, has been associated with poor nutrient intakes in the past (Cohen et al., 2003; Rampersaud et al., 2006; Videon and Manning, 2003; Woodruff et al., submitted) and the negative association with overall diet quality was also detected in grade five students from Nova Scotia (Veugelers et al., 2005). The issue of a negative association between meal skipping and diet quality is problematic, and it seems to have a larger impact (e.g. lower odds ratios) on overall diet quality than the environmental conditions under which the meal was consumed. Health promotion strategies aimed at healthy food behaviours among students in grade six, seven, and eight need to be aware of this potentially harmful behaviour.

6.1.5 Family Meals and Other Commonly Reported Food Behaviours and Attitudes

The associations between family meal frequency and other commonly reported food behaviours (fast food and pop consumption, breakfast skipping, and dieting) and attitudes (body weight concerns and self-efficacy for health eating) were investigated. Higher family meal frequency was associated with lower pop consumption, eating breakfast on the day of the survey, higher self-efficacy for healthy eating at home with family and during social times with friends.

Approximately 63% of participants reported consuming pop at least once a week (with 38% reporting more than once a week). Pop consumption has increased dramatically over the recent decades (French, Biing-Hwan, and Guthrie, 2003), which may have negative effects on body weight status (Ludwig et al., 2001; Troiano et al., 2000), and (arguably) may compromise nutrient intakes by replacing other nutrient-dense beverages such as milk and 100% fruit juice (Johnson and Frary, 2001). Participants who reported consuming pop 2-6

times/week (OR 1.56), once/week (OR 1.85), once/week (OR 1.84), or rarely/never (OR 1.67) were likely to have a higher family meal frequency compared to participants consuming pop at least once/day. Other studies from the US (Gillman et al., 2000; Neumark-Sztainer, Hannan et al., 2003) have also found negative associations between family meal frequency and pop consumption. It is possible that participants who consume more frequent family meals may also have family meal rules that may prevent children and adolescents from consuming pop during meals, thus lowering overall pop consumption.

Breakfast skipping is a commonly reported food behaviour among individuals within this age group, especially among females (Cohen et al., 2003), those who are overweight/obese (Berkey et al., 2003; Siega-Riz et al., 1998), older children and adolescents (Evers et al., 2001), and those who are concerned with a high body weight and/or dieting (Woodruff et al., submitted; Young and Fors, 2001; Zullig et al., 2006). Results of Chapter 5 observed a lower breakfast skipping prevalence (22%) than has been reported by others (Cohen et al., 2003; Evers et al., 2001); however, this study measured whether or not the participants consumed breakfast on the day of the survey, rather than breakfast frequency (which reflects habitual consumption). The strength of the association between family meal frequency and breakfast eating (versus skipping) is important to note (OR 1.80) especially as the ordinal logistic regression model adjusts for sex, grade, body weight status, dieting status, and concerns over high body weight, which have all been associated with breakfast skipping in the literature. Families who are more likely to eat dinner together may also be more likely to consume breakfast together. It is also possible that family meals are a time to teach/learn about the importance of healthy food behaviours (Gillespie and Achterberg, 1998), thus carrying over to the importance of consuming breakfast.

Self-efficacy is a potentially useful construct that has previously been used to measure an individual's confidence in his or her ability to perform a specific behavior, such as practicing healthy eating behaviors, rather than measuring the behaviour itself (Foreyt and Goodrick, 1994; Granner et al., 2004; Young et al., 2004). In the present sample, it was interesting to note that participants have the highest amount of self-efficacy for healthy eating when at home with their family (65%), followed by when they are alone (40%), when they are at school with their friends (30%), and finally during social times with their friends (22%). It was not surprising that self-efficacy for healthy eating was lowest during social times, as previous research indicates that the presence of others increases food intake regardless of time of day, weekend versus weekday, setting (home, restaurant, or elsewhere), or the presence of alcohol (de Castro, 1990 and 1991a). Participants that reported being neutral (OR 0.63) or unsure (OR 0.29) that they could chose to eating healthy foods when they were at home with their family were also likely to have less frequent family meals. The implications of this finding is particularly interesting, as it may suggest that if participants are served healthy foods at home, then they are more likely to be sure that they can choose to eat healthy food (further strengthening the argument for home availability of healthy foods). A second association of self-efficacy and family meal frequency was also noted between being unsure of healthy eating during social times with friends and reporting less frequent family meals (OR 0.47). It has been suggested that family meals may provide a venue for learning and teaching healthy food behaviours, attitudes, and food preparation (Boutelle et al., 2001; Gillespie and Achterberg, 1998; Neumark-Sztainer et al., 1999; Neumark-Sztainer et al., 2004) that may potentially cross over into other social situations and/or situations when participants have to make their own food choices.

There were no associations between fast food frequency and family meal frequency, as originally hypothesized. The majority of participants (41%) reported consuming fast food once a month, which is perhaps lower than expected (Garriguet, 2006; Veugelers et al., 2005). This may be reflective of the age of the participants, as fast food consumption tends to increase with increasing age into adolescence (Garriguet, 2006). In terms of family meals, Gillman et al. (2000) reported a negative association between family meals and consuming fried food away from the home, however, they did not specifically investigate fast food frequency, thus making comparisons to the present study difficult.

Dieting (Jones et al., 2001; McVey et al., 2004) and being concerned with high body weight (Cooper and Goodyer, 1997) are commonly reported among older children and adolescents. The prevalence of dieting and being concerned with a high body weight was 20% and 27% in the present sample, respectively. The current study did not find any associations between family meal frequency and dieting status or the presence of being concerned over a high body weight. Associations between disordered eating patterns and family meals have been previously been reported in the US (Ackard and Neumark-Sztainer, 2001; McDermott and Jaffa, 2005; Neumark-Sztainer et al., 2004), based on for example, unhealthy weight control behaviors, binge eating, chronic dieting, or clinically diagnosed eating disorders. However, the purpose of the present study was not to assess disordered eating patterns, and therefore used different, and perhaps less intense measures, thus not being able to distinguish an association.

6.2 Family Characteristics

Family meals can be seen as both a routine (observable practices) and ritual (symbolic representations of collective events) (Fiese, Tomcho, Douglas, Josephs, Poltrock,

and Baker (2002). "Seemingly mundane and apparently unconscious aspects of family routines are rooted in cultural expectations for child growth and development" (Fiese, 2006, pg. 15). The present thesis sought to investigate student perceptions of family meal frequency (as a routine). However, it is acknowledged that there is another area of literature that seeks to understand the rituals of family meals, through family connectedness (Ackard, Neumark-Sztainer, Story, and Perry, 2006; Archibald et al., 1999; Fonseca, Ireland, and Resnick, 2000; Hill and Franklin, 1998; Neumark-Sztainer et al., 1996; Neumark-Sztainer, Wall et al., 2003), parental concern and support (Archibald et al., 1999; Contento, Michela, and Goldberg, 1988; French et al., 2001; Young et al., 2004), family satisfaction (Eaker and Walters, 2002; Mueller et al., 1995), and sense of personal identity (Cheal, 1988; Fiese, 1992) which has not been captured in the current thesis. Age appropriate and non-rigid family rituals seem to facilitate adolescent identity development and self-esteem (Fiese, 1992; Fiese and Kline, 1993). Family routines and rituals, including family meals, have been associated with parenting competence, child adjustment, and relational/marital well-being in the past (Fiese et al., 2002; Fiese, 2006).

Parenting style and control over offspring can shape food behaviours and attitudes. Greater amount of attention/stimuli (Hertzler, 1983) and better communication between adolescents and parents (Young and Fors, 2001) was associated with healthy food consumption and behaviours (e.g. eating breakfast, vegetable and fruit intake) among children and adolescents. Daily routines, such as in the case of family meals, were found to help mothers of young infants feel more competent about their parenting role (Fiese et al., 2002; Sprunger, Boyce, and Gaines, 1985). In terms of parenting styles defined by Baumrind (1991) and Maccoby and Martin (1983), there is also evidence that authoritat*ive* parenting

style was associated with increased fruit consumption and fruit-specific cognitions in adolescents (Kremers et al., 2003), whereas indulgent, authoritar*ian*, and/or neglectful parenting style was associated with less fruit consumption (Fisher and Birch, 1999; Kremers et al., 2003). It is possible that certain types of parents may be more likely to have a high priority for family meals, which unfortunately was not captured in the present thesis. Interestingly, Trombini et al. (2003) investigated attachment style, defined using the 1994 Attachment Style Questionnaire and the 1958 Parental Attitude Research Instrument, among mothers with and without obese children and adolescents (5-18 years). They concluded that mothers with obese offspring had a higher prevalence (66.6%) of Insecure Attachment style compared to those without obese offspring (33.3%); mothers with obese offspring seemed to make the family their exclusive centre of interest, dedicating themselves to their children with possessiveness and hyperprotection, with obvious negative health effects (Trombini et al., 2003). Finally, greater parental control has been associated with a lower ability to self-regulate energy intake in children (Johnson and Birch, 1994), and higher restrained eating in adolescents (Edmunds and Hill, 1999). Although parenting issues were not dealt with in this thesis, it is an area that should be considered in the future when investigating family meal influence on diet quality.

Family time, regardless of whether or not it happens at the kitchen table, is important to childhood and adolescent growth and health. Children and adolescents of families who spend greater amounts of time together have higher academic achievement (Eisenberg et al., 2004; Hofferth and Sandberg, 2001) and less problematic behaviours (Duncan, Duncan, and Strycker, 2000). Family meals may provide a venue to promote close and healthy relationships between the members of the family (Fiese and Parke, 2002). Children are often

encouraged to tell their news of the day and participate in family-level discussions (Fiese, 2006). Family traditions and stories are often told at the dinner table. Family table talk operates to convey culture and family ideals and norms to children (Bossard, 1943; Bossard and Boll, 1950), even thought the size of families may influence the conversation (e.g. parents tend to talk more to each other, than children, in smaller families) (Dreyer and Dreyer, 1973; Lewis and Fiering, 1982; Sobal, 2006). It was previously reported that meal times were the most frequent times that mothers talked to their children (Hoff-Ginsberg, 1991). Families with more centralized meal arrangements may include interaction rituals in which members can share stories that promote solutions to problems and reinforce dynamics of social control in the family (Ochs, Smith, and Taylor, 1989). Again, while time spent with family, other than at dinner, was beyond the scope of this thesis, future recommendations would be to determine what other activities, besides meal times, may be helping to drive the dietary differences.

6.3 Eating Patterns

This research supports the concept that family meals and certain meal environments are positively associated with diet quality and healthy food behaviours and attitudes. From the time we are born, food connects people together. Breastfeeding, holidays and celebrations, work meetings, or catching up with someone you haven't seen in awhile, are all food-centric occasions. In response to family meals, especially those celebrating a holiday (e.g., Thanksgiving or Christmas), we tend to honour the past generations by preparing the same traditional dishes that our grandmothers used to cook (Makela, 2000). "On a repetitive basis, families come to define who they are by the routine patterns in which they engage as well as the conversations they hold about such routines. Stories of family routines are often

shared with children, which in turn, are related to how the family interacts during mealtimes" (Fiese et al., 2002, pg. 384). It was encouraging to note that the majority of participants (70%) reported consuming family meals on 6-7 days/week, arguing against the possible notion that family meals are becoming extinct.

Over the last century, eating patterns have dramatically changed, especially within the family context. Although not everyone consumes three meals a day, the dinner meal is the most frequent meal consumed by children and adolescents (Caroli et al., 2004; Mestdag, 2005). In the present study, dinner was the most frequent meal consumed (e.g. the cluster analyses revealed that 97% consumed dinner, versus 91% who consumed breakfast and 94% who consumed lunch). Busy schedules of family members, shifting work schedules, and after-school activities can make the family meal near impossible for some families, especially on weekdays. The current study shows a strong presence of family meals in students in grade six, seven, and eight, even though expectations for dinner attendance may be more flexible than they were in the past (Fiese, 2006). Without the time crunch of the weekday, cooking from scratch or preparing more elaborate meals are possible on weekends (Makela, 2000) and are perhaps more important given the decrease in family meals and scatter of weekday meals for some families. Future research needs to investigate the impact of weekend versus weekday family meals on diet quality. One limitation of the current research is that the majority of data reflect school days rather than weekends. Most of the current data were collected Tuesday through Friday, although a small number of recalls in Peel Region were completed on Monday (n=109 or 8% of the Peel sample), thus introducing some weekend data. Within this particular sample, there were no differences in diet quality

ratings or family meal frequency between weekend versus weekday data collection, and therefore the weekend data were combined with the weekday data.

It is well known that individual food intake varies greatly from day to day. It is usually assumed that within a population, these variations are due to random chance in intake and that with repeated measurements the extreme values balance out to provide a valid measure of mean intake (Livingstone and Robson, 2000). The 24 hour recall was considered appropriate to compare food intake across the study sample, as the random chance of variation in food intake within an individual is similar to the random chance of variation in food intake between individuals. Further, not only does the present data not reflect all days of the week, but the data were collected during the school year which may introduce some seasonal effects of food intake. Studies that have collected data during different seasons have suggested that seasonal variations of food intake (e.g. summer versus winter) may be apparent in children (Gagne, Rhainds, and Galibois, 2004) and adults (de Castro, 1991b) which may have influenced the results of this thesis.

6.4 Limitations

It was recognized in advance that this study has several limitations. As outlined in Chapter 1, there are many factors which can influence what an individual chooses to eat (Figures 1 and 2). Given that family meals are only one potential influence on overall intake, it is acknowledged that family meal effects may only explain a small part of the variability of diet quality. Moreover, there are many potential interaction effects, both studied and not studied in the current thesis. Future research needs to investigate what types of food are served and how the food is prepared for family meals (e.g. it is possible that food from a *box*,

such as a fully prepared frozen meal that needs only to be heated up, is of lower nutrient quality compared to food that may be prepared from scratch).

The convenience sample is a limitation of this study. Classrooms were chosen to participate in the various studies by location (Nova Scotia), socioeconomic status (Waterloo), or convenience (Porcupine, Peel, and Toronto). Yet, a strength of the current sample is that the participants were from geographically diverse areas in Ontario and Nova Scotia. Past Canadian studies have found geographic differences in body weight and health behaviours (e.g. dietary intake or physical activity) (Garriguet, 2006; Willms, Tremblay, and Katzmarzyk, 2003) with the Atlantic Provinces having a higher prevalence of overweight/obesity and health risk behaviours. This was mirrored in the present sample, as a higher prevalence of overweight and/or obesity was observed for students participating in the Nova Scotia study compared to Ontario.

The low student response rates (e.g. students had to be in class on the day of the survey and have parental consent) from Porcupine (34%), Waterloo (57%), Toronto (38%), and Nova Scotia (39%) may have influenced the overall findings. Low student response rates have been observed with other food behaviour studies of Canadian children (51% in the CLASS study in Veugelers and Fitzgerald, 2005; Veugelers et al., 2005) and with past studies using the *Food Behaviour Questionnaire* (39% in Hanning et al., 2007 and 35% in Minaker et al., 2007). Due to the large number of possible explanations (parents never received the forms, parents did not care or were too lazy to read and/or sign the information and forms, student forgot the signed form in his/her book bag, or parents/students truly did not want to participate) it is not possible to determine whether the results are generalizable to the larger population. Moreover, given that this is a study of family influence, it is

recognized that certain types of parents may be more likely to sign (or not sign) consent forms (Dent et al., 1993). It has previously been reported that participants who are omitted from research studies because of the lack of parental consent (when active procedures are used), may be at risk for a number of health and social concerns (Dent et al., 1993). The relatively high family meal frequency in the present study may indicate that parents with increased attention/concern to sign consent forms may be also more likely to have more family meals, thus not capturing the true patterns of family meals. Participants from the Peel study, that used passive parental consent procedures, had the highest prevalence of consuming family meals on 0-2 days/week and the lowest for 6-7 days/week, which may be more indicative of family meal frequency among the larger population. Even though the convenience sample was not reflective of Ontario or Nova Scotia grade six, seven, and eight students as a whole, nor were respondents within any individual study entirely generalizable to the target population of the region, it must be noted that the objectives of this thesis were not to mirror student behaviours by geographic region, per se, but rather to look at associations among family meals, diet quality, meal environments, and various demographic factors. In this regard, obtaining data from a broad cross section of participants was desirable.

The use of the HEI-C to categorize diet quality may have also influenced the results. The decision to use the HEI-C was based on (1) the ease of using a single measurement of diet quality rather than numerous indicators individually (such as overall energy intake, servings of food groups from CFGHE, or nutrient intakes in relation to current recommendations) and (2) the fact that it includes Canadian recommendations. However, it is acknowledged that by using this index as the sole measure of diet quality, certain aspects

of the diet may be overlooked (e.g. added sugar, a known health concern in children and adolescents) and others over-emphasized (e.g. fat, cholesterol). A strength of the HEI-C is that it calculates the food serving scores based on total energy intake, thereby accommodating individuals who consume less than 1600 kcals/day, 1600-2200 kcals/day, and greater than 2200 kcals/day. However, lower intakes due to meal skipping, dieting, or overeating may not be adequately described through the use of the HEI-C. Further, certain aspects or components of the HEI-C may have influenced the overall findings of the present thesis. The diet quality scores of participants was based on: grains (10 points), fruits (10 points), vegetables (10 points), milk products (10 points), meat and alternatives (10 points), *other* foods (10 points), total fat (10 points), saturated fat (10 points), cholesterol (10 points), and variety (e.g. greater than 1 serving from each food group for 10 points). The inclusion of total fat and saturated fat, for a combined total of 20 points ($1/5^{th}$ the score) may be high and rather unnecessary. Further, dietary cholesterol is not a major health indictor in children and adolescents. It may have been better suited to include body weight status, added sugar intake, fast food frequency, pop consumption, or meal skipping in lieu of one of the fat and/or cholesterol categories, as these are known nutritional issues in children and adolescents. It is recommended that future research determine which nutritional factors best describe diet quality.

Finally, there are inherent limitations in any nutritional survey. A noted concern throughout the chapters includes the differing numbers of sample size (due to missing data points). It is not possible to know why participants chose not to respond to certain questions, however, it may be related to the length of the survey (e.g. boredom, restlessness), distraction from surrounding participants, or simply not wanting to respond to the question. The non-

response had the most marked influence on the sample for the cluster analyses in Chapter 4, as the data sets needed to be complete for all of the component factors.

Self-reported survey data have the potential for recall error (Baranowski and Domel, 1994; Livingstone and Robson, 2000), inaccurate estimation of portion sizes (Livingstone and Robson, 2000), systematic bias in dietary reporting (Bandini et al., 1990; Briefel et al., 1997), and providing socially desirable answers. The web-based survey was designed to minimize these limitations, with built-in prompts to assist student memory and visuals to assist in portion size estimation. Nevertheless, evidence of systematic underreporting of dietary intake among overweight (Bandini et al., 1990; Champagne et al., 1996; Garaulet, Martinez, Victoria, Perez-Llamas, Ortega, and Zamora, 2000; Johnson-Down et al., 1997; Maffeis, Schutz, Zaffanello, Piccoli, and Pinelli, 1994) and female (Briefel et al. 1997; Johansson, Solvoll, Bjorneboe, and Drevon, 1998) youth have been previously reported. Furthermore, underreporting in females and overweight/obese participants was previously detected using the *Food Behaviour Questionnaire* in grade nine and ten students from Ontario and Alberta even after correcting for self-reported dietary behaviour (Vance et al., submitted).

Among the present sample, reporting status was assessed using a ratio of energy intake (EI) to basal metabolic rate (EI:BMR_{est}). Reporting status ratios were significantly lower among females (adjusted $p=0.003$), grade eight (compared to grade six; adjusted $p=0.008$), overweight (adjusted $p<0.001$) and obese individuals (adjusted $p<0.001$), and higher among participants from Waterloo (compared to all other school surveillance studies; $p<0.001$) in the current sample (adjusted for all other factors in the model, sex, grade, body weight status, and school surveillance study; see section 2.3.4). The methods for accounting

for underreporting are not necessarily agreed upon by researchers. All analyses pertaining to food intake were completed with and without reporting status as a factor, and did not change any of the outcomes when reporting status was included in the model. Further, the inherent energy intake correction with the HEI-C computation, does not take into account under- or over-eating. Therefore, it was felt due to the variations in reporting status among the present sample, underreporting should be accounted for as a factor relating to diet quality in the present thesis.

6.5 Conclusions

Despite these recognized limitations, this study provided novel Canadian information on family meals. This was the first Canadian study to investigate, in depth, the role of family meal frequency on diet quality in grade six, seven, and eight students. Moreover, no previous Canadian research had investigated the environment surrounding meals, and its association with diet quality. The growing concern for healthy lifestyles suggests that this research is timely, unique, and has the ability to potentially drive future healthy intervention strategies geared at improving the lives of Canadian children and adolescents. Since the diet of most students in grade six, seven, and eight was suboptimal, strategies to promote healthy family meals should be widely encouraged.

Over the last few years, promoting family meals has become a strong public health message. The March 2007 National Nutrition Month (Dietitians of Canada) campaigned *Cook it up Healthy,* about the pleasures and benefits of cooking and eating together. ActNow BC uses family meals as a healthy eating and healthy living strategy. Books (*Dimensions of the Meal* by Herbert Meiselman, 2000 and *The Surprising Power of Family Meals* by Miriam Weinstein, 2006), cookbooks (*Family Meals for Everyone* by Jamie Oliver, 2006), articles in

current popular magazines (Time magazine's *The Magic of the Family Meal* by Nancy Gibbs and Canadian Living's *The Benefits of Family Meals* by Joey Shulman), commercials on television (public-education campaigns on TVland's Nick at Nite and Kraft Foods *Dinner on Hand* campaign), and a *National Family Dinner Night* (the 4th Monday in September) are all promoting the benefits of family meals as there seems to be a whole host of benefits, besides better diet quality, of eating together as family. Those campaigns not only promote family meals but also the quality of family meals that will contribute to health.

In conclusion, the studies described in this thesis assessed the associations between family meal frequency, meal environments, diet quality, and other commonly reported food behaviours and attitudes. The main findings of this research was that family meal frequency was associated with improved diet quality, and that certain meal environments (particularly those associated with restaurants/fast food outlets and meal skipping) were associated with worse diet quality. Further, family meal frequency was positively associated with less pop consumption, eating breakfast on the day of the survey, and higher self-efficacy for healthy eating at home with family and during social times with friends. This was the first Canadian study to describe, in depth, family meal frequency of students in grade six, seven, and eight from Ontario and Nova Scotia. The current study lends needed support to Canadian public health recommendations to "enjoy family meals whenever possible" (*Healthy Weights, Healthy Lives*; Ministry of Health and Long Term Care, 2004).

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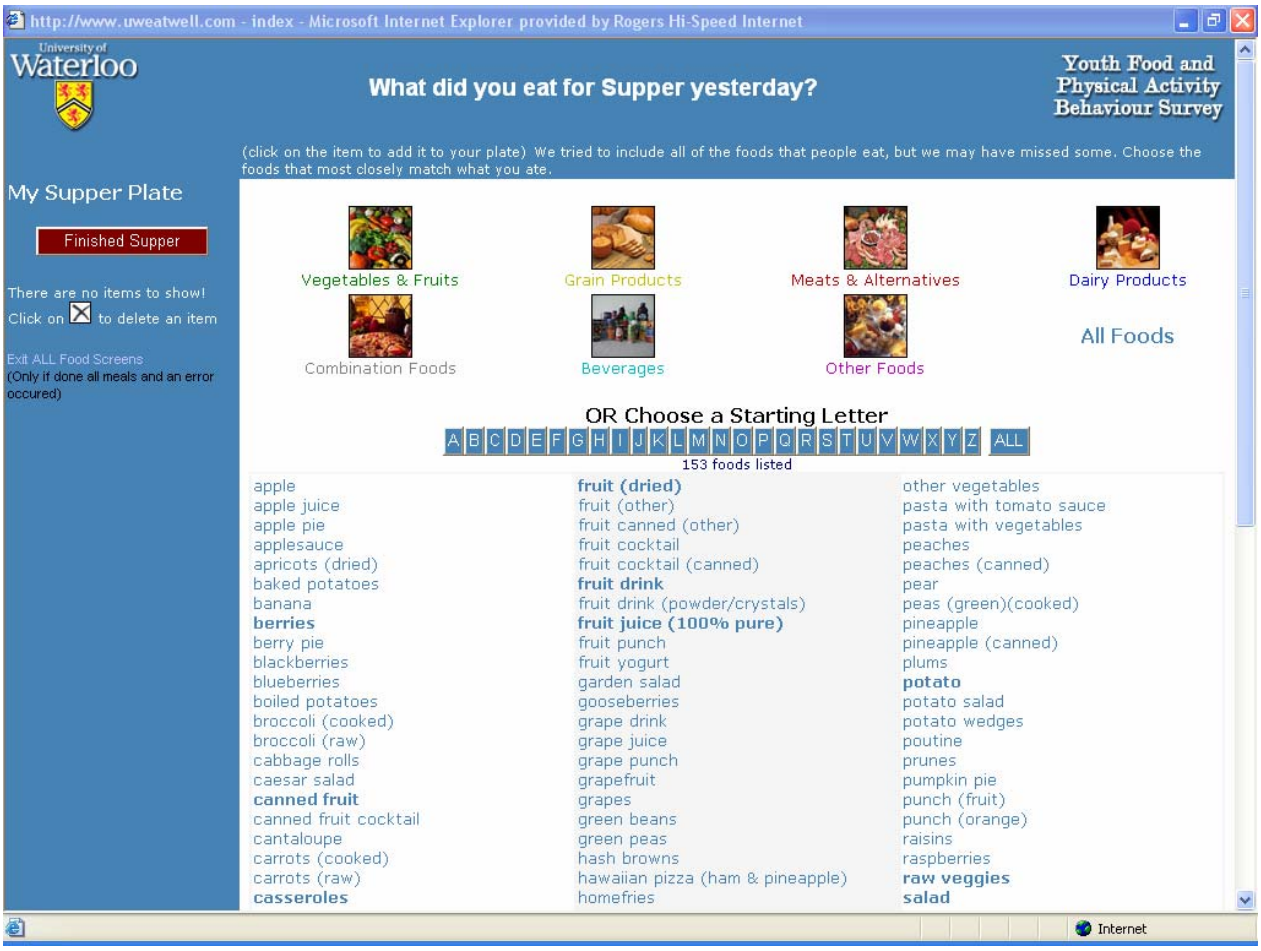
APPENDIX A: Sample Screen of 24-h Recall



APPENDIX B: Food Frequency Questions of Interest

Frequency of Pop Consumption

Data from the questions below will be collapsed into the following categories:

1. Daily
2. 2/6 times/wk
3. 1/wk
4. 1/month
5. Rarely/never

From Porcupine Region, Toronto, and PACY:

How often do you eat the following foods? (one answer for each food)

- Pop (non-diet)

- At least twice a day
- Once a day
- 2-6 times a week
- Once a week
- One a month
- Rarely or never
- Not answered

From Peel:

How often do you drink COLA-type soft drinks? (e.g. Coke, Pepsi, Rootbeer)
How often do you drink NON COLA-type soft drinks? (e.g. Sprite, 7up, Mountain Dew, Orange Crush)

- At least twice a day
- Once a day
- 2-6 times a week
- Once a week
- One a month
- Rarely or never
- Not answered

From Region of Waterloo:

How often do you drink pop drinks?

- At least twice a day
- Once a day
- 2-6 times a week
- Once a week
- One a month
- Rarely or never
- Not answered

Frequency of Fast Food Restaurant or Take Out Use

Data from the questions below will be collapsed into the following categories:

1. Daily
2. 2/6 times/wk
3. 1/wk
4. 1/month
5. Rarely/never

How often do you eat meals or snacks prepared away from home?

Fast food restaurant or take out

- Once a day
- 2-6 times per week
- Once a week
- Once a month
- Rarely or never
- Not answered

APPENDIX C: Food Behaviour Questions of Interest

To Evaluate Who Participants Consumed Each Meal With on the Previous Day

Data from the question below will be collapsed into the following categories:

1. myself
2. family (whole family, my Mom or Dad, brother(s) and/or sister(s), relative(s) (Grandparents, uncles/aunts)
3. friends

Who did you eat with yesterday? (Choose what best fits your family. If your "whole family" is you and your Mom, then choose "whole family" and not with "my Mom or Dad or both" for your answer).

[Breakfast, Lunch, Dinner]

- By myself
- Whole family
- My Mom or Dad or both
- Brother(s) and/or sister(s)
- Relative(s) (Grandparents, uncles/aunts)
- Friend
- Other
- Did not eat
- Not answered

To Evaluate Where the Participant Ate Each Meal Yesterday

Data from the question below will be collapsed into the following categories:

1. home (including at another home)
2. between places
3. school
4. restaurant or fast food outlet

Where did you eat yesterday?

[Breakfast, Lunch, Dinner]

- Home
- At another home (friend, relative)
- Between places (car/bus, walking)
- At school
- Restaurant/fast food outlet
- Other
- I did not eat
- Not answered

To Evaluate a Concern for Either a High or Low Body Weight

Data from the questions below will be collapsed into the following categories:

1. yes (including strongly agree, and agree)
2. no (including strongly disagree, and disagree)

Are you concerned that your weight is too high/low?

From Peel and Region of Waterloo

- Yes
- No
- Not answered

From Porcupine Region and PACY

- Strong disagree
- Disagree
- Neither
- Agree
- Strongly agree
- Not answered

From Toronto

- Strongly agree
- Agree
- Disagree
- Strongly disagree

To Evaluate Dieting Status

Data from the question below will be collapsed into the following categories:

1. yes (including strongly agree, and agree)
2. no (including strongly disagree, and disagree)

Are you eating less than usual to try and lose weight?

From Peel and Region of Waterloo

- Yes
- No
- Not answered

From Porcupine Region and PACY

- Strong disagree
- Disagree
- Neither
- Agree
- Strongly agree
- Not answered

From Toronto

- Strongly agree
- Agree
- Disagree
- Strongly disagree

APPENDIX D: Family Influence Questions

To Evaluate Family Meal Frequency

Data from the question below will be collapsed into the following categories:

1. 0-2
2. 3-5
3. 6-7

Typically, how many days per week do you eat dinner or supper with at least one parent?

- Responses ranged from 0-7

To Evaluate Who Prepared the Food at Each Meal

Data from the question below will be collapsed into the following categories:

1. myself
2. family (parents and other family members)
3. friends
4. restaurant or cafeteria
5. other

Who prepared the food that you ate yesterday? (e.g. cooked, put together, or assembled your sandwich).

[Breakfast, Lunch, Dinner/supper]

- Myself
- Parents
- Other family members
- Friends
- Restaurant or cafeteria
- Other
- Did not eat
- Not answered

To Evaluate Where the Food was Purchased

Data from the question below will be collapsed into the following categories:

1. Grocery store
2. Restaurant or cafeteria
3. Convenience store/vending machine/other

Where did you or your family buy the food that you ate yesterday?
[Breakfast, Lunch, Dinner/supper]

- Grocery store
- Restaurant or cafeteria
- Convenience store
- Vending machine
- Other
- Did not eat
- Not answered

To Evaluate Self-Efficacy Measures

Data from the question below will be collapsed into the following categories:

1. Sure (5 and 6)
2. Neutral (3 and 4)
3. Not sure (1 and 2)

How sure are you that you could choose to eat healthy foods when you are eating
At home with your family
At school with your friends
During social times with your friends
Alone

- Not sure 1
- 2
- 3
- 4
- 5
- Very sure 6
- Not answered

APPENDIX E: Cut-off Values to Determine Overweight and Obesity

(Cole et al., 2000)
Whole ages will be used

	Overweight cut-off BMI greater than or equal to:		**Obese cut-off** BMI greater than or equal to:	
Age (years)	**Boys**	**Girls**	**Boys**	**Girls**
2	18.41	18.02	20.09	19.81
2.5	18.13	17.76	19.80	19.55
3	17.89	17.56	19.57	19.36
3.5	17.69	17.40	19.39	19.23
4	17.55	17.28	19.29	19.15
4.5	17.47	17.19	19.26	19.12
5	17.42	17.15	19.30	19.17
5.5	17.45	17.20	19.47	19.34
6	17.55	17.34	19.78	19.65
6.5	17.71	17.53	20.23	20.08
7	17.92	17.75	20.63	20.51
7.5	18.16	18.03	21.09	21.01
8	18.44	18.35	21.60	21.57
8.5	18.76	18.69	22.17	22.18
9	19.10	19.07	22.77	22.81
9.5	19.46	19.45	23.39	23.46
10	19.84	19.86	24.00	24.11
10.5	20.20	20.29	24.57	24.77
11	20.55	20.74	25.10	25.42
11.5	20.89	21.20	25.58	26.05
12	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17	24.46	24.70	29.41	29.69
17.5	24.73	24.85	29.70	29.84
18+	25.00	25.00	30.00	30.00

APPENDIX F: Healthy Eating Index-Canadian (HEI-C)[a]

Component	Maximum Score: 10[b]	Minimum Score: 0[c]	Variables
Grains	≤1600 kcal: 5 servings 1600-2200 kcal: 9 servings >2200 kcal: 12 servings	0 servings	Breads, cereals, grains, rice, pasta
Vegetables and Fruit	≤1600 kcal: 5 servings 1600-2200 kcal: 7 servings >2200 kcal: 10 servings	0 servings	Fruits, fruit juice, vegetables, potatoes
Milk Products	≤1600 kcal: 2 servings 1600-2200 kcal: 2 servings >2200 kcal: 2 servings	0 servings	Milk, yoghurt, cream, ice cream, cheese
Meat and Alternatives	≤1600 kcal: 2 servings 1600-2200 kcal: 2.5 servings >2200 kcal: 3 servings	0 servings	Meat, poultry, fish, eggs, legumes, nuts
Other Foods[d]	≤1600 kcal: ≤ 4 servings 1600-2200 kcal: ≤ 6 servings >2200 kcal: ≤ 8 servings	> 8 servings > 11 servings > 14 servings	Fats, oils, sugar, confectionery, soft drinks, fruit drinks, packaged snacks, jams, condiments
Total Fat	≤ 30% energy from fat	≥ 45% energy from fat	Total fat
Saturated Fat	<10% energy from saturated fat	>15% energy from saturated fat	Total saturated fat
Cholesterol	< 300 mg	≥ 450 mg	Cholesterol
Variety	At least one serving from each food group	Failure to eat a serving from any food group	Servings from food groups

[a]Maximum score = 100, minimum score = 0, [b]except for Vegetables and Fruit, which are combined for a total score of 20, [c]participants with servings between the maximum and minimum score are assigned a proportional score for the category, [d]assuming one serving contains approximately 60 kcals, servings from *other* foods would contribute 15% (score of 10) to 30% (score of 0) of total energy.

APPENDIX G: Information Letter to Principals – Porcupine Health Unit

P|H|R population health research group

Porcupine Health Unit • Bureau de santé

TOGETHER... I CAN! ENSEMBLE... JE PEUX!

Date: April 26th, 2006

Dear [Principals name]:

The Population Health Research Group, University of Waterloo and the Porcupine Health Unit have the approval of the Northeastern Catholic District School Board, District School Board Ontario North East, Conseil scolaire catholique de district des Grandes Rivières and Conseil scolaire public de district du Nord-Est de l'Ontario School Boards to conduct a study examining food behaviour in Ontario adolescents. The research will investigate the nutrition and activity choices of grade 6 students using a web-based survey, available in French and English. Upon completing the web-based survey, each student will receive immediate individualized feedback on his or her diet. Feedback based on the combined responses from all students participating in the survey will be available to the teachers as well as a Nutrition Resource to facilitate curriculum-specific lesson planning.

Students in grade 6 are experiencing a time of physiological and psychological milestones, i.e. the preliminary stage of adolescent growth spurt with rapid bone development and increasing autonomy in food behaviours. Nutrition and lifestyle problems of Canadian adolescents include obesity, physical inactivity and eating disorders. These have the potential to exert a strong deleterious impact on future health and increase the risk of chronic disease in later life. Through better understanding of the eating and activity patterns of our children and variables that influence this pattern, targeted healthy eating programs and strategies can be designed.

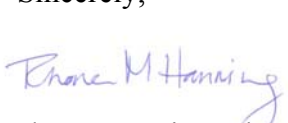
The survey will take approximately 30-40 minutes (one class period to complete). Students will also be invited to go back to the web site on their own time, another day to complete another diet recall. The second portion of the research is optional, and may be done on a computer at school, at home, or in the community. This will result in the most comprehensive assessment of adolescent diet and physical activity to date in Canada.

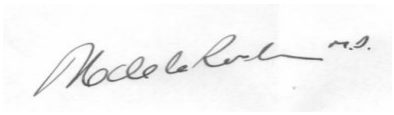
Northeastern Catholic District School Board , District School Board Ontario North East, Conseil scolaire catholique de district des Grandes Rivières and Conseil scolaire public de district du Nord-Est de l'Ontario School Boards has provided approval. Please find attached: 1) a summary of the project with more detail on the design, objectives and measures to be used for the study and 2) a copy of the information letter that will be sent to parents. You can view the website at: http://www.uweatwell.com/, login “phu”, password “phu”.

The research has been reviewed by and received ethics clearance from the Porcupine Health Unit and through the Office of Research Ethics at the University of Waterloo. Any comments or concerns you may have, concerning your school’s involvement may be directed to Betty Ann Horbul, Porcupine Health Unit.

One of our staff will call you within the next week to discuss process. In the meantime, if you have any questions, please call Betty Ann Horbul, at 267-1181 ext 302 or 1-800-461-1818. We look forward to further collaboration with you on this exciting project.

Sincerely,





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Toll Free: 1-800-461-1818

APPENDIX H: Parental Consent Letter – Porcupine Health Unit

Dear Parent(s) or Guardian(s),

Porcupine Health Unit and the Population Health Research Group, University of Waterloo is conducting a survey, to better understand food behaviour and physical activity patterns of children in Porcupine Health Unit Region. We would like to provide you with some information about the survey to help you decide if your son or daughter should be involved.

Why is this study being done?
There is little research information available on what Canadian children eat. The few studies that have been conducted elsewhere have shown that children's diets are often low in energy, calcium and iron but high in fat. Research has shown that a poor diet in childhood and adolescence can increase the risk of developing diabetes, obesity, heart disease and other diseases in adulthood. Through better understanding of eating patterns, and variables that influence these patterns, we can better identify effective strategies to reduce these health risks.

Name of School Boards has granted us permission to approach the parents of their grade six students to ask for their son's or daughter's participation in the study. Grade six students have been selected because of their grade level. Information on what your son's or daughter's participation will involve follows.

Why is the survey web-based?
The web-based survey will allow access to a greater number of participants, and will result in a comprehensive assessment of children's diet in the Porcupine Health Unit area.

What will my son or daughter be asked to do?
All of the students in participating classes will be invited to complete a nutrition and physical activity survey on the Internet during class time. The survey will ask your son or daughter to recall what s/he ate the previous day and to identify the types of physical activity s/he engaged in and how frequently s/he did so. Participants may choose to omit any information or discontinue their participation at ay time. The survey will take approximately 30-40 minutes to complete. Upon completing the survey, your son or daughter will receive feedback on their diet. Students will be encouraged to go back to the website at home, school or in the community on their own time to complete a second dietary record.

You may have been asked in the past or future to be part of the Healthy Measures Surveillance study. At that time, Public Health Dietitians or staff privately takes the student's height and weight measurements[2][1]. This is separate program and therefore a separate consent is requested at that time. The Porcupine Health Unit plans to continue this program having surveyed Timmins, and Hearst. The next community will be Kapuskasing.

Who will have access to my son's or daughter's information?
Each participant will have a unique identification code and password. This means your son's or daughter's name will not be on the survey. The web site will be password protected so that only authorized users will be able to gain access. Only researchers at the University of Waterloo and Porcupine Health Unit, who are involved in this study, will have access to this information, which will be stored on locked computer files. Identification codes, not participant names, will be used in the data analysis. All data will be published in a

[2] The measurements will be taken according to the Guidelines for Collecting Heights and Weights of Children and Adolescents in School Settings by Centre for Weight and Health, College of Natural Resources, University of California, Berkeley

group format so that it will not be possible to determine the responses from any individual student. The school will have access to the group results and we will provide grade level learning resources, so that the study can support and enhance the curriculum. An overall summary of the survey report will be available.

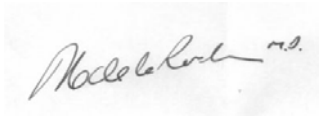
Ethics Clearance and Approval for Project

This project has been approved by the (NAME THE SCHOOL BOARDS) and has the support of the principal at your child's school. As well, it has been reviewed by and received ethics clearance of the Porcupine Health Unit and through the Office of Research Ethics at the University of Waterloo. If you have any questions or concerns about your son's or daughter's participation in the study, please call Betty Ann Horbul, Manager Nutrition Services Porcupine Health Unit or Public Health Dietitian Joëlle Zorzetto.

The final decision to participate in this study must be made by the individual student and her/his parent(s) or guardian(s). Your co-operation in permitting your son or daughter to take part in this research is greatly appreciated. However, there is no penalty of any kind if he/she does not participate. A student will not be included in the study if a parent or guardian indicates that he or she does not want the student to participate, or if the student does not agree to take part. **If you agree to participate, but you or your son or daughter later change your minds, you and/or your son or daughter can withdraw at any time. Taking part in this study does not pose any risks for your son or daughter.**

If you DO want your son or daughter to participate, please complete the permission form below and return it to [Name of School] by **June 9.** If we have not received the permission form by this date, we will assume that you are **NOT** willing to have your son or daughter participate.

Sincerely,



Rhona Hanning, PhD, RD
Principal Investigator,
Population Health Research Group
Associate Professor,
Health Studies & Gerontology
University of Waterloo
LHN 2704, 200 University Ave. W.
Waterloo, ON N2L 3G1
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FOR MORE INFORMATION, CONTACT: Betty Ann Horbul RD, Public Health Nutritionist
Manager of Nutrition Services/ Communicative Disorders Program/ Quality Assurance
Porcupine Health Unit
Tel: 705-267-1181 Ext. 302
Toll Free: 1-800-461-1818

FOOD BEHAVIOUR AND PHYSICAL ACTIVITY OF GRADE SIX STUDENTS IN PORCUPINE HEALTH UNIT AREA:
A WEB-BASED SURVEY

PERMISSION FORM

I agree to have my son or daughter participate in a study conducted by the Porcupine Health Unit and Dr. Rhona Hanning, University of Waterloo. I have made this decision based on the information I have read in the Information Letter and have had the opportunity to receive any additional details I wanted about the study. I understand that I may withdraw this consent at any time without penalty. I also understand that this project has been reviewed by, and received ethics clearance from the Porcupine Health Unit and the University of Waterloo and that I may contact the Porcupine Health Unit if I have any concerns or questions about my son or daughter's involvement in the study.

Child's Name: _____
(Please Print)

Parent/Guardian
Signed: _____

Parent/Guardian
Name: _____
(Please Print)

Date: _____

APPENDIX I: Information Letter to Principals – Peel Region

Recruitment Letter to Principals

[Date]

[Name]
Principal, **[School]**
[Street Address]
[City, Postal Code]

Dear **[Principal]**:

My name is Kathryn McGoldrick and I am an MSc candidate in the Department of Health Studies at the University of Waterloo. I, along with Dr. Rhona Hanning, have received your School Board's approval to conduct a study examining student food behaviours as a **follow-up to a similar study conducted in 2003, in which your school participated.** We are requesting permission to survey the grade 6, 7 and 8 students in your school using a **web-based approach, focusing on dietary habits and beverage consumption.**

This age group is experiencing important health-related milestones, i.e. growth spurts and increasing autonomy in food behaviours. In particular, consumption of sweetened beverages such as soft drinks and fruit drinks tends to increase dramatically during this time, which may be contributing to the alarmingly high prevalence of childhood obesity and the displacement of important nutrients in the diet. A poor diet in childhood has the potential to negatively impact current and future health, including increased risk of heart disease and diabetes. Thus, **it is critical that nutrition behaviours be addressed at an early age.**

The survey, which **will take no more than 30-40 minutes to complete**, will ask students to recall what they ate the previous day and to provide information on their usual beverage purchasing and consumption. We also request that a school official complete a **short questionnaire regarding beverage availability in the school** and any nutrition programs or policies. Finally, we hope to conduct an **observation of lunches** to determine the frequency with which certain beverages are brought to school. This multifaceted approach will result in the most comprehensive assessment of beverage consumption in Canadian adolescents to date.

In order to inform your school's participation decision**, please find attached a summary of the project with more detail on the study design, objectives and measures, as well as how your school can expect to benefit.** You can view the survey website at: www.uweatwell.com, login "Peel", password "Peel".
The research has been reviewed by and received ethics clearance from the Office of Research Ethics at the University of Waterloo. Any comments or concerns you may have concerning your school's involvement may be directed to Dr. Susan Sykes, Director, Office of Research Ethics, at (519) 888-4567, ext. 6005.

We appreciate the strain on schools and do not wish to create more pressure. If there is anything we can do to make it easy for your school to participate, please let us know. **One of our staff will call you within the next week to determine your interest.** In the meantime, if you have any questions, please contact, Dr. Rhona Hanning at (519) 888-4567 ext. 5685, or email at rhanning@healthy.uwaterloo.ca. We look forward to further collaboration with you on this exciting project.

Sincerely,

Kathryn McGoldrick

Kathryn McGoldrick, BSc, MSc (candidate)
Department of Health Studies and Gerontology
University of Waterloo

Summary of Project Provided to Principals

Background and Rationale for the Study

Called an "epidemic" by many researchers and health professionals, **approximately 1 out of 3 children in Canada from 5 to 13 years of age is considered overweight or obese.** Research indicates that a majority of obese children remain obese throughout adulthood, increasing their risk for chronic diseases such as type 2 diabetes, cardiovascular disease, arthritis, and some cancers. Even more alarming, formerly "adult-onset" diseases such as type 2 diabetes and hypertension are increasingly being diagnosed in adolescents and even children.

Although diet is by no means the sole cause of obesity, it plays an important role. Shifts in dietary habits have paralleled increasing obesity, including a dramatic increase in consumption of soft drinks and other sweetened beverages. **Previous research has raised concern that sweetened beverages may not only be contributing to obesity, but also replacing milk and important nutrients in the diet.** Calcium is of particular concern given that adolescents' intakes tend to be suboptimal, which may lead to compromised current and future bone health. **The purpose of this project is to examine the sweetened beverage consumption, accessibility, and purchasing patterns of Peel adolescents.**

One policy response to this issue has been to ban soft drink vending in schools, as the Government of Ontario did in 2004. **Our research group completed a survey in eight Peel District schools in 2003,** prior to the introduction of the ban, in which we assessed beverage consumption through a 24-hour diet recall and food frequency questionnaire. **We now wish to determine if consumption has changed since the removal of soft drink vending.** Questions about student access and purchase of sweetened beverages will help to describe their consumption and help explain any change or lack of change in response to school vending. This has important policy implications for other jurisdictions who have not yet taken similar positive steps to reduce or eliminate the availability of sweetened beverages in schools.

Through better understanding of the diet and sweetened beverage consumption of Peel adolescents, as well as variables that influence this pattern, a targeted strategy can be developed and evaluated to address environmental factors contributing to childhood obesity.

Study Objectives

Through this study, we wish to determine the following:

- **The consumption of sweetened beverages of Peel adolescents.**
- **Where these beverages are purchased or obtained.**
- Whether consumption has decreased since the Ontario Ministry of Education banned soft drink vending in elementary schools.
- Any associations between sweetened beverage consumption and milk intake, food group intake, and Dietary Reference Intakes.
- The frequency with which different beverages, including sweetened beverages, 100% fruit juice, and milk are consumed with meals, particularly school lunch

Application of this Project to Education

Poor nutrition contributes to lower academic achievement. Research confirms what educators have long believed to be true: when children's basic nutritional needs are met, they have the cognitive energy to learn and achieve. **Excessive sweetened beverage consumption may be displacing more nutritious beverages and important nutrients from the diet, potentially impacting negatively on children's ability to learn.** In addition, many of these beverages contain caffeine, which may disrupt sleep patterns and adversely affect concentration and attentiveness in children and adolescents.

Understanding of adolescents' sweetened beverage consumption and the factors associated with it will aid in developing school-based strategies to address the issue, including health education, intervention programs, and policy. Additionally, it is hoped that jurisdictions that have not modified school environments surrounding sweetened beverages will recognize the importance of doing so, and implement programs and policy accordingly.

Benefits from Participation

Both the teachers and students will benefit from participation in the study. Teachers will be provided with an interactive tool useful for teaching the Health and Physical Activity curriculum, computing, or research methods, as well a list of valuable online health and nutrition resources. Immediate feedback will be provided to participants on the survey web site. Upon completion of the survey, a window/screen will appear with a non-judgmental message related to each participant's answers, in comparison to intakes recommended by Canada's Food Guide to Healthy Eating. **This will allow students to develop a better awareness of the positive and negative aspects of their eating patterns.**

Students will also be introduced to the research process; they will gain valuable exposure to survey methods, data collection and data analysis.
School boards in Waterloo Region and London-Thames Valley are also being surveyed this year regarding student beverage consumption and school food and beverage environments. This provides us with an excellent opportunity to provide your school with feedback in comparison to other Peel adolescents and students in other jurisdictions.

Study Procedures

1. We would first ask that you nominate a **contact person** in your school who would be responsible for coordinating the logistics of the study. This individual would be provided with more information regarding the study and instructions on how to use the survey web site. The contact person would be asked to communicate the study purpose and protocol to teachers, and organize a data collection date that is convenient. To date, most schools have reserved their computer lab for 1-2 days during which participating classes are surveyed. Teachers will have access to the web site prior to the beginning of data collection in order to familiarize themselves with the procedures if they wish.

2. Parental Permission: Passive consent would be the preferred approach to obtain parental permission for students to participate in the study. **A permission letter would be mailed from the school to all parents or guardians of eligible participants, with necessary forms and postage provided by the study investigators.** Parents not wishing their son or daughter to participate would be asked to indicate their refusal by contacting the school contact person or study investigator. Schools generally prefer this method of consent as it minimizes the burden faced by staff.

If you would prefer active consent from parents to allow your students to participate, this is possible. In this case, students would only be eligible to participate if the parent has provided written consent by signing a permission form to be sent home with each student.
Please find attached a sample copy of each of an active and passive consent letter.

3. Assessment of students' dietary habits and sweetened beverage consumption: This would be done using a **web-based survey**, thus each student would require the use of a computer. This survey was developed at the University of Waterloo, and was used in our 2003 study in Peel Region, as well as in other school boards from Ontario, Alberta, Nova Scotia, and several First Nations communities. **Students would be asked to recall their food intake from the previous day, as well as answer questions relating to their usual sweetened beverage consumption and where they obtain or purchase these beverages.** They would also be asked to provide their age, gender, height and weight. Time required to complete the survey varies depending on the school's computing facilities, but should **take no longer than one class period.** In addition to parental consent, students would be asked for their consent at the beginning of the survey.

4. Principal's Survey:
We have also designed a **brief questionnaire to be completed by the school principal or appropriate designee.** The person completing the questionnaire should be someone knowledgeable regarding the availability of sweetened beverages within the school, as well as any related programs or policies, both currently and in 2003. This is in order to facilitate a comparison of the school environment now and prior to the government ban on soft drink vending.
This survey **takes approximately 20-30 minutes.** Principals (or designees) would be able to complete it when convenient for them, and return it by mail at a later date.

Confidentiality

For the survey, each student will be assigned a unique identification number and password. This will enable participants to enter the web site and will ensure that only authorized users have access. **All surveys completed by students will be anonymous**; students' names will not appear anywhere on the survey nor will it be associated with the data set in any way. There will be no paper copies of the survey. All electronic files will be stored in locked offices at the University of Waterloo. All data reported will be group data. **School boards and schools/teachers will have access to group, but not individual, data through our feedback report.**

For the principals' survey, the information provided by each principal (or designee) will be matched to the school's data for the purpose of assessing potential impacts of the school environment, programs, and policies on students' sweetened beverage consumption and purchasing. Names will not be required, and all surveys will be stored in a locked cabinet.

Feedback

A report outlining study results pertaining to your school would be available to you by June 2006. In addition, a report outlining the congregated results from all participating Peel schools would be available to the School Board's Research Committee at this time.

We thank you for your consideration of what we believe is an important and worthwhile project, and we look forward to working with you!

APPENDIX J: Parental Consent Form – Peel Region

Sample Passive Consent Letter

Dear Parent(s) or Guardian(s),

Researchers at the Population Health Research Group, University of Waterloo are conducting a study, funded by the Canadian Institutes of Health Research (CIHR) to better understand adolescent soft drink consumption as well as where these beverages are obtained. I am Dr. Rhona Hanning and I am leading the study along with Kathryn McGoldrick. We would like to provide you with some information about the study to help you to decide if your son or daughter should be involved.

Why is this study being done?
There is little research information available on the soft drink consumption of Canadian teens. Related research indicates that the consumption of these beverages has increased dramatically in North America over the past several decades. Concerns have been raised that high soft drink consumption may contribute to childhood obesity, and may displace important nutrients from the diet, particularly calcium. Obesity and poor diet in childhood can increase the risk of developing diabetes, heart disease, some cancers, and other diseases in adulthood. Through better understanding of teens' eating patterns, and variables that influence these patterns, we can better identify effective strategies to reduce these health risks. Using a web-based survey, the proposed study aims to assess the soft drink intake and food behaviours of a large group of Peel adolescents.

Why is the survey web-based?
The web-based survey will allow access to a greater number of participants, and will result in the most comprehensive assessment of adolescent diet in Canada to date. **[Name of School]** has granted us permission to approach the parents of their grade six, seven, and eight students to ask for their son's or daughter's participation in the study. Grade six, seven, and eight students have been selected because of their grade level. Information on what your son's or daughter's participation will involve follows.

What will my son or daughter be asked to do?
All of the students in participating classes will be invited to complete a nutrition survey on the Internet during class time. The survey will ask your son or daughter to recall what they ate the previous day and to provide information about their consumption of sweetened beverages and where they access these beverages. Participants may choose to omit information if they wish. The survey will take approximately 30 minutes to complete. Upon completing the survey, your son or daughter will receive feedback on their diet compared to the recommendations of Canada's Food Guide to Healthy Eating.

Who will have access to my son's or daughter's information?
The survey is anonymous. Each participant will have a unique identification code and password. This means your son's or daughter's name will not be on the survey. The web site will be password protected so that only authorised users will be able to gain access. Identification codes, not participant names, will be used in the data analysis. All data are published in group form so that it will not be possible to determine the responses from any individual student. The teacher will have access to the group results and we will provide grade level learning resources, so that the study can support and enhance the curriculum. Only researchers at the University of Waterloo who are involved in this study will have access to this information, which will be stored on locked computer files. These computers are located in locked offices at the Population Health Research Group, University of Waterloo. The data will be permanently stored on CD in electronic form.

Permission to participate
We have received permission from the school board and the school principal to conduct this research. This study has been reviewed by, and received ethics clearance from the office of Research Ethics at the University of Waterloo. If you have any questions or concerns about your son's or daughter's participation in the study, please call Dr. Susan Sykes of the Office of Research Ethics at (519) 888-4567 extension 6005, or email: ssykes@uwaterloo.ca. If you have any questions regarding this study or would like additional information to assist you in reaching a decision about your son's or daughter's participation, please contact Rhona Hanning, University of Waterloo at (519) 888-4567 extension 5685, or email: rhanning@healthy.uwaterloo.ca.

The final decision to participate in this study must be made by the individual student and her/his parent(s) or guardian(s). Your co-operation in permitting your son or daughter to take part in this research is greatly appreciated. However, there is no penalty of any kind if he/she does not participate. A student will not be included in the study if a parent or guardian indicates that he or she does not want the student to participate, or if the student does not agree to take part. **If you do <u>NOT</u> want your son or daughter to participate, please contact [Name of School Contact] at your son/daughter's school or Rhona Hanning, Population Health Research Group, University of Waterloo, at 519-888-4567, ext. 5685 by [date].** If we have not been contacted by this date we will assume that you are willing to have your son or daughter participate.

Sincerely,

Rhona Hanning, PhD, RD
Associate Professor,
Health Studies & Gerontology
University of Waterloo

Kathryn McGoldrick, BSc
Master's Candidate
Health Studies & Gerontology
University of Waterloo

APPENDIX K: Information Letter to Principals – Region of Waterloo

Waterloo Region
District School Board

Region of Waterloo
PUBLIC HEALTH

Dear School Principal:

The University of Waterloo and Region of Waterloo Public Health have the approval of the Waterloo District School Board to participate in a study examining food behaviour and physical activity of Ontario children. The research will investigate the nutrition and activity choices of grade 6 students using a web-based survey. Upon completing the web-based survey, each student will receive immediate individualized feedback on his or her diet. Feedback based on the combined responses from all students participating in the survey will be available to the teachers as well as a Nutrition Resource to facilitate curriculum-specific lesson planning.

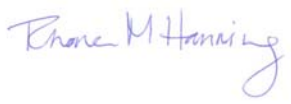
There is little research information on the diet of Canadian children. Dietary surveys elsewhere indicate that children consume insufficient amounts of energy, calcium and iron but more than the recommended fat. These have the potential to exert a strong deleterious impact on future health and increase the risk of chronic disease in later life. Through better understanding of the eating patterns of children and variables that influence this pattern, targeted health eating programs and strategies can be designed.

The proposed research will use a web-based tool to deliver a nutrition and activity survey to grade six students from across the Waterloo Region District School Board. The survey will ask students to recall what they ate the previous day and to identify the types of physical activity they engage in and how frequently they do so. Students may choose to omit certain information if they wish. The survey will take approximately 30-40 minutes (one class period to complete). Students will also be invited to go back to the web site on another day to complete another diet recall. The second portion of the research is optional, and may be done on a computer at school, at home, or in the community. This will result in a baseline assessment of children's diet and physical activity in Waterloo Region.

Researchers from the University of Waterloo will be in the computer lab to conduct the survey, they will explain the process and address any questions or concerns that the students might have about the survey. Teachers will be asked to oversee the students but will not be required to conduct the survey. In the spring, your school will receive a feedback report of the results from the surveys conducted at your school. Additional learning support materials will be made available to you at that time to help your teachers with their nutrition and health lessons.

In order to inform your school's participation decision, please find attached: 1) a summary of the project with more detail on the design, objectives and measures to be used for the study and 2) a copy of the information letter that will be sent to parents. You can view the website at: http://www.uweatwell.com/, login "s", password "s".

The research has been reviewed by and received ethics clearance from the Office of Research Ethics at the University of Waterloo and Region of Waterloo Public Health. Any comments or concerns you may have, concerning your school's involvement may be directed to Dr. Susan Sykes, Director, Office of Research Ethics, at (519) 888-4567, ext. 6005.
If you are interested in having your students participate in the study, please call me at the Population Health Research Group, University of Waterloo at (519) 888-4567 ext. [**5685**], or email at [**rhanning@healthy.uwaterloo.ca**]. We look forward to further collaboration with you on this exciting project.
Sincerely,



Rhona Hanning, Ph.D., R.D.
Associate Professor
Health Studies and Gerontology
University of Waterloo

Daniela Seskar-Hencic
Manager of Planning and Evaluation
Region of Waterloo Public Health

APPENDIX L: Parental Consent Form – Region of Waterloo

Dear Parent(s) or Guardian(s),

Region of Waterloo Public Health and the Population Health Research Group, University of Waterloo are conducting a survey, to better understand food behaviour and physical activity patterns of children in Waterloo Region.. We would like to provide you with some information about the survey to help you decide if your son or daughter should be involved.

Why is this study being done?
There is little research information available on what Canadian children eat. The few studies that have been conducted elsewhere have shown that children's diets are often low in energy, calcium and iron but high in fat. Research has shown that a poor diet in childhood and adolescence can increase the risk of developing diabetes, obesity, heart disease and other diseases in adulthood. Through better understanding of teens' eating patterns, and factors that influence these patterns, we can better identify effective strategies to reduce these health risks.

Why is the survey web-based?
The web-based survey will allow access to a greater number of participants, and will result in a comprehensive assessment of children's diet in Waterloo Region. **[Name of School]** has granted us permission to approach the parents of their grade six students to ask for their son's or daughter's participation in the study. Information on what your son's or daughter's participation will involve follows.

What will my son or daughter be asked to do?
All of the students in participating classes will be invited to complete a nutrition and physical activity survey on the Internet during class time. The survey will ask your son or daughter to recall what they ate the previous day and to identify the types of physical activity they engage in and how frequently they do so. At the end a Public Health Nurse will privately take the student's height and weight measurements[3] [4]. Participants may choose to omit any information or discontinue their participation at ay time. The survey will take approximately 30 minutes to complete. Upon completing the survey, your son or daughter will receive computer-generated feedback on their diet.

Who will have access to my son's or daughter's information?
The survey is anonymous. Each participant will have a unique identification code and password. This means your son's or daughter's name will not be on the survey. The web site will be password protected so that only authorized users will be able to gain access. Identification codes, not participant names, will be used in the data analysis. All data will be published in a group format so that it will not be possible to determine the responses from any individual student. The school will have access to the group results in Spring, 2006 and we will provide grade level learning resources, so that the study can support and enhance the curriculum. Only researchers at the University of Waterloo and Region of Waterloo Public Health, who are involved in this study, will have access to this information, which will be stored on locked computer files.

An overall summary of the survey report will be available in June, 2006 on the Region of Waterloo Public Health web site and through the Public Health Resource Centre (883-2256).

Permission to participate
We have received permission from the school board and the school principal to conduct this research. This study has been reviewed by, and received ethics clearance from the office of Research Ethics at the University of Waterloo and Region of Waterloo Public Health. If you have any questions or concerns about your son's or daughter's participation in the study, please call Dr. Susan Sykes of the Office of Research Ethics at (519) 888-4567 extension 6005, or email: ssykes@uwaterloo.ca. .

[3] The measurements will be taken according to the Guidelines for Collecting Heights and Weights of Children and Adolescents in School Settings by Centre for Weight and Health, College of Natural Resources, University of California, Berkeley
[4] Height and weight information is collected under the authority of the Health Protection and Promotion Act and will be used for program planning and evaluation purposes.

Your co-operation in permitting your son or daughter to take part in this research is greatly appreciated. However, there is no penalty of any kind if he/she does not participate. A student will not be included in the study if a parent or guardian indicates that he or she does not want the student to participate, or if the student does not agree to take part. **If you agree to participate, but you or your son or daughter later change your minds, you an/or your son or daughter can withdraw at any time. Taking part in this study does not pose any risks for your son or daughter.**

If you DO want your son or daughter to participate, please complete the permission form below and return it to (School Name) by **(Insert Date).** If we have not received the permission form by this date, we will assume that you are **NOT** willing to have your son or daughter participate.

Sincerely,

Rhona Hanning, PhD, RD
Principle Investigator,
Associate Professor,
Health Studies & Gerontology
University of Waterloo

Daniela Seskar-Hencic,
Manager, Planning and Evaluation,
Region of Waterloo Public Health
(519) 883-2258
sdaniela@region.waterloo.on.ca

FOOD BEHAVIOUR AND PHYSICAL ACTIVITY OF GRADE SIX STUDENTS IN WATERLOO REGION:
A WEB-BASED SURVEY

PERMISSION FORM

I agree to have my son or daughter participate in a study conducted by Region of Waterloo Public Health and Dr. Rhona Hanning, University of Waterloo. I have made this decision based on the information I have read in the Information Letter and have had the opportunity to receive any additional details I wanted about the study. I understand that I may withdraw this consent at any time without penalty. I also understand that this project has been reviewed by, and received ethics clearance from the Region of Waterloo Public Health Research Ethics Committee and the Office of Research Ethics at the University of Waterloo and that I may contact this office if I have any concerns or questions about my son or daughter's involvement in the study.

Signed: _____

Name: _____
(Please Print)

Date: _____

APPENDIX M: Information Letter to Principals – Toronto

FOOD BEHAVIOUR IN ONTARIO SCHOOL CHILDREN: VALIDATION OF WEB-BASED INSTRUMENT

Dr. Rhona Hanning, University of Waterloo, developed an Internet-based, 24-hour diet recall survey, investigating adolescent food consumption, focusing on consumption of milk and dairy products, fruits and vegetables, and high fat and salty snack foods. This survey has been used across the country to collect data to represent various populations. To substantiate this knowledge, the aim of the proposed research is to validate this survey (i.e., assess the quality of responses, and determine if the survey measuring what it says it is measuring).

BACKGROUND INFORMATION: WHY A SCHOOL SURVEY?

- Nutritional problems in children and adolescents have the potential to exert a strong deleterious impact on future health and increase the risk of chronic disease in later life.
- Results from research in the United States and Western Canada suggest that adolescents are not consuming the number of servings of milk and dairy products recommended by Canada's Food Guide to Healthy Eating and calcium intakes are not being met.
- American and European studies suggest that children and adolescents are not meeting the minimum requirements for fruits and vegetable consumption.
- Currently, there is no information available to assess Ontario childrens' food behaviour
- Previous studies have not looked at some of the factors associated with food consumption which may be important in designing relevant educational materials, e.g. where and with whom foods are consumed, attitudes and knowledge related to foods and nutrition
- An effective way to collect information is through school-based surveys

WHY USE THE INTERNET?

- The ability to provide immediate feedback to participants regarding their food behaviour
- An interactive tool that is fun and easy for participants to use

WHY VALIDATE THE SURVEY?

- Validating the survey will ensure that data collected is both *reliable* (i.e., repeatable) and *valid* (i.e., are we measuring what we intend to?) – these two factors make researchers, schools and school stakeholders confident in the data collected.
- Will enhance the ability to plan, target, evaluate and improve interventions within schools.

WHO IS INVOLVED IN THE PROJECT?

- The project is being conducted by the Population Health Research Group (PHR) at the University of Waterloo. PHR has over 20 years of experience in conducting school-based surveys; over 120, 000 students have participated
- participants will come from classes (grades 6-8) from school boards across Ontario
- the project is sponsored by Ontario Ministry of Health Promotion

WHAT IS INVOLVED FOR THE STUDENTS?

- the web-based survey takes approximately 30 - 40 minutes to complete and students will receive immediate feedback regarding their dietary intake

- students will also be part of a one-on-one, 30-40 minute interview with a trained dietician for a 24 hour diet recall
- students weight and height measurements will be taken by the trained dietician
- *Note:* the dietary recall survey relates to Health and Physical Education, Mathematics, and Computer Usage curricula

WHAT IS INVOLVED FOR THE SCHOOL?

- Distribution and collection of parent information and consent letters
- Access to computers with internet access
- Space for one-on-one interviews to take place

CONSENT AND CONFIDENTIALITY MEASURES

- Information and consent letters will be provided to the school to be sent home to parents
- The survey is anonymous – names are not required on the survey; interview data will be matched with web-based survey by a unique identification code and password
- Unauthorised users will not have access to the survey.

BENEFITS TO THE STUDENTS AND SCHOOLS

- School Feedback Report: Each school will receive a summary of the results. Feedback reports may be used by teachers to plan future lessons and examine current students' eating behaviour. Suggested learning resources will be identified.
- Individual Feedback: Upon completing the diet recall students will receive information about their diet for that day. Students will develop a better understanding of their eating patterns, ways to improve their diets, and the benefits to healthy living.
- Learning Experience: Students will have an opportunity to experience innovative technologies that measure nutritional intake (i.e., web-based survey) and will thereby become more self-aware of their nutritional intake and physical activity levels. In addition, students will be introduced to the research process, and will gain valuable exposure to survey methods and data collection.
- The students will have the opportunity to be part of meaningful work to aid in best practices surveillance of healthy eating behaviours in Canada!

APPENDIX N: Parental Consent Form – Toronto

P|H|R population health research group

Dear Parent(s) or Guardian(s),

Researchers at the University of Waterloo have been conducting Internet-based surveys to better understand food behaviour of children and adolescents in Ontario. As an extension of this survey, we are inviting children in grade 6-8 to participate in further research to see if the information collected in the survey is accurate and how it can be improved. We would like to provide you with some information about the study to help you decide if your son or daughter should be involved.

Why is this study being done?
There is little research information available on what Canadian children eat. Research has shown that a poor diet in childhood and adolescence can increase the risk of developing diabetes, obesity, heart disease and other diseases in adulthood. Through better understanding of eating patterns of children and what influences these patterns, we can find effective strategies to reduce these health risks. Researchers at the University of Waterloo have developed a survey to collect information on food intake of children. This Internet-based survey allows access to a greater number of participants, and results in a comprehensive assessment of children's diets. At this stage, four to five years from the initial development, it is desirable to get input from children to support ongoing quality improvement.

The principal at Military Trail School has granted us permission to approach the parents of grade six, seven and eight students to ask for their son's or daughter's participation in the study.

What will my son or daughter be asked to do?
Participating students will be invited to complete an Internet-based nutrition and physical activity survey individually during class time. Students will then be interviewed on a one-on-one basis by a registered dietician concerning dietary intake, based on a 24-hour recall. The dietician will be trained in this type of interviewing. Following the recall, the dietician will review the feedback sheet (produced for by the web-based survey) with the child to identify potential discrepancies with the interview concerning foods or portion sizes. The interview with the dietician will also include a measurement of the child's height and weight.

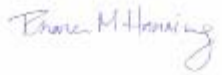
Who will have access to my son's or daughter's information?
For they survey, each participant will have a unique identification code and password. This means your son's or daughter's name will not be on the survey. The web site will be password protected so that only authorized users will be able to gain access. Only researchers at the University of Waterloo will have access to this information, which will be stored on locked computer files. Identification codes, not participant names, will be used in the data analysis. Data will be stored for a period of five years, and will then be destroyed. All data will be published in a group format so that it will not be possible to determine the responses from any individual student. **An overall summary of the survey report will be made available to principals shortly after the study conclusion.**

Ethics Clearance and Approval for Project
This project has been reviewed and has received ethics clearance from the Office of Research Ethics at the University of Waterloo.

The final decision to participate in this study must be made by the individual student and her/his parent(s) or guardian(s). Your co-operation in permitting your son or daughter to take part in this research is greatly appreciated. However, there is no penalty of any kind if he/she does not participate. A student will not be included in the study if a parent or guardian indicates that he or she does not want the student to participate, or if the student does not agree to take part.

If you agree to participate, but you or your son or daughter later change your minds, you and/or your son or daughter can withdraw at any time. Taking part in this study does not pose any risks for your son or daughter.

Sincerely,



Rhona Hanning, PhD, RD
Principal Investigator,
Population Health Research Group
Associate Professor,
Health Studies & Gerontology
University of Waterloo

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APPENDIX O: Parental Consent Form – Nova Scotia

Information letter regarding monitoring of physical activity, dietary intake and questionnaire (Grade 7 & 11)

Dear Parent, Guardian or Caregiver:

Phil Campagna at Dalhousie University is collaborating with Nova Scotia Health Promotion, other provincial departments, St FX. University, Cape Breton University and Acadia University to do a research study. The study is important to help us answer the question "How active are Nova Scotia children and youth?" "Why are children and youth physically active?" and "What are the usual food intakes of children and youth in Nova Scotia?"

The study involves approximately 2000 students from across Nova Scotia. Both boys and girls in grades 3, 7, 11 are being invited to participate. This letter is a formal invitation for you and your son/daughter to participate. This invitation is because your child's school was randomly selected out of all schools in Nova Scotia, and your daughter/son is in one of the grades, which will be part of the study. The study will involve monitoring physical activity during a week of normal activity and filling out a small questionnaire. The research will include an equal number of boys and girls.

The purposes of the research study are to determine the usual food intakes of children and youth in Nova Scotia and to measure physical activity with an accelerometer (activity monitor) a small digital device worn comfortably on a belt. Previous studies have shown that the device is easy to use and does not interfere with normal activities. During the week we will ask your child to wear the activity monitor and simply continue with his or her normal weekly routine. Each child will be asked to keep a record of any physical activities in which they did not wear the activity monitor (for example swimming, or if requested to remove it while playing a sport). Your child will be given a booklet to record this information. In addition, each child and their parent will be asked to each fill out a questionnaire. The questionnaire for the child contains items about their activity choices, why they are active, etc. The parental questionnaire asks for information about family, education, race and your relation to your child's physical activity. The background information (e.g. parent education, income, employment status, height and weight of parent, race of parent and child) will provide us with a context for your family's physical experiences from which to compare families and children with similar backgrounds. As well, we ask for your postal code on the questionnaire in order to ensure your child is grouped with other children in similar school board and health districts. Next, there are questions exploring the role you play in facilitating and encouraging your children's physical activity involvement. All of this information will assist us in obtaining a better understanding of your child's activity levels and their typical physical activity involvement. Your child will also be asked to complete an on-line Food Behaviour Questionnaire. The questionnaire will be completed at school and will take about 20 minutes to complete. A member of the research team will be available to answer any questions that your child may have during the completion of the on-line survey.

Please note that participants, parents, and the Regional School Board are not responsible for the loss or damage of any accelerometer (activity monitor) used in the study. However, it is assumed that participants will be careful while using the equipment.
The data from the accelerometer (activity monitor) will help us to learn how active children are and when and where they are active. Questionnaire data will give us a sense of why children are active. This information can then be used in the design of effective physical activity programs.

If you agree to participate, please read the attached form titled Informed Consent and sign at the bottom in the space given. A separate letter describing the study is included for your son/daughter. A copy of the consent form is included for your own files. Place one of the signed consents form in the return envelope, and ask your daughter/son to deliver the envelope to their teacher or contact person at the school. Not all of the children who agree to participate in the study (i.e. sign the consent form) will necessarily take part in the study. A randomly selected group from those who consent to participate will be chosen. For example, 30 children/parents may sign the consent form but only 25 are needed. As well, children will be asked on the day that the accelerometers are distributed if they want to participate in the study (verbal assent). If they say no, another child will be selected.

Included in this package:

1. Information letter for the parent/guardian/caregiver.
2. Information letter for the child.
3. Informed consent: one copy to be returned to the school if consent is given and one copy for your records.

If consent is given and your child is selected to participate in the study a second package will be distributed containing:

1. Parent questionnaire (to be completed by either parent identified by code number only)
2. Child questionnaire (to be completed by your child identified by code number only)
3. Logbook to record activities when child is not wearing the accelerometer i.e. swimming
4. Instructions for accelerometer placement and use.
5. Follow-up research letter.

If you have any questions about the upcoming study, please contact Phil Campagna at (902) 494-1145 during weekdays. There is also an independent contact at the Office of Human Research Ethics and Integrity at Dalhousie University. Their telephone number is (902) 494-1462. We are asking for your support in the study along with support of teachers and school personnel.

Sincerely,

_____

Phil Campagna, Ph.D. (902) 494-1145
Professor, Dalhousie University
campagna@dal.ca

Informed Consent (Parent/Guardian)

Accelerometer, Dietary Intake Questionnaire & General Questionnaire (Grade 7 & 11)

Title: Measuring Physical Activity and Dietary intake of Children and Youth in Nova Scotia

Local Principal Investigator:
Phil Campagna, Ph.D.
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(902) 494-1145
campagna@dal.ca

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Rene Murphy, Ph.D.
School of Recreation Management and Kinesiology
Acadia University

Angie Thompson, Ph.D.
Department of Human Kinetics
St. Francis Xavier University

Laurene Rehman, Ph.D.
School of Health & Human Performance
Dalhousie University

Laurie Wadsworth, Ph.D.
School of Human Nutrition
St. Francis Xavier University

Matthew Durant Ph.D. (candidate) P.Dt.
School of Nutrition and Dietetics
Acadia University

Jack Porter, Ph.D.
Cape Breton University

Mike Arthur, MSc.
Nova Scotia Health Promotion

Cathy Chenhall, MSc.
Nova Scotia Health Promotion

If you have any questions or concerns about the upcoming study or require any further information or clarification about the study procedures at any time please contact:
Phil Campagna, Ph.D.
School of Health & Human Performance
Phone: (902) 494-1145; FAX (902) 494-5210; campagna@dal.ca

Introduction:

We invite you and your child to take part in a research study at Dalhousie University. Taking part in this study is voluntary and you may choose to stop at any time without penalty. The study is described below. This description tells you about the expected time commitment, possible risks, or discomforts, which you may experience. Participating in the study might not benefit you, but we might learn things that will benefit others. You should discuss any questions you have about this study with the people conducting the study.

Purpose of the Study:

The purposes of this research study is to:

1. measure physical activity for a small group of children and youth using accelerometers (activity monitor). An accelerometer is a small (5 x 4 x 1.5cm) lightweight (43 grams) device designed to fit comfortably on a belt. The study will help us learn how physically active children and youth are and when and where they are most active.
2. determine the usual food intakes of children and youth in Nova Scotia.

Study Design:

Your child has been selected as one of about 2000 children/youth from across Nova Scotia. You and the others in your school were selected to allow an equal number of boys and girls to participate, and to represent a variety of levels of physical activity.

Your child will be asked to wear an accelerometer (activity monitor) for one week. The accelerometer (activity monitor) fits comfortably onto a belt and is placed over your child's right hip. They may choose to wear the monitor, attached to a belt, over or under your clothes. Previous use has shown that the device is easy to use and does not interfere with normal activities. During the week we ask that your child simply carry on with your normal weekly routine. Before placement of the accelerometer (activity monitor) your child's height, weight and waist circumference will be measured. A questionnaire will also be given to yourself as well as another one for your child at the time that the accelerometer is placed on your child's hip. The parent questionnaire contains questions on gender, education, and race. It also has questions about your interaction with your child in relation to physical activity. The questionnaire for your child contains questions about things like activity preferences and why they are active. Both you and your child can choose not to answer any question, if you so wish. The child and parent questionnaire will take about 15 to 20 minutes each to complete.

Please note that participants, parents, and the Regional School Board are not responsible for loss or damage of any accelerometer (activity monitor) used in the study. However, it is assumed that participants will be careful with the equipment used in the study.

A physical education teacher or other school representative will be asked to be the contact person between you, your child and the research team. Also, with the help of you and the physical

education teacher, your child will be asked to keep a record of any physical activities in which they did not wearing the accelerometer (for example swimming, or if requested to remove it while playing a sport). Your child will be given a booklet to record this information.
Contact Person:

Your child will be asked to complete an on-line Food Behaviour Questionnaire. The questionnaire will be completed at school and will take your child about 20 minutes to complete. A member of the research team will be available to answer any questions that your child may have during the completion of the on-line survey.

You and your child have the right to ask questions about the study at anytime before, during, and after the study.

Possible Risks and Discomforts:

The accelerometer (activity monitor) is small and lightweight and worn on a belt around the waist, so the potential for injury from falling on it during physical activity is minimal. Your child will not be asked to participate in any physical activity other than your normal activities.

Possible Benefits:

There is likely little if any benefit for you or your child in participating in this study. You may benefit by becoming more aware of your child's physical activity level. If we find that our children and youth are not sufficiently physically active we will be able to work toward ways to improve opportunities for physical activity in the lives of children and youth.

Confidentiality:

You and your child will be assigned a code number. This code will be placed on all the questionnaires and assigned to the physical activity data that is collected from the accelerometer (physical activity monitor). Neither your child's nor your name will appear on any of the documents. A list of names and matching codes will be stored in the project research office at the School of Health and Human Performance at Dalhousie University. Only the researchers will have access to the names of the participants. The physical activity and dietary data and all results of data analysis will be reported, presented or published without identifying you or any other individual children. You and your child have the right to request a summary of your data after the study is over. All data will be stored in locked file cabinets for a minimum of five years after the completion of the research project in the Exercise Science Laboratory at Dalhousie University.

Voluntary Participation:

Taking part in this study is completely voluntary, and you and your child are free to stop at any time for any reason without penalty. If you choose to stop taking part, you can tell the researchers in person or by phone (494-1145), or send a message by email (campagna@dal.ca). If you choose to stop taking part in this study, any data collected from you or your child will be destroyed immediately.

Compensation:

For agreeing to participate in the study, your child will be eligible to win a $100.00 gift certificate for a sporting goods store (of your choice). This draw will be conducted at the end of the study and your child will be eligible even if they choose to withdraw at any time during study. The odds of winning will be approximately 1 in 360.

If you require any further information or have any questions concerning the study you can contact the principal investigator Phil Campagna at 902-494-1145 or send a message by e-mail to campagna@dal.ca.

Consent (Adult)

Title: Measuring Physical Activity and Dietary Intake of Children and Youth in Nova Scotia

I have read the attached letter and the above information describing the research study, and I agree to allow my child to participate in the study. I understand my child's participation is voluntary, and that we may withdraw from the study at any time for any reason. My signature below shows that my child and I agree to participate in the study, if we are randomly selected and my child gives verbal assent to participate.

_____ _____
Name of parent or legal guardian Signature of parent or legal guardian

_____
Full name of child

I, , have received a copy of this form for my records

_____
Date

We are asking that you provide your phone number. We will only be using this information to inform you that your child has been selected and has given assent to wear an activity monitor.

Phone #_____

In the event that you have any difficulties with, or wish to voice concern about, any aspect of your participation in this study, you may contact Human Research Ethics / Integrity Coordinator at Dalhousie University's Office of Human Research Ethics and Integrity for assistance: (902) 494-1462.
Are you willing to be contacted to participate in future research studies related to this project?

☐ Yes Phone number _____

Researchers:
Dr. Phil Campagna Dalhousie University (902) 494-1145 campagna@dal.ca
Dr. Laurene Rehman Dalhousie University (902) 494-6389 lrehman@dal.ca
Dr. Angie Thompson St. Francis Xavier University (902) 867-3540 amthomps@stfx.ca
Dr. Laurie Wadsworth St. Francis Xavier University (902) 867-2190 lwadswor@stfx.ca
Mr. Matthew Durant Acadia University (902) 585-1351 matthew.durant@acadiau.ca
Dr. Rene Murphy Acadia University (902) 585-1559 rene.murphy@acadiau.ca
Dr. Jack Porter Cape Breton University (902) 563-1215
Mr. Mike Arthur N.S. Health Promotion (902) 424-7629 ARTHURMH@gov.ns.ca
Ms. Cathy Chenhall N.S. Health Promotion (902) 424-3749 CHENHACL@gov.ns.ca

APPENDIX P: Poster Presented at the Canadian Society for Nutritional Sciences Annual Meeting in Edmonton, AB in May, 2006

FAMILY DINNER FREQUENCY AND ENVIRONMENT OF GRADE SIX STUDENTS FROM WATERLOO REGION DISTRICT SCHOOL BOARD

Sarah Woodruff[1], Rhona Hanning[1], Pat Fisher[2]
[1]Health Studies & Gerontology and the Population Health Research Group, University of Waterloo, Waterloo, ON N2L 3G1
[2]Region of Waterloo Public Health, Waterloo, ON N2J 4V3

Rationale and Purpose

•Purpose: To describe family dinner frequency, nutrient intake, and body weight status among grade 6 students. The secondary objective was to examine the impact of family dinner environment.

• Hypothesis: Family dinner meals will have a positive influence on body weight status and dietary quality.

Methods

•Using the web-based survey "Food Behaviour Questionnaire" that was developed at the University of Waterloo (www.uweatwell.com), the following were assessed from a 24 hour diet recall (see sample screens):
- •Total energy, macro- and micro-nutrients
- •Number of food group servings of Canada's Food Guide to Healthy Eating (CFGHE)

•Participants also responded to questions regarding meal patterns and food preparation (see sample screens).
•Nutrient analysis software, ESHA, processed the 24 hour recall measures of food intake with the 2001b Canadian Nutrient File database.
•Since nutrition data tend to be non-normally distributed, square root transformations were completed to permit the use of standard statistical tests.
•Body Mass Index (BMI) was calculated for each participant based on measured height and weight and classified according to Cole et al., BMJ 2000; 320(7244): 1240-1243.

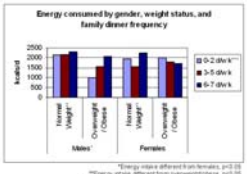
Results

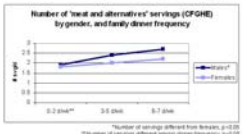
•Data were obtained from 396 grade 6 (males=185, females=206) students from the Waterloo Region District School Board (n=15 schools).

•Among males, 72%, 21%, 7% were classified as normal weight, overweight, and obese, respectively. Among females, 74%, 19%, 7% were classified as normal weight, overweight, and obese, respectively.

•Dinner was consumed with at least one parent by 77% on 6-7 d/wk, 12% on 3-5 d/wk, and 11% on 0-2 d/wk.

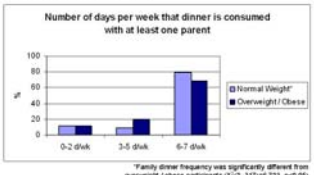
•Family dinner frequency was positively associated with total energy (kcal/d), number of 'meat and alternatives', and 'other' food group servings (CFGHE)



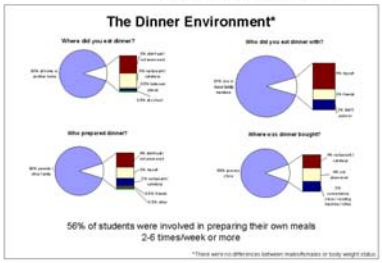


Results (cont'd)

•Family dinner frequency was different between normal weight and overweight/obese students



*Family dinner frequency was significantly different from overweight / obese participants (X^2(2, 317)=6.723, p<0.05)



•Among those that skipped the dinner meal on the previous evening (9%, n=37), the majority (46%, n=13) reported consuming dinner with at least one parent on 0-2 d/wk (X^2(2, 320)=15.96, p<0.001).

Summary and Implications

•Students who reported more family dinner meals consumed more energy and food group servings according to CFGHE. This greater intake, however, did not impact body weight status. Moreover, there were differences in family dinner frequency between normal weight and overweight/obese students, which potentially suggests that family dinner meals are protective against increased body weights. Additional research among a larger sample is needed to better understand this relationship.

This research was supported by the Region of Waterloo Public Health. Travel assistance was provided by University of Waterloo Graduate Conference Travel Assistantships.
SJ Woodruff is funded by the Danone Institute of Canada.
Contact Information: Sarah Woodruff, MSc, PFLC. swoodruff@ahsmail.uwaterloo.ca

The abstract is published:

Woodruff, S. J., Hanning, R. M., & Fisher, P. (2006). Family dinner environment of grade six students from Waterloo Region District School Board [Abstract]. *Applied Physiology, Nutrition, and Metabolism, 31*, 364.

APPENDIX Q: Basal Metabolic Rate Equations

(World Health Organization, 1985)

Males (10-18 years) kcals = $(0.0732 \times weight(Kg) + 2.72) \times 240$

Females (10-18 years) kcals = $(0.0510 \times weight(Kg) + 3.12) \times 240$

APPENDIX R: Statistics used in Chapter 3

General Linear Model: HEI scores versus descriptors

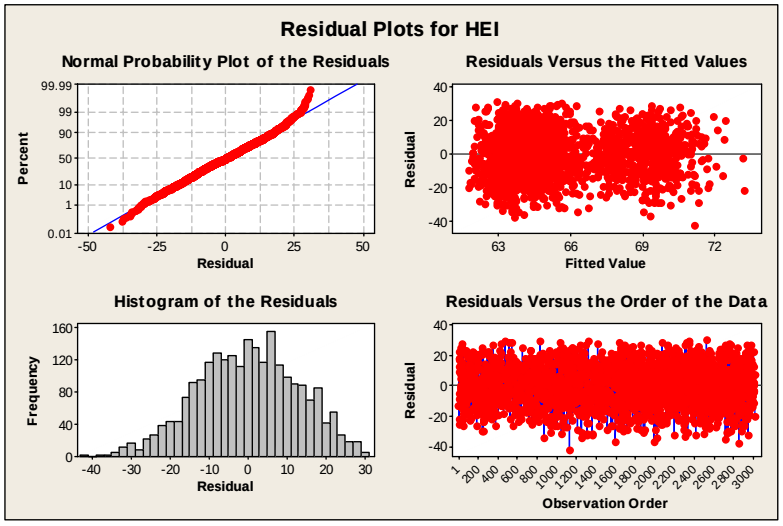
```
Factor   Type   Levels  Values
Dataset  fixed       5  1, 2, 3, 4, 5
SEX      fixed       2  1, 2
GRADE    fixed       3  6, 7, 8
COLE     fixed       3  1, 2, 3


Analysis of Variance for HEI, using Adjusted SS for Tests

Source     DF    Seq SS    Adj SS  Adj MS      F      P
RATIO       1    3053.6     916.9   916.9   5.46  0.020
Dataset     4   10052.9    7630.6  1907.7  11.36  0.000
SEX         1      14.0       7.5     7.5   0.04  0.832
GRADE       2      66.6      67.9    34.0   0.20  0.817
COLE        2     138.0     138.0    69.0   0.41  0.663
Error    2334  392046.7  392046.7   168.0
Total    2344  405371.8

S = 12.9604   R-Sq = 3.29%   R-Sq(adj) = 2.87%

Term         Coef  SE Coef      T      P
Constant  64.2632   0.6856  93.74  0.000
RATIO      0.9010   0.3856   2.34  0.020
Dataset
1         -2.0992   0.8295  -2.53  0.011
2         -1.0139   0.5579  -1.82  0.069
3          3.5697   0.7607   4.69  0.000
4          1.9258   0.7963   2.42  0.016
SEX
1         -0.0574   0.2709  -0.21  0.832
GRADE
6          0.0739   0.6214   0.12  0.905
7          0.2698   0.5854   0.46  0.645
COLE
1          0.4178   0.4672   0.89  0.371
2          0.1052   0.5434   0.19  0.847
```



POST HOC TESTING

```
Tukey 95.0% Simultaneous Confidence Intervals
Response Variable HEI
All Pairwise Comparisons among Levels of Dataset

Dataset = 1  subtracted from:
Dataset   Lower   Center  Upper  ---------+---------+---------+-------
2        -2.068   1.0853  4.239                (-----*-----)
3         2.816   5.6689  8.522                          (----*-----)
4         0.300   4.0250  7.750                    (------*------)
5        -4.136  -0.2833  3.569          (------*-------)
                                 ---------+---------+---------+-------
                                       -5.0       0.0       5.0
Dataset = 2  subtracted from:
Dataset   Lower  Center  Upper  ---------+---------+---------+-------
3         1.656   4.584  7.511                     (-----*-----)
4         0.073   2.940  5.806                  (-----*-----)
5        -3.824  -1.369  1.087            (----*----)
                               ---------+---------+---------+-------
                                     -5.0       0.0       5.0
Dataset = 3  subtracted from:
Dataset   Lower  Center   Upper  ---------+---------+---------+-------
4        -5.178  -1.644   1.890          (------*------)
5        -9.630  -5.952  -2.274  (------*------)
                                 ---------+---------+---------+-------
                                       -5.0       0.0       5.0
Dataset = 4  subtracted from:
Dataset   Lower  Center   Upper  ---------+---------+---------+-------
5        -7.504  -4.308  -1.113     (-----*------)
                                 ---------+---------+---------+-------
                                       -5.0       0.0       5.0
Tukey Simultaneous Tests
Response Variable HEI
All Pairwise Comparisons among Levels of Dataset

Dataset = 1  subtracted from:
         Difference       SE of           Adjusted
Dataset    of Means  Difference  T-Value   P-Value
2            1.0853       1.155   0.9394    0.8815
3            5.6689       1.045   5.4238    0.0000
4            4.0250       1.365   2.9494    0.0264
5           -0.2833       1.411  -0.2007    0.9996

Dataset = 2  subtracted from:
         Difference       SE of           Adjusted
Dataset    of Means  Difference  T-Value   P-Value
3             4.584      1.0726   4.274    0.0002
4             2.940      1.0502   2.799    0.0410
5            -1.369      0.8996  -1.521    0.5485

Dataset = 3  subtracted from:
         Difference       SE of           Adjusted
Dataset    of Means  Difference  T-Value   P-Value
4            -1.644       1.295  -1.270    0.7099
5            -5.952       1.347  -4.417    0.0001

Dataset = 4  subtracted from:
         Difference       SE of           Adjusted
Dataset    of Means  Difference  T-Value   P-Value
5            -4.308       1.171  -3.680    0.0022
```

Ordinal Logistic Regression: HEI-C Rating versus descriptors

Link Function: Logit

Response Information

Variable	Value	Count
rate	1	346
	2	1700
	3	299
	Total	2345

* NOTE * 2345 cases were used
* NOTE * 670 cases contained missing values

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Const(1)	-2.13574	0.185325	-11.52	0.000			
Const(2)	1.61068	0.181637	8.87	0.000			
Dataset							
2	0.0446649	0.198615	0.22	0.822	1.05	0.71	1.54
3	0.633110	0.178914	3.54	0.000	1.88	1.33	2.67
4	0.528416	0.233286	2.27	0.024	1.70	1.07	2.68
5	-0.155202	0.242237	-0.64	0.522	0.86	0.53	1.38
SEX							
2	-0.0187430	0.0925416	-0.20	0.839	0.98	0.82	1.18
GRADE							
7	0.114869	0.181402	0.63	0.527	1.12	0.79	1.60
8	-0.0720573	0.179991	-0.40	0.689	0.93	0.65	1.32
COLE							
2	-0.0630902	0.119331	-0.53	0.597	0.94	0.74	1.19
3	-0.0629606	0.188695	-0.33	0.739	0.94	0.65	1.36
RATIO	0.152335	0.0652321	2.34	0.020	1.16	1.02	1.32

Log-Likelihood = -1801.665
Test that all slopes are zero: G = 46.155, DF = 10, P-Value = 0.000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	4693.67	4678	0.433
Deviance	3603.33	4678	1.000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	687473	57.3	Somers' D	0.17
Discordant	484752	40.4	Goodman-Kruskal Gamma	0.17
Ties	27729	2.3	Kendall's Tau-a	0.07
Total	1199954	100.0		

General Linear Model: HEI scores versus family meal frequency

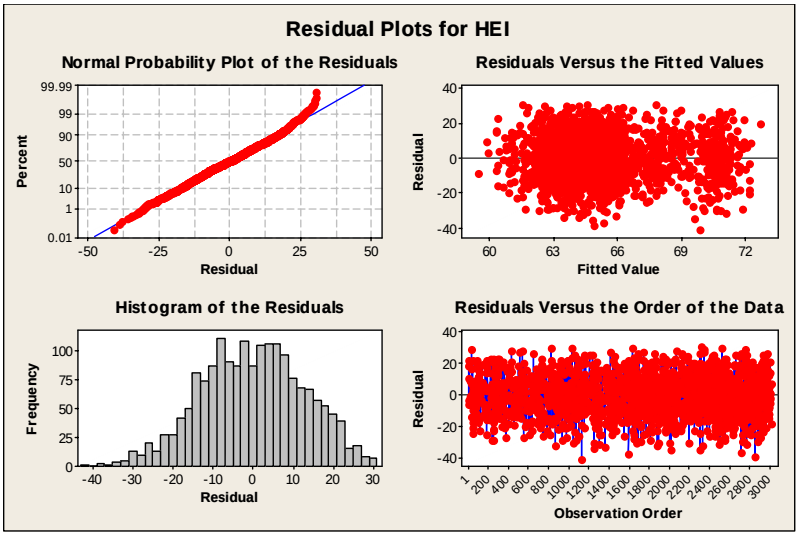
```
Factor        Type   Levels  Values
Dataset       fixed       5  1, 2, 3, 4, 5
SEX           fixed       2  1, 2
GRADE         fixed       3  6, 7, 8
COLE          fixed       3  1, 2, 3
family meals  fixed       3  1, 2, 3

Analysis of Variance for HEI, using Adjusted SS for Tests

Source          DF    Seq SS    Adj SS  Adj MS      F      P
RATIO            1    1800.0     335.8   335.8   2.03  0.155
Dataset          4    8793.0    6717.1  1679.3  10.14  0.000
SEX              1     100.6      97.5    97.5   0.59  0.443
GRADE            2      57.6      56.7    28.3   0.17  0.843
COLE             2     252.7     203.3   101.7   0.61  0.541
family meals     2    1515.9    1515.9   757.9   4.58  0.010
Error         1806  299134.0  299134.0   165.6
Total         1818  311653.6

S = 12.8699   R-Sq = 4.02%   R-Sq(adj) = 3.38%

Term             Coef  SE Coef      T      P
Constant      63.4265   0.8256  76.83  0.000
RATIO          0.6210   0.4362   1.42  0.155
Dataset
1              -3.684    1.042  -3.54  0.000
2             -0.3972   0.6527  -0.61  0.543
3              3.8900   0.8689   4.48  0.000
4              1.5720   0.9798   1.60  0.109
SEX
1             -0.2346   0.3057  -0.77  0.443
GRADE
6              0.3860   0.7220   0.53  0.593
7             -0.0695   0.6797  -0.10  0.919
COLE
1              0.5869   0.5299   1.11  0.268
2              0.0174   0.6116   0.03  0.977
family meals
1              1.3812   0.4570   3.02  0.003
2             -0.4131   0.5793  -0.71  0.476
```



POST HOC TESTING

```
Tukey 95.0% Simultaneous Confidence Intervals
Response Variable HEI
All Pairwise Comparisons among Levels of family meals
family meals = 1  subtracted from:

family
meals    Lower  Center     Upper  ---+---------+---------+---------+---
2       -3.675  -1.794   0.08653       (--------*--------)
3       -4.653  -2.349  -0.04568  (----------*----------)
                                  ---+---------+---------+---------+---
                                  -4.0      -2.0       0.0       2.0


family meals = 2  subtracted from:

family
meals    Lower   Center  Upper  ---+---------+---------+---------+---
3       -3.273  -0.5550  2.163         (------------*-------------)
                                 ---+---------+---------+---------+---
                                 -4.0      -2.0       0.0       2.0


Tukey Simultaneous Tests
Response Variable HEI
All Pairwise Comparisons among Levels of family meals
family meals = 1  subtracted from:

family  Difference       SE of           Adjusted
meals     of Means  Difference  T-Value   P-Value
2           -1.794      0.8036   -2.233    0.0658
3           -2.349      0.9842   -2.387    0.0448


family meals = 2  subtracted from:

family  Difference       SE of           Adjusted
meals     of Means  Difference  T-Value   P-Value
3          -0.5550       1.161  -0.4778    0.8818
```

Ordinal Logistic Regression: HEI-C rating versus family meal frequency

```
Link Function: Logit

Response Information

Variable  Value  Count
rate      1        265
          2       1328
          3        226
          Total   1819

* NOTE * 1819 cases were used
* NOTE * 1196 cases contained missing values

Logistic Regression Table

                                                        Odds     95% CI
Predictor           Coef    SE Coef      Z      P  Ratio  Lower  Upper
Const(1)        -2.16721   0.234073  -9.26  0.000
Const(2)         1.62957   0.230060   7.08  0.000
Dataset
 2              0.314589   0.249069   1.26  0.207   1.37   0.84   2.23
 3              0.756197   0.222917   3.39  0.001   2.13   1.38   3.30
 4              0.650426   0.295289   2.20  0.028   1.92   1.07   3.42
 5              0.197620   0.295772   0.67  0.504   1.22   0.68   2.18
SEX
 2             0.0437921   0.105892   0.41  0.679   1.04   0.85   1.29
GRADE
 7            -0.0314098   0.214933  -0.15  0.884   0.97   0.64   1.48
 8             -0.111922   0.209338  -0.53  0.593   0.89   0.59   1.35
COLE
 2             -0.100031   0.136657  -0.73  0.464   0.90   0.69   1.18
 3            -0.0119342   0.216562  -0.06  0.956   0.99   0.65   1.51
RATIO           0.103552  0.0749310   1.38  0.167   1.11   0.96   1.28
family meals
 2              -0.371248   0.140045  -2.65  0.008   0.69   0.52   0.91
 3              -0.337670   0.171222  -1.97  0.049   0.71   0.51   1.00

Log-Likelihood = -1380.689
Test that all slopes are zero: G = 37.828, DF = 12, P-Value = 0.000

Goodness-of-Fit Tests

Method    Chi-Square    DF      P
Pearson      3628.57  3624  0.475
Deviance     2761.38  3624  1.000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs       Number  Percent  Summary Measures
Concordant  411122     57.7  Somers' D              0.17
Discordant  288249     40.5  Goodman-Kruskal Gamma  0.18
Ties         12567      1.8  Kendall's Tau-a        0.07
Total       711938    100.0
```

General Linear Model: HEI scores versus with whom?

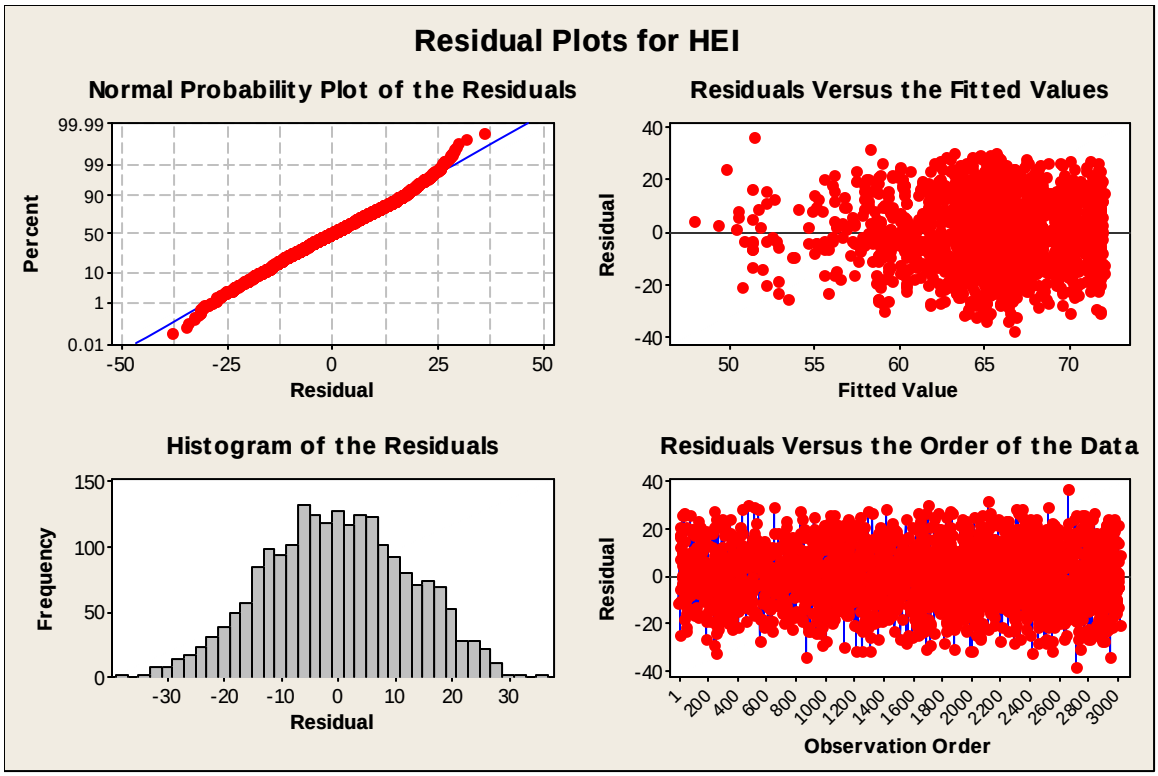
Factor	Type	Levels	Values
Dataset	fixed	5	1, 2, 3, 4, 5
SEX	fixed	2	1, 2
GRADE	fixed	3	6, 7, 8
COLE	fixed	3	1, 2, 3
who b (fam)	fixed	4	1, 2, 3, 4
who l (fri)	fixed	4	1, 2, 3, 4
who d (fam)	fixed	4	1, 2, 3, 4

Analysis of Variance for HEI, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
RATIO	1	1844.8	15.6	15.6	0.10	0.754
Dataset	4	10349.3	4632.2	1158.1	7.29	0.000
SEX	1	28.6	178.2	178.2	1.12	0.290
GRADE	2	83.9	2.6	1.3	0.01	0.992
COLE	2	136.1	106.9	53.5	0.34	0.714
who b (fam)	3	12020.1	8702.4	2900.8	18.27	0.000
who l (fri)	3	5965.7	5741.9	1914.0	12.06	0.000
who d (fam)	3	662.2	662.2	220.7	1.39	0.244
Error	2090	331818.0	331818.0	158.8		
Total	2109	362908.7				

S = 12.6002 R-Sq = 8.57% R-Sq(adj) = 7.74%

Term	Coef	SE Coef	T	P
Constant	60.661	1.096	55.37	0.000
RATIO	-0.1277	0.4070	-0.31	0.754
Dataset				
1	-1.8782	0.9067	-2.07	0.038
2	-0.6413	0.5879	-1.09	0.276
3	3.0470	0.7895	3.86	0.000
4	1.5845	0.8692	1.82	0.068
SEX				
1	-0.2986	0.2818	-1.06	0.290
GRADE				
6	-0.0439	0.6514	-0.07	0.946
7	0.0776	0.6120	0.13	0.899
COLE				
1	0.2315	0.4832	0.48	0.632
2	0.3892	0.5626	0.69	0.489
who b (fam)				
1	2.8725	0.6521	4.41	0.000
2	1.1848	0.6732	1.76	0.079
3	1.141	1.540	0.74	0.459
who l (fri)				
1	3.3578	0.5592	6.00	0.000
2	0.6071	0.7627	0.80	0.426
3	0.1244	0.8484	0.15	0.883
who d (fam)				
1	1.5848	0.7902	2.01	0.045
2	0.609	1.046	0.58	0.561
3	-0.327	1.259	-0.26	0.795


Residual Plots for HEI
Normal Probability Plot of the Residuals
Percent
99.99
99
90
50
10
1
0.01
-50
-25
0
25
50
Residual
Residuals Versus the Fitted Values
Residual
40
20
0
-20
-40
50
55
60
65
70
Fitted Value
Histogram of the Residuals
Frequency
150
100
50
0
-30
-20
-10
0
10
20
30
Residual
Residuals Versus the Order of the Data
Residual
40
20
0
-20
-40
1
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
Observation Order

Ordinal Logistic Regression: HEI-C rating versus with whom?

```
Link Function: Logit

Response Information
Variable  Value  Count
rate      1        320
          2       1536
          3        254
          Total   2110

* NOTE * 2110 cases were used
* NOTE * 905 cases contained missing values

Logistic Regression Table
                                                        Odds     95% CI
Predictor           Coef    SE Coef      Z      P  Ratio  Lower  Upper
Const(1)       -1.65847   0.221378  -7.49  0.000
Const(2)        2.27171   0.225965  10.05  0.000
Dataset
 2             0.157958   0.224487   0.70  0.482   1.17   0.75   1.82
 3             0.537909   0.202074   2.66  0.008   1.71   1.15   2.54
 4             0.543938   0.264658   2.06  0.040   1.72   1.03   2.89
 5           -0.0205976   0.267198  -0.08  0.939   0.98   0.58   1.65
SEX
 2            0.0759743   0.100082   0.76  0.448   1.08   0.89   1.31
GRADE
 7           -0.0033100   0.197148  -0.02  0.987   1.00   0.68   1.47
 8            -0.139183   0.194638  -0.72  0.475   0.87   0.59   1.27
COLE
 2            0.0066081   0.127768   0.05  0.959   1.01   0.78   1.29
 3           -0.0192882   0.202329  -0.10  0.924   0.98   0.66   1.46
RATIO         0.0029213  0.0719446   0.04  0.968   1.00   0.87   1.15
who b (fam)
 2            -0.274580   0.109362  -2.51  0.012   0.76   0.61   0.94
 3            -0.518748   0.368348  -1.41  0.159   0.60   0.29   1.23
 4             -1.19140   0.191818  -6.21  0.000   0.30   0.21   0.44
who l (fri)
 2            -0.419374   0.155500  -2.70  0.007   0.66   0.48   0.89
 3            -0.663103   0.182978  -3.62  0.000   0.52   0.36   0.74
 4             -1.20123   0.267214  -4.50  0.000   0.30   0.18   0.51
who d (fam)
 2            0.0835501   0.192980   0.43  0.665   1.09   0.74   1.59
 3           -0.0978375   0.259306  -0.38  0.706   0.91   0.55   1.51
 4            -0.487453   0.415726  -1.17  0.241   0.61   0.27   1.39

Log-Likelihood = -1563.248
Test that all slopes are zero: G = 131.492, DF = 19, P-Value = 0.000

Goodness-of-Fit Tests

Method    Chi-Square    DF      P
Pearson      4189.65  4199  0.538
Deviance     3126.50  4199  1.000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs       Number  Percent  Summary Measures
Concordant  600304     62.3  Somers' D              0.27
Discordant  339570     35.3  Goodman-Kruskal Gamma  0.28
Ties         23070      2.4  Kendall's Tau-a        0.12
Total       962944    100.0
```

APPENDIX S: Statistics used in Chapter 4

Ordinal Logistic Regression: HEI-C rating versus Breakfast cluster

```
Link Function: Logit

Response Information

Variable  Value  Count
rate      1        305
          2       1399
          3        225
          Total   1929

* NOTE * 1929 cases were used
* NOTE * 519 cases contained missing values

Logistic Regression Table

                                                    Odds     95% CI
Predictor         Coef    SE Coef      Z      P  Ratio  Lower  Upper
Const(1)     -1.97505   0.216995  -9.10  0.000
Const(2)      1.86067   0.216465   8.60  0.000
Dataset
 2           0.182662   0.226497   0.81  0.420   1.20   0.77   1.87
 3           0.628042   0.202733   3.10  0.002   1.87   1.26   2.79
 4           0.629438   0.266780   2.36  0.018   1.88   1.11   3.17
 5         -0.0268523   0.274110  -0.10  0.922   0.97   0.57   1.67
SEX
 2          0.0530587   0.103113   0.51  0.607   1.05   0.86   1.29
GRADE
 7          0.0151105   0.202696   0.07  0.941   1.02   0.68   1.51
 8          -0.181620   0.202369  -0.90  0.369   0.83   0.56   1.24
COLE
 2          -0.0560676   0.133913  -0.42  0.675   0.95   0.73   1.23
 3          -0.0756801   0.212211  -0.36  0.721   0.93   0.61   1.41
RATIO         0.104694  0.0772475   1.36  0.175   1.11   0.95   1.29
B CLUSTER
 2           -0.521235   0.236260  -2.21  0.027   0.59   0.37   0.94
 3           -0.977414   0.180215  -5.42  0.000   0.38   0.26   0.54

Log-Likelihood = -1458.138
Test that all slopes are zero: G = 74.573, DF = 12, P-Value = 0.000

Goodness-of-Fit Tests

Method    Chi-Square    DF      P
Pearson      3844.33  3844  0.495
Deviance     2916.28  3844  1.000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs       Number  Percent  Summary Measures
Concordant  484747     59.8  Somers' D              0.22
Discordant  309418     38.2  Goodman-Kruskal Gamma  0.22
Ties         15930      2.0  Kendall's Tau-a        0.09
Total       810095    100.0
```

Ordinal Logistic Regression: HEI-C rating versus Lunch cluster

```
Link Function: Logit

Response Information

Variable  Value  Count
rate      1        282
          2       1311
          3        215
          Total   1808

* NOTE * 1808 cases were used
* NOTE * 514 cases contained missing values

Logistic Regression Table
                                                    Odds     95% CI
Predictor        Coef    SE Coef       Z      P  Ratio  Lower  Upper
Const(1)     -1.90495   0.243539   -7.82  0.000
Const(2)      1.94347   0.244347    7.95  0.000
Dataset
 2          0.0365805   0.232794    0.16  0.875   1.04   0.66   1.64
 3           0.455473   0.213204    2.14  0.033   1.58   1.04   2.39
 4           0.371571   0.274842    1.35  0.176   1.45   0.85   2.48
 5          -0.189637   0.282947   -0.67  0.503   0.83   0.48   1.44
SEX
 2         -0.0004830   0.106598   -0.00  0.996   1.00   0.81   1.23
GRADE
 7          0.0329283   0.201649    0.16  0.870   1.03   0.70   1.53
 8          -0.175659   0.199010   -0.88  0.377   0.84   0.57   1.24
COLE
 2          0.0312890   0.140686    0.22  0.824   1.03   0.78   1.36
 3          0.0396369   0.222336    0.18  0.859   1.04   0.67   1.61
RATIO        0.159020  0.0779322    2.04  0.041   1.17   1.01   1.37
LCLUSTER
 2          -0.576546   0.227106   -2.54  0.011   0.56   0.36   0.88
 3          -0.481062   0.175786   -2.74  0.006   0.62   0.44   0.87
 4          -0.395972   0.213415   -1.86  0.064   0.67   0.44   1.02
 5           0.179127   0.153916    1.16  0.245   1.20   0.88   1.62
 6           0.358482   0.230626    1.55  0.120   1.43   0.91   2.25
 7          -0.603113   0.234336   -2.57  0.010   0.55   0.35   0.87
 8          -0.880163   0.244794   -3.60  0.000   0.41   0.26   0.67

Log-Likelihood = -1364.000
Test that all slopes are zero: G = 78.358, DF = 17, P-Value = 0.000

Goodness-of-Fit Tests

Method    Chi-Square    DF      P
Pearson      3613.75  3597  0.419
Deviance     2728.00  3597  1.000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs       Number  Percent  Summary Measures
Concordant  438217     61.5  Somers' D              0.24
Discordant  266392     37.4  Goodman-Kruskal Gamma  0.24
Ties          7588      1.1  Kendall's Tau-a        0.11
Total       712197    100.0
```

Ordinal Logistic Regression: HEI-C rating versus Dinner cluster

Link Function: Logit

Response Information

Variable	Value	Count
rate	1	297
	2	1391
	3	237
	Total	1925

* NOTE * 1925 cases were used
* NOTE * 539 cases contained missing values

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Const(1)	-1.99130	0.231744	-8.59	0.000			
Const(2)	1.76322	0.230399	7.65	0.000			
Dataset							
2	0.0954779	0.233969	0.41	0.683	1.10	0.70	1.74
3	0.549351	0.216702	2.54	0.011	1.73	1.13	2.65
4	0.418074	0.273709	1.53	0.127	1.52	0.89	2.60
5	-0.170107	0.281263	-0.60	0.545	0.84	0.49	1.46
SEX							
2	-0.0118298	0.102196	-0.12	0.908	0.99	0.81	1.21
GRADE							
7	0.0358056	0.199306	0.18	0.857	1.04	0.70	1.53
8	-0.136089	0.197104	-0.69	0.490	0.87	0.59	1.28
COLE							
2	0.0319125	0.134448	0.24	0.812	1.03	0.79	1.34
3	-0.0749170	0.211694	-0.35	0.723	0.93	0.61	1.40
RATIO	0.166119	0.0751062	2.21	0.027	1.18	1.02	1.37
DCLUSTER							
2	-0.135156	0.204717	-0.66	0.509	0.87	0.58	1.30
3	-0.299199	0.264800	-1.13	0.259	0.74	0.44	1.25
4	-0.265693	0.198518	-1.34	0.181	0.77	0.52	1.13
5	-0.638210	0.221528	-2.88	0.004	0.53	0.34	0.82
6	-0.460020	0.300602	-1.53	0.126	0.63	0.35	1.14

Log-Likelihood = -1478.740
Test that all slopes are zero: G = 49.406, DF = 15, P-Value = 0.000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	3835.12	3833	0.487
Deviance	2957.48	3833	1.000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	475077	58.4	Somers' D	0.18
Discordant	325472	40.0	Goodman-Kruskal Gamma	0.19
Ties	12634	1.6	Kendall's Tau-a	0.08
Total	813183	100.0		

APPENDIX T: Statistics used in Chapter 5

Ordinal Logistic Regression: Family meal frequency versus behaviours and attitudes

```
Link Function: Logit

Response Information

Variable      Value  Count
family meals  1       1044
              2        269
              3        162
              Total   1475

* NOTE * 1475 cases were used
* NOTE * 1550 cases contained missing values

Logistic Regression Table
```

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Const(1)	1.20856	0.542610	2.23	0.026			
Const(2)	2.50072	0.546571	4.58	0.000			
Dataset							
2	-0.830894	0.311201	-2.67	0.008	0.44	0.24	0.80
3	-0.476591	0.295051	-1.62	0.106	0.62	0.35	1.11
4	-0.559793	0.388393	-1.44	0.149	0.57	0.27	1.22
5	-0.481676	0.356679	-1.35	0.177	0.62	0.31	1.24
SEX	-0.0655279	0.123372	-0.53	0.595	0.94	0.74	1.19
GRADE							
7	0.0655931	0.234896	0.28	0.780	1.07	0.67	1.69
8	-0.0051236	0.221803	-0.02	0.982	0.99	0.64	1.54
COLE							
2	-0.0345975	0.158005	-0.22	0.827	0.97	0.71	1.32
3	0.0123809	0.249581	0.05	0.960	1.01	0.62	1.65
FFFU							
2	-0.320775	0.443348	-0.72	0.469	0.73	0.30	1.73
3	-0.0096739	0.410994	-0.02	0.981	0.99	0.44	2.22
4	0.245916	0.409898	0.60	0.549	1.28	0.57	2.86
5	0.259900	0.419476	0.62	0.536	1.30	0.57	2.95
pop							
2	0.269648	0.190617	1.41	0.157	1.31	0.90	1.90
3	0.409920	0.178898	2.29	0.022	1.51	1.06	2.14
4	0.257712	0.199705	1.29	0.197	1.29	0.87	1.91
5	0.149106	0.197726	0.75	0.451	1.16	0.79	1.71
Eat break?	0.533995	0.141145	3.78	0.000	1.71	1.29	2.25
dieting?	-0.177007	0.168643	-1.05	0.294	0.84	0.60	1.17
wt high?	-0.302840	0.160063	-1.89	0.058	0.74	0.54	1.01
SE HOME							
2	-0.324510	0.146468	-2.22	0.027	0.72	0.54	0.96
3	-0.931988	0.233522	-3.99	0.000	0.39	0.25	0.62
SE SCHOOL							
2	0.164055	0.173705	0.94	0.345	1.18	0.84	1.66
3	-0.0278546	0.220980	-0.13	0.900	0.97	0.63	1.50
SE SOCIAL							
2	-0.316492	0.194496	-1.63	0.104	0.73	0.50	1.07
3	-0.479119	0.219795	-2.18	0.029	0.62	0.40	0.95
SE ALONE							
2	0.0743176	0.153477	0.48	0.628	1.08	0.80	1.46
3	0.228793	0.161546	1.42	0.157	1.26	0.92	1.73

Log-Likelihood = -1117.455
Test that all slopes are zero: G = 117.872, DF = 28, P-Value = 0.000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	2652.78	2648	0.470
Deviance	2077.22	2648	1.000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	322195	65.3	Somers' D	0.31
Discordant	168481	34.1	Goodman-Kruskal Gamma	0.31
Ties	2866	0.6	Kendall's Tau-a	0.14
Total	493542	100.0		

Ordinal Logistic Regression: family meals versus pop consumption

Link Function: Logit

Response Information

Variable	Value	Count
family meals	1	1241
	2	321
	3	190
	Total	1752

* NOTE * 1752 cases were used
* NOTE * 1273 cases contained missing values

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Const(1)	1.04087	0.244052	4.26	0.000			
Const(2)	2.28820	0.250549	9.13	0.000			
Dataset							
2	-0.819570	0.263493	-3.11	0.002	0.44	0.26	0.74
3	-0.179939	0.250700	-0.72	0.473	0.84	0.51	1.37
4	-0.530160	0.314907	-1.68	0.092	0.59	0.32	1.09
5	-0.594812	0.307148	-1.94	0.053	0.55	0.30	1.01
SEX							
2	-0.184360	0.108450	-1.70	0.089	0.83	0.67	1.03
GRADE							
7	0.287574	0.205102	1.40	0.161	1.33	0.89	1.99
8	0.0167265	0.193387	0.09	0.931	1.02	0.70	1.49
COLE							
2	-0.218393	0.133213	-1.64	0.101	0.80	0.62	1.04
3	-0.378029	0.207235	-1.82	0.068	0.69	0.46	1.03
pop							
2	0.444308	0.168291	2.64	0.008	1.56	1.12	2.17
3	0.617803	0.154817	3.99	0.000	1.85	1.37	2.51
4	0.609348	0.173299	3.52	0.000	1.84	1.31	2.58
5	0.511658	0.165592	3.09	0.002	1.67	1.21	2.31

Log-Likelihood = -1368.479
Test that all slopes are zero: G = 52.622, DF = 13, P-Value = 0.000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	422.878	379	0.059
Deviance	422.991	379	0.059

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	408776	58.8	Somers' D	0.20
Discordant	269927	38.8	Goodman-Kruskal Gamma	0.20
Ties	16438	2.4	Kendall's Tau-a	0.09
Total	695141	100.0		

Ordinal Logistic Regression: family meals versus breakfast consumption

```
Link Function: Logit

Response Information

Variable      Value  Count
family meals  1       1221
              2        314
              3        187
              Total   1722

* NOTE * 1722 cases were used
* NOTE * 1303 cases contained missing values

Logistic Regression Table

                                                    Odds     95% CI
Predictor         Coef   SE Coef      Z      P  Ratio  Lower  Upper
Const(1)      0.939765  0.242173   3.88  0.000
Const(2)       2.18626  0.248643   8.79  0.000
Dataset
 2           -0.845286  0.260337  -3.25  0.001   0.43   0.26   0.72
 3           -0.150540  0.247844  -0.61  0.544   0.86   0.53   1.40
 4           -0.625741  0.311305  -2.01  0.044   0.53   0.29   0.98
 5           -0.607859  0.307764  -1.98  0.048   0.54   0.30   1.00
SEX
 2          -0.0498235  0.109447  -0.46  0.649   0.95   0.77   1.18
GRADE
 7            0.345220  0.210922   1.64  0.102   1.41   0.93   2.14
 8            0.162742  0.198399   0.82  0.412   1.18   0.80   1.74
COLE
 2           0.0007103  0.142722   0.00  0.996   1.00   0.76   1.32
 3          -0.0694187  0.226464  -0.31  0.759   0.93   0.60   1.45
Eat break?
 1            0.587941  0.126054   4.66  0.000   1.80   1.41   2.30
dieting?
 1           -0.164706  0.151810  -1.08  0.278   0.85   0.63   1.14
wt high?
 1           -0.247902  0.143161  -1.73  0.083   0.78   0.59   1.03


Log-Likelihood = -1340.235
Test that all slopes are zero: G = 58.219, DF = 12, P-Value = 0.000


Goodness-of-Fit Tests

Method    Chi-Square   DF      P
Pearson      490.209  472  0.272
Deviance     489.931  472  0.275


Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs       Number  Percent  Summary Measures
Concordant  393949     58.8  Somers' D              0.21
Discordant  252889     37.7  Goodman-Kruskal Gamma  0.22
Ties         23601      3.5  Kendall's Tau-a        0.10
Total       670439    100.0
```

Ordinal Logistic Regression: family meals versus self-efficacy for healthy eating at home

Link Function: Logit

Response Information

Variable	Value	Count
family meals	1	1264
	2	322
	3	195
	Total	1781

* NOTE * 1781 cases were used
* NOTE * 1244 cases contained missing values

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Const(1)	1.88777	0.239375	7.89	0.000			
Const(2)	3.13706	0.248421	12.63	0.000			
Dataset							
2	-1.02731	0.269510	-3.81	0.000	0.36	0.21	0.61
3	-0.342186	0.257711	-1.33	0.184	0.71	0.43	1.18
4	-0.812937	0.320536	-2.54	0.011	0.44	0.24	0.83
5	-0.694229	0.313157	-2.22	0.027	0.50	0.27	0.92
SEX							
2	-0.179107	0.106591	-1.68	0.093	0.84	0.68	1.03
GRADE							
7	0.286641	0.204399	1.40	0.161	1.33	0.89	1.99
8	-0.0548768	0.193184	-0.28	0.776	0.95	0.65	1.38
COLE							
2	-0.238108	0.131976	-1.80	0.071	0.79	0.61	1.02
3	-0.304299	0.206121	-1.48	0.140	0.74	0.49	1.10
SE HOME							
2	-0.465784	0.121698	-3.83	0.000	0.63	0.49	0.80
3	-1.22934	0.174156	-7.06	0.000	0.29	0.21	0.41

Log-Likelihood = -1373.292
Test that all slopes are zero: G = 84.388, DF = 11, P-Value = 0.000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	236.306	215	0.152
Deviance	248.744	215	0.057

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	432095	60.3	Somers' D	0.24
Discordant	261026	36.4	Goodman-Kruskal Gamma	0.25
Ties	23157	3.2	Kendall's Tau-a	0.11
Total	716278	100.0		

Ordinal Logistic Regression: family meals versus self-efficacy for healthy eating during social times with friends

Link Function: Logit

Response Information

Variable	Value	Count
family meals	1	1251
	2	319
	3	191
	Total	1761

* NOTE * 1761 cases were used
* NOTE * 1264 cases contained missing values

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Const(1)	1.92070	0.254320	7.55	0.000			
Const(2)	3.16329	0.262756	12.04	0.000			
Dataset							
2	-0.851589	0.261811	-3.25	0.001	0.43	0.26	0.71
3	-0.254476	0.249414	-1.02	0.308	0.78	0.48	1.26
4	-0.419008	0.324528	-1.29	0.197	0.66	0.35	1.24
5	-0.578589	0.307838	-1.88	0.060	0.56	0.31	1.03
SEX							
2	-0.176332	0.106705	-1.65	0.098	0.84	0.68	1.03
GRADE							
7	0.264359	0.208003	1.27	0.204	1.30	0.87	1.96
8	-0.0795468	0.195544	-0.41	0.684	0.92	0.63	1.35
COLE							
2	-0.286466	0.132063	-2.17	0.030	0.75	0.58	0.97
3	-0.393225	0.204713	-1.92	0.055	0.67	0.45	1.01
SE SOCIAL							
2	-0.288028	0.151248	-1.90	0.057	0.75	0.56	1.01
3	-0.759929	0.150964	-5.03	0.000	0.47	0.35	0.63

Log-Likelihood = -1365.526
Test that all slopes are zero: G = 63.028, DF = 11, P-Value = 0.000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	297.972	249	0.018
Deviance	309.415	249	0.005

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	415318	59.4	Somers' D	0.22
Discordant	264174	37.8	Goodman-Kruskal Gamma	0.22
Ties	19447	2.8	Kendall's Tau-a	0.10
Total	698939	100.0		