A GENDERED PERSPECTIVE ON PARENTING PRACTICES AND ITS ASSOCIATION WITH ADOLESCENTS' DIETARY BEHAVIOURS

by

Alysha Deslippe

BSc, University of British Columbia, 2018

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

in

THE FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES

(Population and Public Health)

THE UNIVERSITY OF BRITISH COLUMBIA

(Vancouver)

November 2020

The following individuals certify that they have read, and recommend to the Faculty of Graduate and Postdoctoral Studies for acceptance, the thesis entitled:

A gendered perspective on parenting practice and its associations with adolescents' dietary behaviours

submitted by Alysha L Deslippe in partial fulfillment of the requirements for

the degree of Master of Science

in Population and Public Health

Examining Committee:

Louise C. Mâsse, School of Population and Public Health, University of British Columbia
Supervisor

Teresia O'Connor, Pediatrics, Baylor College of Medicine
Supervisory Committee Member

Mariana Brussoni, School of Population and Public Health, University of British Columbia
Supervisory Committee Member

Eva Oberle, School of Population and Public Health, University of British Columbia
Additional Examiner

Abstract

Background: Dietary behaviours are a modifiable risk factor contributing to adolescent obesity (13-to-17-year-olds). Interventions involving the home have shown promise in promoting healthy eating directly through parenting practices (i.e., structured, autonomy supportive and controlling parenting practices) and indirectly through adolescents' commitment to healthy eating (i.e., cognitive factors including self-efficacy and motivation). However, it is currently unknown if boys and girls respond similarly to parenting practices or whether sex of parent matters.

Objective: The aims of this thesis were to explore the associations between parenting practices (Aim 1) and cognitive factors (Aim 2) on adolescents' dietary behaviours (i.e., fruit/vegetable (F&V) and sugar sweetened beverage (SSB) consumption) as well as the mediated associations of parenting practices through adolescents' cognitive factors (Aim 3).

Methods: Two samples were analyzed including the LiGHT project from Canada and the FLASHE study from the United States (US). The Canadian sample included 362 parent-adolescent dyads (65.5% mothers; 49.7% girls) and the US sample included 1633 parent-adolescent dyads (73.7% mothers; 50.4% girls). All measures were collected using self-reported questions. Using path analyses, direct associations between parenting practice (Aim 1) and adolescents' cognitive factors (Aim 2), as well as indirect associations of parenting practices through adolescents' cognitive factors on dietary behaviours (Aim 3) were explored. All models were stratified by sex of adolescent and controlled for known confounders. Sex of parent was explored as a moderator in aims 1 and 3.

Results: Direct associations between controlling (β =-.24, $p<.01$) and autonomy supportive (β=.18, $p<.01$) parenting practices and F&V intake emerged among boys only. Direct associations between intrinsic motivation and SSB consumption also emerged for boys (β=-.13, $p<.01$). Findings from the mediation analyses suggest that controlling and autonomy supportive parenting practices have significant indirect associations on boys' dietary behaviours through motivation pathways, but not for girls. Parent sex was not found to act as a significant moderator.

Conclusion: Boys and girls do not appear to be affected in the same way by parenting practices. Home-based interventions using a broader range of parenting practices may be advantageous in helping shape boys' motivation for healthy eating more so than girls.

Lay Summary

Over 30% of teenagers in Canada and the United States are considered overweight or obese. Food choices are one modifiable factor that can be used to promote maintenance of a healthy weight. Currently, it is not clear if interventions relying upon parent-teen interactions ('Parenting practices'), have similar effects on boys' and girls' food choices or if mothers and fathers have different effects.

More involved or hands-on types of parenting practices were found to have greater impacts on boys' food choices but not girls (Ages 12-17 years). Sex of parent was not found to affect boys and girls differently. These results suggest that parents use different parenting practices to encourage their boys or girls to consume more health promoting foods. Program developers should take these results into consideration when implementing home-based interventions that target strategies for improving adolescent boys' and girls' commitment to healthy eating.

Preface

This thesis contains work conducted by Alysha L. Deslippe under the supervision of Dr. Louise C. Mâsse. AL Deslippe was responsible for the data interpretation and write up. Additional guidance was provided by Dr. Mariana Brussoni and Dr. Teresia M. O'Connor. This thesis relied upon data coming from two samples: 1. Living Green and Healthy for Teens (LiGHT) project conducted by Dr. Louise C. Mâsse with the help of additional research staff at British Columbia's Children Hospital Research Institute (BCCHR); and 2. Data from the Family, Life, Activity, Sun, Health and Eating (FLASHE) study conducted by the National Cancer Institute (NCI) in partnership with Westat. Sections of this thesis will be submitted for publication in peer reviewed journals.

LiGHT was approved by the University of British Columbia Children's and Women's Research Ethics Board (#H16-03090). FLASHE is an open source, de-identified data set freely accessible from https://cancercontrol.cancer.gov/brp/hbrb/flashe.html, thus no ethics approval was required for its use in this thesis.

Table of Contents

List of Tables

List of Figures

Abbreviations

AA - African American

β - Beta coefficient

BCCHR - British Columbia's Children Hospital Research Institute

BMI - Body mass index

CCHS - Canadian Community Health Survey

CFPQ - Comprehensive Feeding Practices Questionnaire

CFQ - Child Feeding Questionnaire

CI - Confidence interval

CL - Complementary mediation

CP - Competitive mediation

CVD - Cardiovascular disease

D - Direct effects, no mediation

DSQ - Dietary Screener Questionnaire

FLASHE - Family, Life, Activity, Sun, Healthy and Eating

F&V - Fruits and vegetables

I - Indirect mediation

Ipsos - Ipsos' Consumer Opinion panel

IQR - Interquartile Range

LiGHT - Living Green and Healthy for Teens

M - Mediators

n - Number

NA - Not applicable

NCI - National Cancer Institute

NE - No indirect or direct effects

NHANES - National Health and Nutrition Examination Survey

NYPANS - National Youth Physical Activity and Nutrition Study

OMB - Office of Management and Budget

PCS - Perceived Competence Scale

% - Percent

PFSQ - Parental Feeding Style Questionnaire

Psex - Parent sex

R - Reference group

SCT - Social cognitive theory

SD - Standard deviation

SDT - Self-determination theory

SRQ - Self-Regulation Questionnaires

SSB - Sugar sweetened beverage

SSIRB - NCI's Special Studies Institutional Review Board

STDXY - Continuous standardized beta coefficients

STDY- Binary standardized coefficients

TNS -Tested, not significant

UBC - University of British Columbia

US - United States

X - Independent variables

YBRSS - Youth Behavioral Risk Surveillance System

Acknowledgements

This thesis would not have been possible without the encouragement and support of my supervisor, committee, lab mates, friends and family.

I would first like to thank Dr. Louise Màsse for her guidance and ability to push me to continually improve. I would also like to thank her for her adaptability given all the unanticipated challenges that were brought about by Covid-19.

Second, I would like to thank my wonderful committee members, Dr. Mariana Brussoni and Dr. Teresia O'Connor, for their helpful contributions and expertise. I have truly learned so much from listening to your feedback and insights.

To the Màsse lab, Nicole, Janae, Angelica, Yingyi, Tomoko, Jean and co-op students, thank you for working so patiently with me and always being willing to help. A very special thank you to Camilla who played a significant role in guiding me through the writing process, checking in one me and always answering my questions no matter how many I had (or the hour I sent them at).

I would like to say a huge thank you to my family and friends for their endless support and encouragement as I completed this thesis and navigated several big life changes that occured over these past 2 years outside of academia. I know I was a bucket of stress at times and you were always willing to be there, even when physically far away.

Finally, I would like to thank the Canadian Institutes of Health Research for helping fund my Master's studies over the course of this degree**.**

Dedication

This thesis is dedicated to all the adolescents out there just trying to figure out what to eat.

Chapter 1: Introduction

Childhood obesity has drastic effects on both physical and psychological health (1,2). Weight status in childhood often tracks into adulthood (3–7), having a compounding effect on the likelihood of chronic disease development (8,9). In Canada, 32.8% of adolescents (12-18 years) are categorized as overweight or obese (10). Similar rates are observed within the United States (US) at 40.0% of adolescents (12-19 years) (11). Adolescent boys have higher rates compared to girls (11–13).

Well documented changes in adolescents' dietary behaviours have been identified as a key determinant of obesity (14–17). A shift away from consumption of micronutrient rich foods like fruits and vegetables (F&V) to energy dense, but nutrient poor foods or beverages including sugar sweetened beverages (SSBs) have contributed to excessive caloric consumption (18,19) and incidence of obesity. Within Canada, adolescent boys and girls have been found to consume an average of four and a half servings of F&V each day (20), below recommended guidelines of five servings (21). In the US, adolescents (14-18 years) consume approximately two cups of F&V per day (22), approximately equivalent to three servings of F&V (23). This age group further consumes the highest amount of SSBs (20,24). One in every five Canadian adolescents consumes SSBs at least once per day (25) while approximately 25.7% of US adolescents consume soda and sports drinks at least once per day (26). Adolescent boys in particular have been found to have lower overall diet quality in comparison to girls (26–31).

Differences in boys' and girls' dietary behaviours may be contributing, in part, to the observed differences in boys' and girls' prevalence of obesity within Canada and the US (32). For this reason, it is critical to understand how boys' and girls' dietary behaviours are differentially influenced by a variety of factors (33), including the impact of parents.

Parents and the home food environment have been highlighted to play a substantial role in shaping adolescents' dietary behaviours (34). Parents rely on various food-related parenting practices (i.e., structured, autonomy supportive and controlling) to regulate the foods adolescents are exposed to or encouraged to consume (34,35). More favorable dietary patterns have been observed in adolescents exposed to autonomy supportive and structured parenting practices (36–

38). Use of controlling parenting practices have been found to correlate with less beneficial dietary patterns (39–42). Adolescents' cognitive factors including their self-efficacy or motivation for healthy eating can further be influenced by parenting practices (43). These cognitive factors can also impact dietary behaviours and have been found to predict long-term behavioural commitment (44,45). In this way, parents can indirectly impact their adolescents' dietary behaviours by influencing their adolescents' self-efficacy or motivation for healthy eating. Adolescents tend to maintain behaviours that they feel are achievable (44) or those that they perceive as personally important (45). If an adolescent is exposed to F&V or receive parental support for their consumption, they may develop confidence (i.e., self-efficacy) in their ability to consume F&V or view their intake as important (i.e., motivation), thereby increasing F&V consumption.

Evidence has highlighted that differences in parenting practices can be influenced by both parent (34,46,47) and child sex (32,48). It appears that fathers may be more likely then mothers to rely on controlling parenting practices (34,46,47,49). Use of controlling practices aligns with historical gendered connotations surrounding displays of authority as masculine (50). As controlling practices have been negatively associated with adolescents' dietary behaviours (39–42), it is possible that fathers may have more adverse impacts on their adolescents' diet quality compared to mothers. However, in more recent years, father's involvement in food-related tasks within the home environment have been on the rise (51,52). It isn't clear to what extent these changes in a father's involvement in food-related tasks influences their use of different types of parenting practices in contrast to mothers, and their subsequent effect on an adolescent's dietary behaviours.

Adolescent boys appear to be exposed to controlling parenting practices more often than girls (48,53,54). This may contribute to observations of lower self-efficacy (54,55) or motivation (56) among boys over their dietary behaviours, and may further influence differences in dietary quality among boys and girls (27).

Limited contemporary literature has considered how differences in mothers and fathers parenting practices may contribute to adolescent boys' and girls' dietary behaviours. Without this understanding, it is not clear to what extent higher prevalence of childhood obesity among

boys compared to girls may be reduced if boys' and girls' dietary behaviours were similarly supported (57). This thesis will add to the literature by exploring the influence of mothers' and fathers' parenting practices on boys' and girls' self-efficacy, motivation and dietary behaviours. These findings will deepen our understanding of how sex affects the relationship between parenting practices and adolescents' dietary behaviours, helping ensure boys and girls are equally supported to maintain a healthy weight through their dietary behaviours.

Chapter 2: Literature review

2.1 Prevalence of childhood overweight and obesity

Global rates of childhood overweight and obesity defined as a body mass index (BMI) for age above the 85th and 97th percentile, respectively, (58) have reached epidemic proportions (2,59,60). In 2014, the worldwide prevalence of childhood overweight and obesity was reported at 47.1% among children and youth (2-19 years) using data from 188 countries (61). Despite the fact that prevalence rates have plateaued within developed nations in recent years (62), no single country has experienced a significant decrease in prevalence over the past three decades (61). Sixty-two percent of all obese and overweight individuals reside within higher-income developed nations like Canada and the US (61).

In Canada, the prevalence of overweight and obese youth (5-18 years old) has been reported at 30.1% (10). Canadian adolescents (12-18 years) have higher prevalence rates with 32.8% of this age group affected, compared to 28.6% of children 6-11 years old (10). Adolescent boys (12-18 years) may represent a key at-risk group (10) as prevalence rates among boys have been reported to be up to 11.0% higher compared to girls using a mix of self-report and objectively measured data (12).

Comparatively, thirty-five percent of youth (2-19 years) in the US are considered overweight and obese (63) according to the 2015-2016 National Health and Nutrition Examination Survey (NHANES). Similar to trends within Canada, significant linear associations between prevalence of overweight and obesity are present with increases in age (11,13). Older adolescents (12-19 years) experience a higher prevalence of obesity at 40.0% compared to 18.7% in children (6-11 year-olds) (11). It seems that prevalence rates between boys and girls within the US may vary based on age or ethnicity (11,13,63). Though not statically significant from girls, prevalence rates are often observed to be higher among boys (11,13,63).

It is important to acknowledge the limits of BMI as an indicator of body size as it fails to account for body composition (12). With increasing age and male sex, greater muscle mass tends to increase based on biological mechanism, especially around puberty (12,18,19). It is possible that such differences may contribute to the differences in reported BMI between boys and girls.

However, literature has found consistent differences between boys and girls hold constant across age groups (12), suggesting that factors are likely occurring. Specifically, it has been hypothesized that differences in health behaviours, including dietary behaviours, between the two may be underlying these observations (57).

2.2 Burden of childhood overweight and obesity

Childhood overweight and obesity have been associated with numerous physiological and psychological health consequences (1,2). As weight status tracks into adulthood (3,4), reaching a higher BMI at a younger age may have more detrimental effects on long-term health (19,64). Earlier entry into this high risk health trajectory can increase the amount of time an individual has to acquire health complications across the life span (19,64). This trajectory is defined by an accumulation of negative physiological and psychological changes which are discussed below.

2.2.1 Physiological impacts of overweight and obesity in childhood

Overweight and obesity in childhood has been associated with both short and long term changes in a child's physical development (i.e., changes in body composition and size) (3–7), quality of sleep (65,66), skeletal (1,67,68), cardiovascular (8,59,60,69), and metabolic (70–73) health. Adolescents with obesity have been observed to have a higher prevalence of a clustering of unfavorable metabolic changes known as 'metabolic syndrome' (Increased insulin resistance, elevated triglyceride levels, higher fasting glucose, high density lipoproteins, and high blood pressure) compared to their normal weight counter parts (21.1% vs. 3.8%, respectively) (70). Metabolic syndrome increases the risk of chronic disease incidence, including type two diabetes and cardiovascular disease (CVD) in later adulthood (74–76). Although no experimental trials have been conducted to determine the causal effect between excess adiposity and chronic disease incidence due to ethical concerns, the temporality and dose-response relationship between excess adiposity and health risk has demonstrated a strong association (8,70,77,78).

2.2.2 Psychological impacts of overweight and obesity in childhood

In certain societies or social situations being overweight or obese can be perceived by some as being associated with negative personal and physical qualities (79). These views can lead to the teasing of children who possess these physical attributes (80), contributing to long-lasting

psychological consequences (81–83) including body dissatisfaction, depression, low self-esteem and weight preoccupation (84–87).

Weight stigma seems to disproportionately affect adolescent girls (80,84,87–90). Girls experience significantly more weight-related teasing (84,86) and internalization of weight status (53,80,81,87,88) compared to boys. Rates of body dissatisfaction in adolescent girls is linearly associated with body size, with significant increases found for those self-reporting a BMI above the 50th percentile (91). Compared to boys, adolescent girls often emphasise physical appearance (90) and body dissatisfaction (92,93) as key motivators for weight loss. It also possible that societal pressure girls and women face in maintaining a thin appearance (48,89,91–94) contributes to greater weight related teasing, especially around the time of adolescence (18,19,91,95). Natural changes in adiposity distribution spurred by puberty that support development of adiposity stores among girls more so than boys, may intensify the pressure adolescent girls experience to maintain a thin body shape (18,19,91,95). As a result, girls may experience more pressure to avoid weight gain and associated teasing at this life stage, despite the benefits associated with natural gains in adiposity during puberty (19,90).

In contrast, boys often experience societal pressure to gain muscle and maintain a larger body size (92,93). Teasing and body dissatisfaction tend to be observed at higher levels for boys who appear smaller in size, though it is also present at a lower prevalence in boys with elevated body weight (89,91). This phenomenon, referred to as a 'U-shape' of body dissatisfaction (89,91), appears among boys who self-reported a BMI above the 75th percentile or below the 25th percentile (91). Studies have found that an equal numbers of boys report wanting to gain weight as those wanting to lose weight (92,93). Though adolescent girls report higher levels of psychological consequences associated with weight status (91,93), both boys and girls experience some degree of body dissatisfaction in relation to their body weight (89,91–93).

2.3 Health behaviours and risks of overweight and obesity

Health promoting behaviours such as increased physical activity, consumption of F&V, adequate sleep and reduced screen time have demonstrated strong associations with more positive health outcomes including maintenance of an adequate weight (2,57,96). While a number of health behaviours are associated with the risk of being overweight or obese, the

remainder of this thesis will focus on the association between dietary behaviours and subsequent risk of excess weight and weight gain among boys and girls.

2.3.1 Dietary behaviours and risk of overweight and obesity

Adolescents' dietary behaviours are marked by a shift from the consumption of more nutrient dense foods like F&V to more energy dense foods like SSBs, fast food, or pre-packaged foods (18,29,33,97–99). Consumption of F&V provides more fiber and fewer calories to the body (100–102). It is thought that the fiber present in F&V helps maintain insulin sensitivity (100,101) and promote feelings of satiety by delaying gastric emptying (101–103). These satiety signals may offer protective effects against the development of overweight and obesity caused by overeating (104). The lower overall caloric content of F&V further helps promote adequate weight by contributing fewer calories per amount of food consumed (101,104). Some observational studies looking at dietary patterns have supported the notion that micronutrient rich diets high in F&V offer advantages against obesity incidence (100–104). However, other work has failed to find a significant link between F&V consumption and risk of overweight or obesity in children (105). Instead, only small associations between F&V consumption and obesity risk in adult populations occurs in conjunction with other health promoting behaviours including adequate physical activity (105). Despite these discrepancies, it is clear that F&V consumption has overall positive impact on health including promotion of ordinary cardiovascular or metabolic functioning, thus offering protection against the development of many chronic diseases (100,104). As dietary patterns track forward, commitment to consumption of F&V in adolescence is critical to support long-term consumption (33,64,106,107) and maintenance of overall health (104).

Paralleled increases between SSBs and increases in childhood overweight or obesity among children and adolescents have lent support for these beverages as a key determinant in the risk of excess weight gain (108–112). The high percentage of added sugars or the liquid form of SSBs may induce an incomplete satiety response (109,112–115), which can negatively contribute to energy imbalance through overconsumption (14,15,102,103,113). In a recent review of 32 cohort and experimental studies, those with higher quality ratings suggested that SSB intake was found to have a positive linear association with the risk of overweight and obesity (111). However,

caution needs to be expressed when comparing these studies against one another as serious methodological limitations are present (108,111,114). For example, total energy intake is inconsistently considered as a mediator or confounder in these studies. This poses concern as consumption of SSBs may coincide with less healthful dietary behaviours (15,25,98,107,116,117), acting as proxy for overall diet quality (118). Therefore, without consistent control for total energy intake or consumption of other energy dense foods, it is difficult to establish a causal link between SSB intake alone and risk of excess weight gain.

2.4 Dietary trends among Canadian and US adolescents

Based on current literature, international bodies have suggested that dietary patterns higher in F&V and lower in SSBs offer merit as a preventative health strategy (22,119). Canadian guidelines suggest adolescent boys (14-18 years) consume "eight servings of fruits and vegetables per day" and girls consume "seven" (21). Guidelines further recommend limiting the intake of "foods high in… sugar" including SSBs (120). US recommendations echo similar statements with suggested daily consumption of two cup equivalents of fruit and two and a half cup equivalents of vegetables per day (22). US recommendations offer more specific guidelines for sugar intake with recommendations suggesting keeping added sugar intake below 10.0% of total calories (22).

2.4.1 Fruit and vegetable intake

Data from the 2015 Canadian Community Health Survey (CCHS), a nationally representative survey of Canadians, suggests that adolescents (13-17 years) are consuming less F&V in 2015 than they did in 2004 (20). Adolescents are presently consuming an average intake of four and a half servings of F&V per day (20), below Canadian recommendations of five servings per day (21). Canadian boys are more likely to consume more energy dense foods (29,30,97), contributing to a lower overall diet quality compared to girls. Additional work within Canada has suggested girls may consume more mean servings of F&V compared to boys (28).

US adolescents seem to follow similar dietary trends to Canadian adolescents. Data from the 2019 Youth Behavioral Risk Surveillance System (YBRSS), a nationally representative survey of American youth in grades 9-12, suggests that boys consume less mean servings of F&V

compared to girls with 7.7% and 9.4% of boys failing to report any consumption of F&V, respectively, compared to 4.9% and 6.3% among girls (26). Among adolescent boys and girls, 91.5% are failing to consume the recommended number of fruits per day and 97.9% are failing to consume the recommended number of vegetables per day (31).

2.4.2 Sugar sweetened beverages

Adolescents represent the highest consuming age group of SSBs in Canada (20,24). Canadian youth (9-18 years) consume a total of 116 grams of sugar per day with 20.6% of this attributed to fruit juice, fruit drinks and non-diet/artificially sweetened pop (24). In an additional study considering SSB consumption (Soft drinks, energy drinks, and sports drinks) within Canada, 19.3% of participating youth report consuming SSBs "at least once per day" (25). Although Canadian recommendations do not indicate a clear numeric guidelines for SSB consumption although it suggests refraining intake of SSBs (120), based on international guidelines it seems Canadian youth are consuming more SSBs than recommend for health (104).

Consumption patterns within the US mirror those within Canada as adolescents appear to consume more added sugar from beverages then health officials recommended. In 2015, SSBs including soft drinks, fruit drinks, sports and energy drinks accounted for 39.0% of all added sugar intake in the US population (22). Among adolescent boys and girls (14-18 years old), 16.5% of total caloric intake was attributed to added sugars (22). Evidence from 2019 implies that 18.2% of boys and 11.7% of girls (Grade 9-12) consume soda at least once per day (26).

Comparable to F&V intake, boys appear to be at a greater risk of failing to achieve guidelines for SSB consumption compared to girls (25,26,28,109,121,122). In the Canadian context, adolescent boys (14-18 years) have been observed to consume the highest mean calories of SSBs per day at 227 calories, compared to 144 calories reported by adolescent girls (28). In the US, boys are more likely to consume soda at least once per day (22.3% vs. 15.4%) (26).

Given recent data from the North American context, it appears that children and adolescents are not meeting the guidelines for F&V or SSBs consumption (20,22,25,26,28). As dietary behaviours in adolescence often become entrenched (19,64,106), this life stage represents a critical intervention point (11,18,19,33,64,121) to promote adolescents' commitment to pursue

consumption of foods like F&V compared to foods like SSBs. To successfully achieve this, it is vital to understand and account for differences in the factors that affect boys' and girls' dietary behaviours (33).

2.5 Socio-ecological determinants of dietary behaviours in adolescents

Simply knowing the recommended health guidelines is not sufficient to change dietary behaviours (54,64,123). However, several factors have been identified as important. From a social ecological perspective (See Figure 1), there are thought to be four different levels of influences that affect dietary behaviours: 1. Societal; 2. Community; 3. Interpersonal; and 4. Individual (33,34,122,124). At the societal level, a number of factors such as cultural, religious or gender norms can dictate what foods are considered acceptable to consume and by whom (125–127). Next, an adolescents' physical environments - including their community and school - may limit access to certain foods, restricting intake (2,19,33). At the broader interpersonal level, social relationships between parents and peers may affect the types of foods adolescents are conditioned to consume (27,33,128–131). Finally, at the individual level preference, hunger, food literacy, self-efficacy and motivation for healthy eating all have a role in influencing adolescents' food choices (33,132).

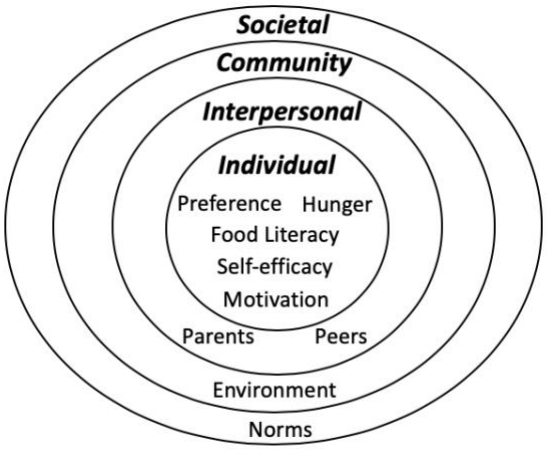

Figure 1. Social Ecological Model depicting a collection of factors that may affect adolescents' dietary behaviours.

The interplay between personal and interpersonal factors among boys and girls are of particular interest in this thesis. Gender may influence these associations as adolescents are

beginning to develop their own identity through social interactions and perceptions of societal norms at this life stage (19,33,54,128). Differences in the how gender influences personal and interpersonal factors will be discussed in the remainder of this section.

2.5.1 Societal level: Gender norms and adolescents' dietary behaviours

Unlike sex, a biologically defining factor used to characterize individuals, gender is established based upon social or cultural norms (50,133–135). Historically, this biological categorization of sex has dictated, in part, the types of roles, careers and behaviours considered acceptable for an individual to perform (136,137). For example, from a young age boys are encouraged to be tough and independent whereas girls are encouraged to emphasize agreement and focus on preparing for married life (135,138). Societal and cultural norms often postulate that gender is based off of an individual's sex, implying that physiological differences between the sexes dictate behavioural practices or health outcomes in some way (133). For some adolescents, conforming to gender norms is an increasingly challenging and even unnatural task (139–141). Greater then 98% of adolescents self-identify with the dichotomized male or female mold assigned to them at birth, however, 1.5% of adolescents do not self-identify their gender in agreement with their biological sex (139–141). Whether an adolescent identifies their gender in line with their biological sex or not, gender norms can influence an adolescents' 'gender attitude' (135) or understanding of how they should act given an understanding of their own gender in relation to gender norms (50,133–135).

The gender literature has sought to understand how gender norms and individual gender attitudes incorporate the idea of masculinity and femininity (135,137,142). Masculinity and femininity are broad characterizations classifying a set of behaviours relating to 'typical' actions of a male compared to a female defined by society (135). Often times masculinity has been associated with dominance or assertion whereas femininity has been associated with nurturing or quietness (135). One form of masculinity referred to as 'hegemonic masculinity' outlines a specific behavioural practices where males assert verbal or physical control over females (137). In such cases inequality at a societal level often appears (135). Instances of hegemonic masculinity can be observed in certain societies and cultures where inequalities in labor, pay, political rights and the division of household responsibilities are present between males and

females (143). Nevertheless, this view of masculinity has been criticized for being too narrow and fails to consider how one form of masculinity may dominate over another and not just over individuals who are considered female (144). This has led to the notion that there are many sub forms of both masculinity and femininity, with these attributes acting more as a spectrum instead of a rigid category (144). Some scholars have further argued that masculinity and femininity can be viewed as independent attributes whereby an individual possess some degree of both (136).

2.5.1.1 Gender and social modeling

Different theories detailing how youth identify their own gender ("Gender identity") and apply this knowledge through their behaviours (142) have been proposed (135,145). It is largely supported among gender scholars and consistent within these theories that social interactions facilitate an individual's perception of their gender identity in relation to gender norms (32,50,133–135,138,145). Behavioural modeling through observations or communication with parents, peers and the media can demonstrate what behaviours are considered appropriate for a boy or girl to enact (135,142,146).

Parents can act as a key role model for behaviours and set rules for how their boys or girls should act (138). For example, observations of a mothers engagement in housework (147,148) and a father's larger role in labour outside of the home may influence an adolescent's perception of 'appropriate' gender responsibilities within the home environment (149). Long standing societal perceptions have helped normalize the involvement of mothers within the home environment (32,50,148) and have contributed in part to some mothers feeling pressure to act as a home maker based on these historical norms (150). Fathers may fuel this pressure by associating household tasks as a women's domain and avoiding participation (148). Observations of these gender-based patterns in food-related tasks or beliefs in housework can have an inter-generational impact (151). Daughters whose parents expressed more historical division of labor within the home self-identify with housework as a part of their future role (151). Similarly, boys of parents who expressed more historically gendered roles conveyed greater commitment to traditional gender beliefs surrounding the division of household labor (151). This literature highlights how parents can embody and model gender-based roles to their children, resulting in an intergenerational transmission of gendered behaviours, attitudes and norms (143). However,

as the social context and expectations regarding a father's role within food-related tasks has evolved away from these norms in more recent years (49,51,52,152), the extent to which traditional gender roles are modelled by parents and adopted into their own belief systems may differ from historical literature. More mothers have expressed a desire to take on full-time work and less involvement within the home food environment compared to previous reports (52). These shifts in the time mothers and fathers spend involved in food-related tasks (49,51,152) and changes in mindset about what 'role' a parent has based upon their gender (52), could contribute to the transmission of a new type of belief about parental roles within the home being passed on to adolescents in today's society (153). It is possible that such changes have contributed, in part, to adolescent girls challenging gender norms over their behaviours in more recent years (135). Future work is needed to clarify the extent to which fathers' changing roles within the home environment influence the inter-generational transmission of historical or more modern norms to adolescents (49,52).

Peers can also model gender-based behaviours and create pressure for an individual to display certain attributes as a means to fit in (135,142). The current literature has suggested that boys are often subject to greater pressure to appear masculine whereas girls experience pressure to appear feminine (142,143,151). In addition, peers tend to reinforce (135) the pressure boys and girls experience to conform to gender ideals surrounding body shape (As discussed in section 2.2.2 above (89,91–93)), physical appearance (i.e., clothing or hair styles) (50) and typical behaviours (i.e., display of interest, sports participation, risk taking, food preferences, etc.) (137). In particular, adolescence and the onset of puberty is thought to act as a critical time in evaluation and commitment to a gender identity among youth, referred to as 'gender intensification' (135,142,149). With the physical changes brought on by puberty, greater teasing and expectations regarding conformation to gender norms of behaviour can occur (135).

Media based sources including TV, internet, video games and movies often portray females in a sexualized manner or in subordinate roles (146). In contrast, males are often displayed as the hero or assertive character (146). It is possible that these portrayals have an effect on the propagation of behavioural actions such as those associated with hegemonic masculinity (144). For example, media portrayal of males within professional culinary roles is often depicted to fall in line with hegemonic masculinity (154). Cooking within the home environment is assumed to

be a mother's role whereas cooking within a professional environment is largely male dominated and associated with aggression and toughness (154). These conflicting views of food preparation help to reinforce gender norms whereby men are acknowledged for completing a task (i.e., food preparation) that a woman is expected to complete unacknowledged as part of her maternal role.

Though much remains unknown about how adolescents form their gender identity and manage social and cultural expectations, this is beyond the scope of this thesis. Instead, this thesis will focus on understanding how gender plays a role in shaping adolescents' dietary behaviours as differences in consumption patterns based on sex may unequally effect boys' and girls' risk of obesity development (32).

2.5.1.2 Gender and dietary behaviours

Dietary behaviours can vary by region, culture and gender (118). Gender is also embedded within social context, culture and geography (50,134,137). Historically, gender literature has suggested that women and girls display behaviours that society has deemed to be 'feminine' (94,126,155) whereas men and boys partake in behaviours that are traditionally considered masculine (32,133). Dietary behaviours are no exception to these gender-based norms (48,92–94).

Lower calorie foods like F&V and smaller portion sizes have been associated with feminine connotations in society (48,126,155,156). These perceptions have arisen as a result of two different gender norms. First, the notion that females should aspire to be thin (48,89,91–94) has created a perception that in order to meet this ideal, a female will need to consume lower calorie foods like F&V (126,156). Second, by consuming F&V an individual is demonstrating a commitment to being health conscious (48), an ideal consistent with femininity in gender literature (48,94,130,157). Inversely, boys and men may experience less societal pressure to consume smaller portion sizes or select F&V (94,125,126,156) to avoid partaking in behavioural practices that have been historically associated with being more feminine (126,156). Instead, societal pressure to consume foods such as meat, that are associated with muscle or masculinity are more prevalent for boys and men (94,126,137,156,158).

Research investigating the association between gender and dietary behaviours has suggested that gendered connotations surrounding food may still be present in contemporary society. In

certain instances, women and girls have been reported to eat less in the presence of others and choose to consume lower calorie foods like F&V (48,94,125–127,155,156,159). In contrast, men and boys are observed to eat more and select less healthful food options (94,125,126,156). It is possible that both males and females embody these gendered behaviours more so when eating in mixed-sex group settings, compared to eating in same-sex group settings (94). Other literature has suggested that this group effect may be stronger among women or girls compared to men or boys (125,127,155). Work considering boys' and girls' risk perception and concern for future health in relation to dietary choice also supports maintained gender norms. In a study of Portuguese youth (15-21 years), girls expressed concern for how fruit consumption effects subsequent health whereas the same association was not found among boys (54).

The majority of contemporary literature considering the effect of gender on dietary choices has relied upon adult population groups (48,94,125,126,155,156). However, from the few published studies examining adolescents, similar results have been replicated (54,127,159). Given more recent acceptance of diverse gender identities and movement away from the dichotomized categories of sex (136), the extent to which these historical norms remain acknowledged by adolescents and influence their food choices is unclear (155). This includes the influence of gender on the interactions between parents and their adolescents' dietary choices.

2.5.2 Interpersonal level: Parenting practices

Broadly defined, food-related parenting practices encompass the tactics that parents employ to influence their child's behaviours or attitudes surrounding food (35). These practices are not to be confused with parenting style, the overall emotional environment or context parents create with their children that holds constant across numerous parenting practices and behavioural interactions (160). Though a vast amount of literature has studied the effects of food parenting practices, differences in the categorization and operationalization of parenting practices among studies make comparisons difficult (35,161). To simplify this issue, this thesis will use the three higher order categories of food parenting practices defined by Vaughn (2016): 1. 'Structured parenting practices' which include non-coercive techniques meant to help a child learn to maintain health promoting dietary behaviours by a parent's organization of the home environment (i.e., food rules, modelling, availability, and monitoring); 2. 'Autonomy supportive

parenting practices' which includes strategies that promote a sense of personal volition and self-regulation in a child over their own dietary behaviours (i.e., education, child involvement in food preparation, encouragement for healthy eating and food negotiation); and 3. 'Controlling parenting practices' which encompasses parental punishment, bribery, force, threats, guilt or use of food as an emotional reward to enforce a parent's food-related beliefs, desires and behaviours on to a child. Despite peers' growing influence on youths' dietary practices with increasing age, especially in social settings (33,55,127,132,159), parents continue to maintain an influential role over certain aspects of their adolescents' dietary behaviours (122,152,162–164). In addition, parents can influence the foods an adolescent chooses to consume away from the home (34) by helping shape their adolescents' self-efficacy (40,119) or motivation for healthy eating (121,165–167). A detailed description as to how adolescents' cognitive factors (Self-efficacy and motivation) affect dietary behaviours and the role of social influences (Including parents), can be found in section 2.5.3 below. The remainder of this section will highlight the links between parenting practices and adolescents' dietary behaviours.

2.5.2.1 Structured practices and adolescents' dietary behaviours

Structured parenting practices including home availability of F&V (34,36,168–171), parental modelling of their consumption (36,37,162,170,171) and food rules (168) have been found to have significant positive effects on a child or adolescents' dietary behaviours (122,172). Availability of foods within the home directly controls which foods an adolescent can easily access (121). Parental modelling of F&V intake may demonstrate to an adolescent that eating F&V is important and feasible (173). This can help normalize F&V intake (34,130,163). Inversely, modelling of less healthful dietary behaviours such as SSB consumption can have a negative effect on a child or adolescents' diet by normalizing the intake of these less healthful foods (34,170,171). Food rules surrounding SSBs consumption may be an effective strategy to monitor or limit a child's or an adolescent's intake (168). Such rules may be especially advantageous in situations where an adolescent feels unable to effectively regulate their own dietary consumption (39).

Greater home availability of F&V and modelling of their consumption correlates with increased intake among children and adolescents (34,36,37,122). Parent rules regarding

consumption of SSBs have also been found to have positive dietary effects (168). Absence of parental food rules or modelling of F&V consumption has been observed to correspond with less healthful dietary behaviours including increased intake of energy dense foods (34,168,170).

2.5.2.2 Autonomy supportive practices and adolescents' dietary behaviours

Parental encouragement for healthy eating (38,121,171,174) and verbal negotiation (36,169) for the amounts and types of foods consumed seems to have positive impacts on adolescents' dietary behaviours. Adolescents who are encouraged to consume more F&V by their parents are observed to eat more of these foods (38), and have greater dietary diversity and balance (174). It is thought that through negotiation, adolescents' preferences are still being taken into account (129) while parents help guide dietary choices towards favourable outcomes.

2.5.2.3 Controlling practices and adolescents' dietary behaviours

Controlling parenting practices are thought to have more negative effects on adolescents' dietary behaviours (40,121). As adolescents are typically beginning to gain autonomy (19,33,38,55,98), more rigid parent control over dietary behaviours can be especially counterproductive (40,175). Parental control may reduce a child or an adolescent's ability to regulate their food intake based on satiety (42,175). By learning to rely on external cues for when and what to eat instead of hunger (42), an enhanced risk of overeating is created (96,176). This concern may be especially prominent when parents use food as an emotional reward (41,42). Harsh parenting, and being forced to restrict consumption of SSBs can also increase adolescents' preference for such foods or drinks (41,46,177), contributing to their increased intake (172). This may be especially problematic when SSBs are freely available within the home and their intake is modelled by parents (171).

Nevertheless, additional literature has indicated that high levels of parental control including parental force can have a positive effect on F&V consumption (41,46,172). These controlling practices may be beneficial when an adolescent feels incapable of restricting their intake of foods like SSBs (39,177).

In a single cross-sectional study considering parental control, it was found that children (9-13 years) exposed to higher levels of parental control (i.e., using food as an emotional reward and force) reported greater intakes of both unhealthy and healthy foods (41). This may indicate that parental control can be both beneficial and have adverse impacts on adolescents' dietary behaviours. Additional cross-sectional literature has proposed that food restriction can impact a child's BMI unfavourably despite no significant associations with dietary intake observed (42). However, due to the nature of this study design, it is also possible that parents use different parenting practices in response to their child's BMI (42). This work seems to support theories indicating that greater parental control increases food consumption overall, having a negative effect on energy balance. Adolescents (12-15 years) who self-identified as 'healthy eaters' have also been found to report higher levels of autonomy supportive parenting practices while those identifying as 'unhealthy eaters' report greater parental control (39).

Though the literature has consistently suggested that all three types of parenting practices do have significant influences on a child's dietary behaviours (34,36,46,170), substantial limitations are present. The majority of available studies do not clearly define parenting practices based on the literature (39,54,121,165–167) or consider the effect of gender (38,47,55,57). Untangling the influence of mothers and fathers on boys' and girls' dietary behaviours over time is critical for long-term health (34,162).

2.5.2.4 Gender and parenting practices

As touched on above (See section 2.5.1.1), it is typically assumed that mothers have a greater role than fathers over the home food environment (32,50,148). Despite more women entering into the workforce in more recent decades and fathers taking a more active role within the home (51,52), mothers have largely remained the main parent in charge of the home food environment (49,52,148,152). Research from the United States in 2016 suggested 88.3% of mothers remain involved in food preparation versus only 40.4% of fathers express such a role (178). Similar research has also supported these findings with 83.8-89.1% of mothers identified as the main food purchaser and preparer (148,179). Despite rationalization for this unequal distribution in household food-related tasks highlighting greater time or skills among mothers, underlying gender norms are largely influencing these patterns (148).

Many mothers may still feel that it is part of their role to perform food-related tasks due to long-standing observations of their own mothers and grandmothers preforming such tasks (148,150,152). Though some mothers acknowledge these gender-based norms and express greater contentment with their role being defined in this way, others wrestle with these norms that place them unequally as the key parent in charge of the home food environment (148,152). For example, some mothers express frustration with their role as the key food provider within the home despite working outside the home as much as their husbands (152). These mothers emphasize how they would like to see greater involvement from their spouse in daily food-related activities to more equally divide household tasks (152). It is possible that a father's perceptions of family food-related tasks as a mother's domain (94) reduces the likelihood of their participation regardless of their partners involvement outside of the home (148). These views may promote an inequality in food-related tasks furthering a mother's frustration (152). Some literature has suggested that in order to rationalize this inequality in family food-related tasks, mothers have suggested that they simply have more time or better skills to adequately provide food for their families (148). This has contributed to expectations that mothers are responsible for educating their children on food literacy skills (180). As literature considering fathers as the key parent in charge of a family's food-related tasks is scarce, it is difficult to interpret how fathers parenting practices affect the dietary behaviours of their adolescents and if those who take on a larger role within family food-related tasks are different in some way from fathers who embody more traditional roles in food work (152).

Though still unequal, fathers increasing involvement in food-related tasks in recent years has created a need to understand the effects fathers have upon their adolescents' dietary behaviours (49,152). Some literature has suggested that fathers' roles increase as their adolescents age (49) or that fathers rely on different practices compared to mothers (152). In a recent scoping review considering fathers involvement in food-related parenting practices it was found that only 26.0% of the 77 studies focused on a father's role in their children's dietary behaviours through food-related parenting practices (49). Of these studies, most consist of a small sample of fathers ($n<100$) and only 18.3% considered relationships among adolescents (49). Future work considering the role of fathers in their adolescents' dietary behaviours is necessary to clarify how mothers and fathers may differently impact their children in today's parenting climate (49).

As historical gender norms have placed a mother as the authority over food-related tasks and nutrition, adolescents may look towards their mother as a role model for dietary behaviours compared to their fathers (43,151,169,174,181). Some evidence has indicated that dietary behaviours of children and adolescents correlate with the behaviours expressed by their mothers (159,161,162,153,160). However, methodological limitations within these studies need to be considered. Many of these studies exclusively consider a mother's dietary behaviours (43,169), rely upon adolescent self-report (174) or contain a very small number of participating fathers (170,181). Due to these limitations, fathers' influence on their children and adolescents' dietary behaviours are largely under-investigated (152) and may be misinterpreted. Currently, three different schools of thought underlying how boys and girls may look towards their mothers and fathers as an example of dietary behaviours are present.

It is possible that mothers and father may rely on different types of parenting practices (34,46,47,148,150,152,177,182). Mothers have been suggested to rely upon more structural or autonomy supportive parenting practices compared to fathers (47,177,182), including modelling of F&V consumption or encouragement for healthy eating (148,150,152). In contrast, fathers have been observed to rely on more controlling parenting practices (i.e., pressure to eat) (34,46,47,177,182). The differences may reflect embodiment of gender norms. Norms associating less forceful, more supportive techniques with a more caring or nurturing persona fit in line with historical perceptions surrounding a 'good mother' and femininity (150). In contrast, use of controlling behaviours is consistent with masculinity, an attribute associated with being a father (50). As use of more supportive parenting practices have been found to be better received by adolescents (34,35), it is possible mothers may have a more beneficial effect on adolescents' dietary behaviours. However, additional studies have suggested no differences between mothers and fathers in terms of their use of structure, controlling or autonomy supportive parenting practices (49).

Boys and girls may look towards the dietary behaviours of their parent with similar gender as a model of how to appropriately act. For example, a boy may experience greater pressure to follow the dietary behaviour modelled by their father by interpreting practiced behaviours as typical of a male (32,151). Through this, a boy may enact behaviours they have socially been conditioned to associate with masculinity (151), consistent with current gender theory literature

(50,133,134). In contrast to boys, girls may feel less pressure to mirror the dietary behaviours of their fathers based on societal norms that postulate a father's behaviours as appropriate for a boy and not a girl (50,133,134,151). In the same way, a girl may follow the dietary behaviours modelled by their mother instead of their father.

Mothers and fathers may exert control over different domains of their adolescents' dietary behaviours (152,170). Boys and girls may look towards their fathers as the key authority over consumption of less healthful foods but their mother as the role model for consumption of health promoting foods like F&V (151). In a study comparing dietary intake patterns of parent-child (6-16 years) dyads, both boys and girls were more likely to consume more sweets and high fat foods if their fathers consumed higher amounts of these foods and the two shared meals together, regardless of a mother's dietary pattern (170). Additional literature has suggested that a father's use of controlling parenting practices has a negative association with their children diet by increasing the consumption of less healthful foods (49). Qualitative literature also seems to support these findings through observations that boys and girls are more likely to go to their fathers when they crave junk foods (152). Adolescents tend to perceive their fathers as less healthy, less competent in nutritional literacy (148,150) and thus, more likely to indulge their cravings (152). Mothers have also expressed concern in their husbands' tendency to give in to their adolescent's cravings (152).

These three schools of thought lend support for a gender effect based on the relationship between mothers and fathers and their adolescents' dietary behaviours (152,170). However, due to the limited amount of literature available, more work considering the role that fathers have on their son's and daughter's dietary behaviours is needed to clarify this theory (38,47).

2.5.2.5 Child or adolescent gender and parenting practices

Similar to differences in parent gender, it is possible that adolescent gender also affects the likelihood of one type of parenting practice being used over another (32). Differences in the parental treatment of boys and girls have been documented since infancy (32) and found to last throughout childhood (48). Though limited literature has explored these interactions in the context of food-related parenting practices, it does seem that differences in parenting practices based on their child's gender are present.

Boys are more often reported to be exposed to more controlling parenting practices (46) and receive less social support for food literacy skills (48,53). Girls seem to experience more supportive parenting practices for F&V consumption in general compared to boys (38,54) and education on food literacy skills (53). These differences in parenting practices could contribute to the observed higher quality of adolescent girls' dietary intake (34,123) However, literature has also suggested that boys may respond in positive ways to more parental 'regulation' (Defined as a mix of controlling and structural practices) of the home food environment (121). It has been hypothesized that this could occur as boys tend may receive greater restrictions over their diet so when autonomy is provided, it has more noticeable or novel effects over dietary behaviours (121). Parental encouragement for healthy eating for both boys and girls has further been suggested to decrease with age (38).

Currently, the majority of the literature considering the use of controlling parenting practices is cross-sectional (46,47,53,54) or includes younger children (41,111,159). As parenting practices tend to support more autonomy with increasing age (33,34), research considering changes in parenting practices overtime would be valuable. Current literature may not accurately reflect the relationship between mothers' and fathers' parenting practices for older adolescent boys and girls (34,47). Large reliance on cross-sectional studies also fails to untangle the bidirectional effect of parenting practices (42). It is entirely possible that parents rely on more controlling parenting practices as a result of their child behaviour or health characteristic, or that more controlling parenting practices cause a particular behaviour response in a child.

2.5.3 Individual level: Cognitive factors and adolescents' dietary behaviours

Personal factors affecting youths' dietary behaviours can be grouped into three separate categories: 1. Biological; 2. Learned; and 3. Cognitive factors. Biological factors such as hunger and taste, including a preference for sweetness (183), have been suggested as the main driving forces behind eating (2,39,129,132). Learned factors such as repeated exposure to foods can normalize the consumption of foods like SSBs, having a positive effect on intake (2,33,177). Lastly, cognitive factors affect an adolescent's internal drive to select one food over another. These cognitive factors include self-efficacy (36,40,46,130,157,184,185), motivation (36,56,165–167,186), intention (27,162,167,187), attitudes (27,46,162,167), competency

(123,166) and enjoyment (167) in healthy eating. While there are many personal factors associated with children and adolescents' dietary behaviours, this thesis will focus on the role of self-efficacy and motivation. Both self-efficacy and motivation have been well documented within the literature to have significant associations with adolescents' dietary behaviours (44,45,54,173) and are often assessed within behavioural research on this topic.

2.5.3.1 Self-efficacy and adolescents' dietary behaviours

Social cognitive theory (SCT) suggests that self-efficacy, or one's confidence to be successful in a given behaviour, directly affects an individual's likelihood and commitment of performing that behaviour (See 2) (44,188). By observing the behaviours of other individuals (Normalization) or trying a particular behaviour and achieving success (Outcome expectation), an adolescent increases their self-efficacy to perform a behaviour (44,130). For example, use of structured parenting practices (i.e., modelling or food availability) or autonomy supportive practices (i.e., encouragement) can help normalize consumption of these foods within the home (34,130,163). Through this normalization, an adolescent may feel more capable or confident in choosing to consume F&V over less healthful foods by watching their parents successfully make these choices or having reduced barriers to access these foods (44,188). In contrast, parenting practices that focus on forcing an adolescent to perform a behaviour (i.e., controlling practices) that seems unusual or difficult may contribute to an adolescent developing a negative attitude towards consumption of forced foods (41,42,175). This would have a harmful effect on an adolescent's dietary self-efficacy (39).

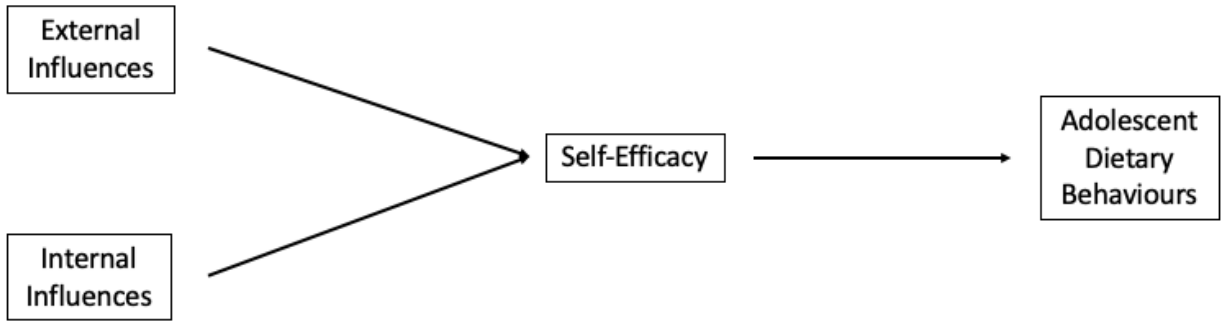

Figure 2. Relationship between self-efficacy and adolescents' dietary behaviours.

The literature has suggested self-efficacy in dietary behaviours has positive effects on adolescents' food choices. Adolescents' expressing greater self-efficacy for the consumption of F&V consume more of these nutrient rich foods (46,55,130,185). Furthermore, adolescents' who also express greater dietary self-efficacy to limit their consumption of less healthful foods such as junk food, have a reduced intake of these foods (43,189).

2.5.3.2 Motivation and adolescents' dietary behaviours

According to Ryan and Deci's Self-determination theory (SDT) (45,190), an individual's motivation to perform a particular behaviour significantly impacts their commitment and intention of performing that behaviour (Figure 3). By experiencing a sense of volition, autonomy or enjoyment in one's actions, feelings of internal motivation are created (45). For example, when an adolescent is able to select the types of F&V they can consume (i.e., autonomy supportive parenting practices) they experience a sense of autonomy over their dietary behaviours (40,121,167). SDT argues that adolescents who are intrinsically motivated are more likely to fulfil their psychological needs and partake in health promoting behaviours (45). In a study of youth (14-22 years), those who perceive their parents as more autonomy supportive report better attitudes and beliefs surround F&V consumption, positively affecting their enjoyment, intention and commitment to consume these foods (167). Inversely, adolescents who are exposed to more external control, including societal pressures or parental force, have poorer behavioural and cognitive outcomes (45,190). These adolescents are less likely to adopt a long-term commitment to forced behaviours, like F&V consumption, as once an external control is removed the performance of that behavior is likely to cease (34,39,45). However, certain forms of extrinsic motivation, referred to as identified or integrated regulation, can mirror the behavioural commitment associated with intrinsic motivation (45). Adolescents who self-identify as being externally driven to pursue specific behaviours (i.e., F&V consumption) may view these behaviours as important, adopting them into their personal belief system and maintaining a commitment to enact such behaviours in the long term (45,166). For example, parental modelling of F&V intake (i.e., structured practice) can contribute to an adolescent viewing F&V consumption as an important part of their diet. These adolescents may then be more likely to consume F&V in adulthood (191) by adopting F&V consumption into their personal belief system (165,166).

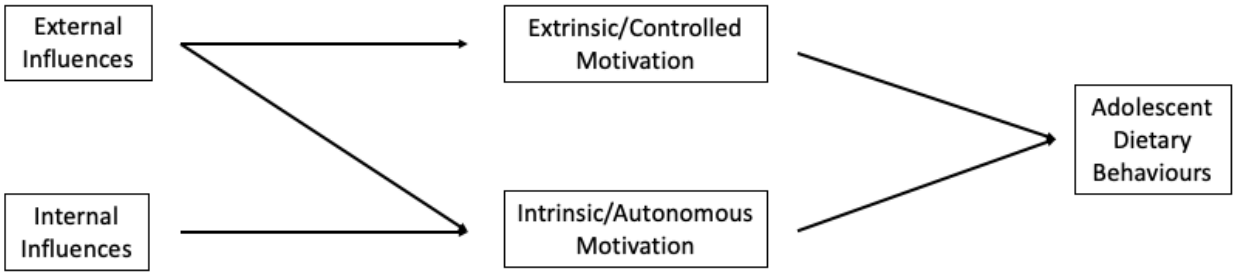

Figure 3. Relationship between motivation and adolescents' dietary behaviours.

Autonomous or intrinsic motivation has been linked to more beneficial dietary outcomes including F&V consumption (39,56,121,167,186,192) and reduced SSB consumption (121,193). It has been proposed that adolescents' intrinsic motivation can foster an intention or enjoyment in eating F&V (167). Literature considering the effects of extrinsic motivation over dietary behaviours have presented mixed results. Some studies have argued that more external control has a negative effect on consumption of F&V by leading to negative attitudes (41,42) or a lack of enjoyment (190) in their intake. When an adolescent is forced to consume a food (Like F&V) they can develop a dislike for such foods and an increased preference for other foods that are often restricted (Like SSBs) (34,39). When an adolescent is then provided with an opportunity to select the foods they want to consume they are more likely to choose the foods that are often restricted to them (34,39). However, other studies have argued that without extrinsic motivation, an adolescent would be unable to effectively regulate their dietary behaviours (39,166). Consumption of F&V may not be perceived as inherently enjoyable for adolescents (132,165) due to a preference for sweet and savory tastes (194,195) or perceptions that F&V are 'adult foods' (33,132). Instead, adolescents tend to choose foods based on palatability (2,33,129,132), a trait often consistently lacking an association with F&V among this age group (132). By initially experiencing greater extrinsic motivation for F&V consumption, perhaps through events such as parental provision or encouragement, an adolescent can learn to appreciate the importance of F&V consumption through identified or integrated pathways (165,166). This would result in maintenance of F&V consumption overtime (45) having a beneficial effect on dietary behaviours. It has been thought that if an adolescent internalizes F&V consumption into their personal belief system, positive cognitive outcomes can be achieved that contribute to long term dietary behaviours through controlling parenting practices (166).

Both self-efficacy and motivation represent strong cognitive factors that affect an adolescents' likelihood of continually consuming F&V compared to less healthful foods like SSBs (Figure 4) (44,45,54,173). These cognitive factors may be experienced differently among boys and girls and are discussed below in the next section.

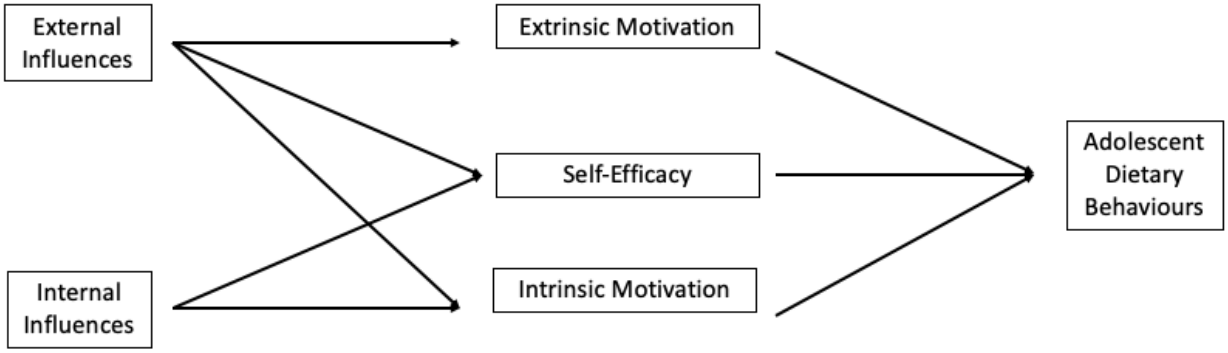

Figure 4. Relationship between cognitive factors and adolescents' dietary behaviours.

2.5.3.3 Gender and cognitive factors associated with healthy eating

Research considering the differences in boys' and girls' cognitive factors is very limited and has produced mixed results. These differences could result from societal gender-based pressures surrounding the roles that boys and girls are assumed to have with food. However, to date, no literature has robustly considered the theoretical underpinnings as to why these differences may arise (43).

It is possible that girls experience greater self-efficacy for healthy eating compared to boys. Literature suggests that boys are often not encouraged to learn food literacy skills to the same extent as girls (53,196,197). Historical gender norms postulate that it is more appropriate for girls to learn food-related skills to prepare for married life (138). Factors such as these may result in greater dietary freedom and training among girls (48,53,196,197), having positive effects on girls' dietary behaviours in the long run (178,180). In contrast, if boys do not feel capable of preparing or selecting F&V, they are less likely to pursue their consumption (143,144). Though less entrenched in society today, it may be more likely that a girl's observation of older female figures demonstrating greater nutritional knowledge, role in food preparation and commitment to health promoting dietary behaviours compared to males (148,152,179,182) promote a girl's self-

efficacy to pursue such behaviour through peer normalization (44). Greater freedom over dietary behaviours or food literacy could also have a positive impact on a girl's sense of enjoyment and volition in F&V consumption (45). These factors may promote greater intrinsic motivation for F&V consumption among girls (45). Inversely, it is also possible that external pressure to maintain a thin appearance encourages the consumption of lower calorie foods like F&V (48,90) through extrinsic pathways (45).

In contrast, boys observations of other male figures consuming less F&V (148,150,152), or expressing greater disinterest in healthy eating (32) may contribute to reduced confidence, personal enjoyment or value for consuming F&V among boys (198). This in turn can promote a lower sense of self-efficacy (48,199) or intrinsic motivation (45) in food preparation and dietary monitoring. Fitting in line with these notions, more girls in a US sample (n=737, 53.5% girls) of 7-11th graders stated an interest in healthy eating (50.0%) and weight loss (44.7%) compared to boys (34.1% and 33.2%, respectively) (157). It is possible that the higher interest and pressure for appearance stated by girls may contribute to greater motivation (Intrinsic and extrinsic) to pursue health promoting dietary behaviours compared to boys. However, the literature has also suggested that boys may respond in positive ways to more parental 'regulation' (Defined as a mix of controlling and structural practices) of the home food environment, influencing their intrinsic motivation for healthy eating more so than girls (121). It has been hypothesized that this could occur as boys tend to have greater restrictions over their diet so when autonomy is provided, it has more noticeable or novel effects (121).

Data from longitudinal, cross-sectional and qualitative research have indicated that girls may experience greater dietary self-efficacy (39,46,54) or intrinsic motivation (56,121) compared to boys. Other cross-sectional work has suggested no differences in self-efficacy (163,168,185) or higher levels among boys (55).Variation in the types of measures used to assess boys' and girls' self-efficacy and/or motivation in their dietary behaviours may play a role in the incongruencies between studies. Future work using population validated measures to assess both of these cognitive factors is necessary to clarify why these observed differences may arise and if they hold true across diverse populations.

2.6 Study rationale

Limited literature has robustly tried to disentangle the effect of gender on the relationship between parenting practices (34,47) and boys' and girls' dietary behaviours (38). Understanding these interactions will help develop more effective interventions within the home environment that support adolescent girls' and boys' consumption of F&V and reduced intake of SSBs. By promoting these dietary behaviours, lifelong benefits can be achieved including a reduced risk of overweight and obesity development (164,173).

2.7 Study aims & hypotheses

The purpose of this study was to examine the influence of parenting practices, adolescent self-efficacy, intrinsic and extrinsic motivation on Canadian and American boys' and girls' dietary behaviours. This thesis has three aims and hypotheses:

Aim 1: Explore the associations between parenting practices and adolescents' dietary behaviours including the moderating effect of parent gender for boys and girls (Figure 5).

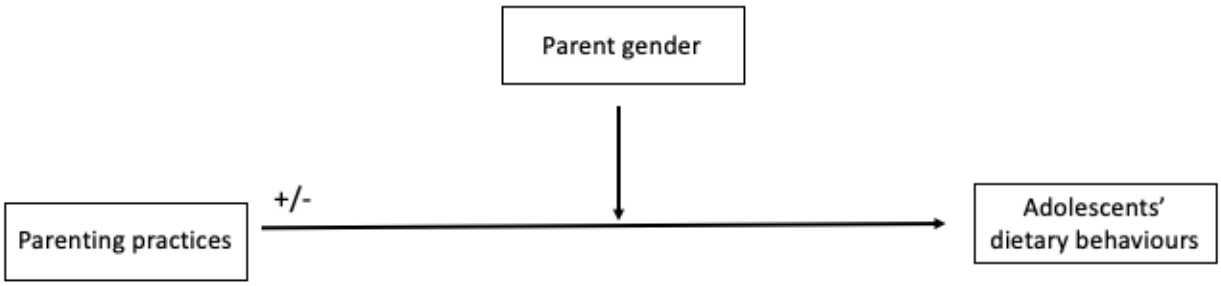

Figure 5. Theoretical model depicting the effects of parenting practices on adolescent consumption of F&V and SSBs.

Hypothesis 1a: Autonomy supportive and structured parenting practices will correlate positively with adolescents' consumption of F&V and negatively with adolescents' consumption of SSBs. Controlling parenting practices will have the opposite associations (i.e., negative association to F&V consumption and positive association with SSB intake).

Hypothesis 1b: Parent gender will have a moderating effect on the associations between parenting practices and boys' and girls' consumption of F&Vs and SSBs.

Aim 2: Investigate the associations between adolescents' self-efficacy and motivation (Intrinsic and extrinsic) and their dietary behaviours (Figure 6).

Hypothesis 2: Presence of self-efficacy and intrinsic motivation to regularly consume F&V and limit SSBs will correlate positively with boys' and girls' F&V consumption and negatviely with their SSBs intake. Greater extrinsic motivation over dietary behaviours will correlate negatively with boys' and girls' F&V intake but positively with their SSB intake.

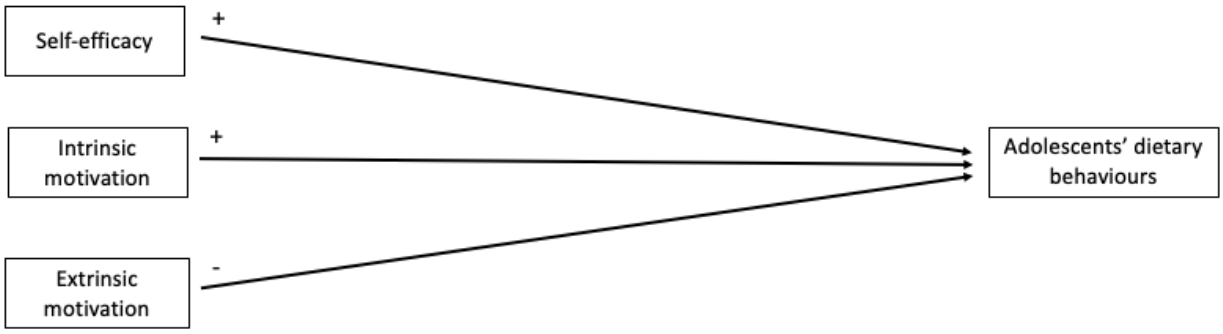

Figure 6. Study theoretical model depicting the effects of adolescents' cognitive factors on their dietary behaviours.

Aim 3: Examine if boys' and girls' self-efficacy, intrinsic or extrinsic motivation partially or fully mediates the associations between parenting practices and adolescents' dietary behaviours, while accounting for the moderating effect of parent gender (Figure 7)

Hypothesis 3a

Autonomy supportive and structured parenting practices will have a positive association with boys' and girls' self-efficacy and autonomous motivation for consuming F&V and SSBs. Controlling parenting practices will have a positive association with boys' and girls' extrinsic motivation for F&V and SSB consumption but a negative association with self-efficacy and intrinsic motivation.

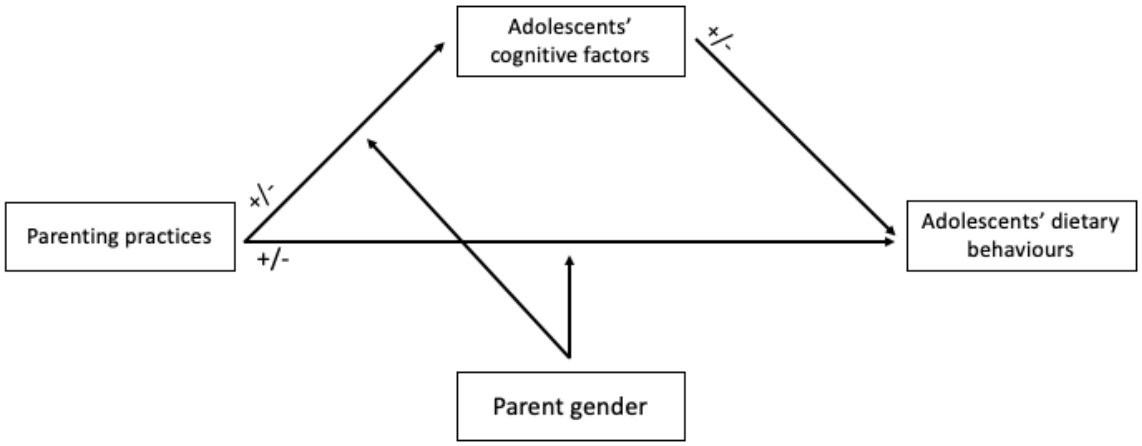

Figure 7. Study theoretical model depicting the effects of parenting practices on adolescents' dietary behaviours through adolescents' cognitive pathways.

Hypothesis 3b

Parent gender will moderate associations between boys' and girls' self-efficacy, intrinsic and extrinsic motivation and dietary behaviours.

These three outlined aims and corresponding hypotheses were assessed in both a Canadian and US sample to consider if the relationships found can be replicated across different population groups. As this thesis is exploratory in nature and current literature is inconclusive as to the effects on mothers compared to fathers on their adolescents' dietary behaviours, no specific hypothesis regarding the direction of moderation was made in aims 1 and 3.

Chapter 3: Methods

3.1 Study design

In this thesis, I conducted a secondary analysis using two different data sources; a Canadian longitudinal project and an open-source data set from the US. By using these two samples, this thesis was able to evaluate the stability of gendered interactions across diverse populations.

The Canadian sample consisted of data collected as part of the Living Green and Healthy for Teens (LiGHT) project. The overall purpose of LiGHT was to test the efficacy of a gamified mobile app, Aim2Be©, in promoting healthy behaviours among Canadian adolescents (13-17 years). Aim2Be© used behaviour change strategies to promote the adoption of practices in line with current Canadian recommendations regarding diet, physical activity, sleep and sedentary behaviours. This thesis utilized the baseline data from the formative evaluation of Aim2Be© collected from March 2018-October 2018. Ethics approval for LiGHT was approved by the Children and Women's Research Ethics Board at the University of British Columbia (H16–03090).

The American sample contained data from the Family Life, Activity, Sun, Health, and Eating (FLASHE) Study. This study was supported by the National Cancer Institute (NCI) in partnership with Westat (Rockville, MD). The goal of FLASHE was to consider cancer-related lifestyle behaviours among parent-adolescent (12-17 years) dyads (200) including dietary behaviours, physical activity, parenting practices and other health related behaviours like smoking, sleep and sun safety (201). Cross-sectional data were collected using self-report from April 2014 to October 2014 via internet-based surveys. The US Government's Office of Management and Budget (OMB), NCI's Special Studies Institutional Review Board (SSIRB) and Westat's Institutional Review Board (IRB) all approved study procedures and collection materials (201). The de-identified data are freely available online from the NCI website (200). Due to the open source nature of this secondary data set, no ethics approval was required to analyze the FLASHE data for this thesis.

3.2 Participants

3.2.1 Canadian sample

Canadian participants were recruited using a web-based panel managed by InSights West. This Canadian market research company recruited members via web advertisement or random digital dialling to increase the representation of minority groups within the sample pool (15.0% Chinese, 12.0% Asian, 6.0% First Nations/Metis/Inuit and 5.0% other ethnic groups). To take part in the LiGHT project, participants had to meet the following criteria: both parent and child (13-17 years) had to be literate in English and able to read at a minimum of a grade five reading level, have access to an electronic device that is connected to the internet and freely give consent to participate. Parents additionally had to be the primary caregiver of the participating child. Participants were excluded if: the child had any physical or psychological conditions that limited their physical activity or severely restricted their dietary intake, and if the child had a type one diabetes diagnosis.

InSights West initially screened 1418 potential parents. Once eligibility was determined, parents were briefed about the LiGHT Project and asked if they were interested in participating. Parents who provided consent to be contacted electronically by the research team at the University of British Columbia (UBC) were then provide additional study details by UBC research staff. After this briefing, parents interested in participating provided consent and adolescents were sent an assent form.

Of 1418 screened prospective families, 873 parents met the eligibility criteria. Of these, 632 parents agreed to be contacted by UBC researchers. After initial contact, 438 parents and 387 adolescents provided full consent to take part in the LiGHT Project. Of those who consented, 426 parents and 371 adolescents completed baseline assessments. Participants received financial compensation for completing study tasks with a maximum honorarium of $100 CAD awarded for completion of all questionnaires with partial incentives paid out for partly complete surveys.

3.2.2 US sample

Participants who took part in the FLASHE Study were recruited from the Ipsos' Consumer Opinion panel (Ipsos) (200). This US-based panel was used to obtain a nationally representative sample of families on key demographic factors including age, sex, income, region, household size and ethnicity. Participants in this panel were recruited through print advertisements, internet sources, and referrals (201). To be eligible to participate in the FLASHE study, participants had to meet the following inclusion criteria: parents had to be the legal guardian of the participating adolescent, be older than 18 years of age and live with that adolescent at least 50% of the time. Adolescents had to be between the ages of 12-17 years. No specific exclusion criteria limiting participation was applied.

Ipsos allowed parents to complete a screener to establish eligibility. Once eligibility was determined parents were asked to provide electronic consent and additional contact details. Ipsos screened and provided contact information of 5,088 dyads who met the inclusion criteria to the research team at Westat. Electronic assent forms were then sent to adolescents of parents who had consented. Once adolescent assent was obtained, a dyad was considered enrolled. Recruitment continued until researchers obtained a representative sample based upon sex, ethnicity and adolescents' age similar to the general US population (201). Each recruited dyad completed three web-based surveys: 1. Demographic; 2. Diet and factors affecting dietary behaviours; and 3. Other lifestyle behaviours with an emphasis on physical activity (200). Only the demographic and diet surveys were analyzed for this thesis.

Of the 5,027 participant dyads originally invited to participate in FLASHE, 1,945 provided consent/assent and were considered enrolled. Of these, 1,479 dyads completed the cross-sectional surveys (1,745 parents and 1,657 adolescents) (201). Participants received a maximum honorarium of $10 US for each completed study questionnaires (201).

3.3 Measures

Self-reported questionnaires were used in LiGHT and FLASHE to assess parent and adolescent characteristics including dietary behaviours, mediators of behaviour change (Self-

efficacy, intrinsic and extrinsic motivation), parenting practices and socio-demographic information. Additional details surrounding the relevant variables to this thesis can be found below. A contrasted list of applicable survey measures from each data source can be found in 0

3.3.1 Adolescents' dietary behaviours

In LiGHT and FLASHE, dietary intake was assessed using questions adapted from the National Youth Physical Activity and Nutrition Study (NYPANS) (202). These dietary measure were validated against 24-hour dietary recall data (Corrected r values of 0.14-0.29 and 0.26-0.49, respectively) (203,204). FLASHE also used additional items modified from the Dietary Screener Questionnaire (DSQ) (205). Validity of DSQ items (Including F&V and fruit juice intake) has been compared to 24-hour dietary recalls with correlations of 0.5-0.8 among adult populations (206).

Participants were asked to recall the number of times they consumed fresh, frozen or canned fruit excluding 100% fruit juice (One item), vegetables (Separate for potatoes (One item LiGHT, two items FLASHE), green lettuce/salad (One item) and all other vegetables) and 100% fruit juice (One item), and SSBs including non-diet pop (Or soda), fruit-flavored drinks, sports drinks, energy drinks or other sweetened drinks (Two items LiGHT, five items FLASHE). In LiGHT, responses were categorized as "none", "1-3 times", "4-6 times", "1 time per day", "2 times per day", "3 times per day" and "> 4 times per day." In FLASHE, participants could respond using the same categories with an additional category of up to "3 or more times per day." It is worth noting that measure of times consumed per day does not equate to number of servings consumed by adolescent per day.

Slight differences in how LiGHT and FLASHE participants were asked to recall their dietary consumption were present (See 0In addition to the SSBs listed above, LiGHT participants were also asked to consider their intake of "sweetened tea or coffee drinks (Such as iced tea, Starbucks latte or Frappuccino etc."). LiGHT participants were also asked to report their intake of regular soda or pop separately from all other SSBs (Two items) whereas FLASHE participants were asked to report their intake of each SSBs category separately (Five items). Similarly, potato consumption in FLASHE was split into two items ("Fried potatoes like French fries, tater tots,

hash browns etc." and "other kinds of potatoes that aren't fried like baked, mashed, boiled etc.") whereas LiGHT combined these items as one item.

For analysis purposes, a F&V measure was summed to estimate the daily average times F&V were consumed per day using two items (Fruit consumption and vegetable consumption, excluding questions individually asking about fried potato, potato and lettuce consumption). To operationalize SSB intake, participants' responses were converted into a continuous variable 'number of times consumed per day.' Responses from FLASHE were summed together as one SSB measure in a similar fashion. Due to the controversy surrounding consideration of 100% fruit juice and associations with adverse health outcomes (207–209), this thesis excluded measure of 100% fruit juice as a serving of F&V to reflect this nuance in recent amendments to current guidelines (22,120,210). Violations of normality caused both the F&V and SSB measures to be transformed using the square root to facilitate parametric analysis.

3.3.2 Adolescents' self-efficacy for healthy eating

Adolescents' self-efficacy over their dietary behaviours was measured using two modified items from the Perceived Competence Scale (PCS) (211) in both studies. The PCS has been found to have a high internal consistency among adult diabetic patients with Cronbach alpha values of 0.84-0.87 reported (212).

The two self-efficacy items used in LiGHT were more specific with participants being asked if they felt confident to "eat at least 6-8 F&V every day" and "cut sugary drinks from [their] diet." FLASHE participants were asked more broad self-efficacy questions including adolescent confidence to "eat F&V every day" and "limit the amount of junk food and sugary drinks". Both samples used a five-point Likert scale ranging from "strongly disagree" (Score of one) to "strongly agree" (Score of five) (Two items). Both items were kept continuous for analysis with higher values indicating greater self-efficacy.

3.3.3 Adolescents' intrinsic and extrinsic motivation for healthy eating

Adolescents' motivation (Intrinsic and extrinsic) for healthy eating was assessed using items modified from the Self-Regulation Questionnaires (SRQ) (213). Internal consistency of this

shortened scale appears to be valid for dietary behaviours among various adult populations with Cronbach alphas ranging from 0.85-0.93 for intrinsic motivation and 0.73-0.91 for extrinsic motivation (214).

Adolescents were asked to select how much they agreed with statements regarding their reasons for consuming F&V and SSBs using a five-point Likert scale ranging from "strongly disagree" to "strongly agree." Two items specifically looked at intrinsic motivation while two measured extrinsic motivation. The four items were repeated separately for F&V and SSB consumption for a total of eight items. Though both LiGHT and FLASHE participants were asked four items about intrinsic and extrinsic motivation, slightly different wording was present between the two samples. These differences are outlined in 0

Survey responses for each of the two intrinsic motivation items for F&V consumption were averaged for each participant and kept continuous. Higher scores implied higher adolescents' intrinsic motivation. The same procedure was followed for the intrinsic motivation item for SSB consumption and extrinsic motivation for both dietary behaviours.

3.3.4 Parenting practices related to adolescents' dietary behaviours

Parenting practices were measured using items modified from the parent self-reported Child Feeding Questionnaire (CFQ) (215), Comprehensive Feeding Practices Questionnaire (CFPQ) (216) and Parental Feeding Style Questionnaire (PFSQ) (217). The validity of these scales has been previously determined with Cronbach alphas of 0.70-0.73 (215), 0.75-0.80 (216), 0.65-0.77 (217). The Legitimacy of Parental Authority (218) scale was used and adapted for inclusion in the parenting practices survey but has not had its psychometric properties formally evaluated.

A total of 14 items were similarly worded and asked of participants in both LiGHT and FLASHE data sets. For this analysis, 12 of these items were retained. Two items ("I have to make sure my teenager eats enough F&V" and "I have to make sure my teenager doesn't eat too much fast food or sugary drinks") were dropped due to ambiguity in the wording of these items. These items fit in line with the definition of monitoring, a structural parenting practice, as well as pressure to eat, a controlling practice (161). This discrepancy has a large effect on data interpretation and thus, these items were dropped. A total of six items assessing structured

practices, three assessing autonomy supportive and five assessing controlling parenting practices were analyzed in this thesis. All responses were recorded on a five-point Likert scale ranging from "strongly disagree" to "strongly agree." FLASHE participants responded to two additional questions surrounding food availability of F&V ("How often are F&V available in your home?") and SSBs ("How often are Sugary drinks like regular soda, sports drinks, fruit drinks, sweetened teas or other drinks with added sugar available in your home?") with responses ranging from "never," "rarely," "sometimes," "often" or "always." These items were dropped to keep consistency between FLASHE and LiGHT measures. A full breakdown of retained parenting practice items can be found in **Error! Reference source not found.**below.

A scale score for each of the three types of parenting practices was created (Structured (6 items), autonomy supportive (3 items) and controlling (3 items)) using the retained 12 items from each data set. Each scale score was kept continuous and analyzed as an average for each participant. Higher scores indicated greater use of a particular category of parenting practice.

3.3.5 Parent and adolescent sex

In LiGHT, biological sex of parents was gathered through a single item asking "what sex is listed on your birth certificate" with possible choices only corresponding to male or female. Biological sex and gender of adolescents were asked using two items: 1) "What sex is listed on your birth certificate" and 2) "How do you describe yourself" with possible answers of "male/female" and "male/female/other/prefer not to answer." Comparisons between sex and gender in LiGHT presented very few discrepancies. Five adolescents reported a mismatch between their sex and gender (1.4%). Due to this very small sample size (Less then 5.0%), adolescent self-reported biological sex was used in this analysis. Where applicable, parent report of adolescent sex was used if an adolescent did not report their own sex or gender. Only biological sex (Parents and adolescents) was reported in FLASHE.

3.3.6 Covariates

Parent combined household income, ethnicity and educational attainment were asked similarly in LiGHT and FLASHE. Responses were categorized to match between the two data sets. In LiGHT, concerns of small group sizes for different ethnic group resulted in only two

categories: 1. White, and 2. Other. In FLASHE, ethnicity categories were kept in their original 4 groups (1. White, 2. African American, 3. Hispanic, and 4. Other). In all ethnicity comparisons white was used as the reference group. Adolescents' age was kept continuous from both data sets. A full comparison of demographic measures can be found in 0

3.4 Data analysis

For the purpose of this thesis, all dyads where an adolescent participant successfully completed the baseline surveys (LiGHT) or demographic and diet surveys (FLASHE) and indicated their sex were retained. In LiGHT, nine participants had a discrepancy between parent and adolescent reported sex. As it is unclear why this discrepancy existed, and if parents were answering about another child, these participants were dropped resulting in the final sample of 362 dyads (362 adolescents, 362 parents). In FLASHE, 24 participants were dropped as there was no indication of adolescents' sex and it would be inappropriate to assume a value given the nature of this thesis. Of the remaining 1633 participants, 14 parents were missing an indication of parent sex with additional missing data surrounding the parenting practice scales (n=1619 parents). However, these participants were retained as all adolescent data were present and could be analyzed for Aim two.

A total of 40 models were run in Mplus version 8.4 (219) to assess the stated aims (See section 2.7). In each of the Canadian and US samples, path analysis was utilized to explore direct and indirect effects of parenting practices on adolescents' dietary behaviours through adolescents' cognitive factors. All models controlled for adolescents' age, parental report of socio-economic status (Using parent income and highest attained education level) and ethnicity. Models in each data set were stratified by boys and girls, and each dietary behaviour was considered independently (See Table 1). To account for multiple model comparisons a p-value of 0.01 was used to establish statistical significance.

To fit in line with recent statistical theory, Baron and Kenney's 'causal steps approach' to establish mediation was not used (220–223). Instead, bootstrap techniques were employed to assess all aim three models (220–223). Bootstrap techniques offer benefits such as higher power and no assumptions about the shape of the indirect effects distribution (222). Presence of mediation was defined according to the work of Zhao, Lynch and Chen (2010) as follows: 1.

Complementary (By having the direct and indirect pathways significant and having the same signs); 2. Competitive (By having the direct and indirect pathways significant but the effects have different signs); 3. Indirect only (By having the indirect pathway only significant), 4. Direct only (By having the direct pathway only significant); and 5. No effect (Neither the direct or indirect pathways are significant). To establish differences between boys and girls, this thesis took a more conservative approach. If differences were present between boys and girls in both data sets, a higher degree of confidence in differences were present. If differences between boys and girls were present in only one data set, differences based on sex were considered presented. If no differences were present in either data set, no differences between boys and girls was inferred. It is worth noting that this approach may not have accounted for cultural nuances present between FLASHE and LiGHT participants.

Moderation effects of parent sex were considered through introduction of an interaction term in analysis of aim 1b (Eight models) and 3b (Eight models) only. Each interaction term was entered univariably and retained into the final model if $p<0.01$ was established. In aim 3b models, the moderating effect of parent sex was explored on the direct relationship between parenting practices and adolescents' dietary behaviours as well as on the pathway between parenting practices and adolescents' cognitive factors (Conditional indirect effect). An index of moderation was calculated to assess presence of any conditional indirect effects (224,225).

Table 1. Independent and dependent variables evaluated in Canadian and US samples.

Aim	Independent	Dependent	Moderator	Mediators	Models‡
1	Parenting Practices scales†	Adolescent F&V consumption			2
		Adolescent SSB consumption			2
		Adolescent F&V consumption	Parent sex		2
		Adolescent SSB consumption	Parent sex		2
2	Adolescent factors‡	Adolescent F&V consumption			2
		Adolescent SSB consumption			2
3	Parenting Practices scales†	Adolescent F&V consumption		Adolescent factors††	2
		Adolescent SSB consumption		Adolescent factors††	2
		Adolescent F&V consumption	Parent sex	Adolescent factors††	2
		Adolescent SSB consumption	Parent sex	Adolescent factors††	2
				Models run in each sample	20
				Total models run in both samples	40

Covariates (parent income, highest education level and adolescent self-reported BMI and age) controlled for in all models. Models stratified by boys and girls.
†Parenting practice scales separate for structured, autonomy supportive and controlling practices.
††Adolescent factors include self-efficacy, intrinsic and extrinsic motivation.
‡ *one model for boys, the other for girls.*

Descriptive statistics and testing model assumptions (Normality, independence, homoscedasticity, linearity) were conducted in Stata version 16.0 (226). Differences between mothers and fathers or boys and girls were calculated using chi-squared tests when expected cell counts were greater than five or Fisher exact test when expected cell counts were less than five for all categorical variables. Two sample t-tests were used for continuous variables. A p-value of .05 was used to establish significance for descriptive statistics.

3.5 Missing data

In FLASHE, missing data ranged from 0.0% (Self-efficacy variable) to 4.4% (Adolescent consumption of sugar sweetened beverages per day). In LiGHT, missing data ranged from 0.0% (Self-efficacy and intrinsic motivation variables) to 1.7% (Autonomy supportive parenting practice scale). To deal with missing data the full informed maximum likelihood estimation procedure was used in Mplus. This methods has been recommended as it uses all observed available data (219) and does not assume missing completely at random (223). If covariates were missing, the data were considered missing as the models were estimated conditionally on the covariates (219).

Chapter 4: Results

4.1 Descriptive statistics of demographic characteristics

Table 2 below indicates the demographic characteristics of both LiGHT and FLASHE participants.

4.1.1 LiGHT participants

In LiGHT, an even split between boys (50.3%) and girls (49.7%) was present. Boys were on average significantly younger than girls by 0.4 years (14.7 years vs.to 15.1 years, p=.04). More mothers (65.5%) participated compared to fathers (34.5%). The only difference found between participating mothers and fathers was for educational attainment, with significantly more fathers completing a college or university degree compared to mothers (62.4% vs. 43.9%, respectively). On average, parents were 45-to-59-years-old, white and had a combined family income of <$100,000 CAD.

4.1.2 FLASHE participants

Similar to LiGHT, an even split between boys (49.6%) and girls (50.4%) was present among participants. No differences in age were present (Mean age boys 14.5 years vs. mean age girls 14.4 years). Significantly more mothers participated within FLASHE (n=73.7%) compared to fathers (25.5%). In contrast to LiGHT, significant differences between mothers and fathers in FLASHE were found for all demographic variables; fathers were older (45-59 years), reported higher combined family income (>$100,000 USD) and had higher education (University or college degree) in contrast to mothers. Though the majority of both participating mothers and fathers were largely white, significantly more mothers self-identified as African American whereas significantly more fathers self-identified as Hispanic.

Table 2. Summary of demographic characteristics of LiGHT (n=362) and FLASHE (n=1633) participants.

	LiGHT (n=362)			FLASHE (n=1633)		
	n (%)		Difference	n (%)		Difference
Parents	FATHERS	MOTHERS		FATHERS	MOTHERS	
Sex	125 (34.5)	237 (65.5)		416 (25.5)	1203 (73.7)	
Age			p=.08			p=.00
18-34 years	2 (1.6)	14 (5.9)		41 (9.9)	146 (12.2)	
35-44 years	37 (29.6)	82 (34.6)		143 (34.4)	559 (46.5)	
45-59 years	82 (65.6)	137 (57.8)		205 (49.3)	477 (39.7)	
60+ years	3 (2.4)	2 (0.8)		27 (6.5)	19 (1.6)	
Ethnicity			p=.05			p=.00
white[R]	98 (78.4)	205 (86.5)		291 (70.0)	829 (68.9)	
Other	27 (21.6)	32 (13.5)		31 (7.5)	63 (5.2)	
Hispanic				45 (10.8)	70 (5.8)	
African American				47 (11.3)	227 (18.9)	
Income			p=.06			p=.00
<$100,000[R]	55 (44.0)	129 (54.4)		292 (70.2)	974 (81.0)	
≥ 100,000	57 (45.6)	86 (36.3)		121 (29.1)	212 (17.6)	
Education			p=.00			p=.00
<College/university[R]	47 (37.6)	133 (56.1)		189 (45.4)	666 (55.4)	
≥College/university	78 (62.4)	104 (43.9)		226 (54.3)	531 (44.1)	
Adolescents	BOYS	GIRLS		BOYS	GIRLS	
Sex	182 (50.3)	180 (49.7)		810 (49.6)	823 (50.4)	
Gender						
Male	180 (98.9)	2 (1.1)	p=.06			
Female	1 (0.5)	174 (96.7)				
Other	1 (0.5)	2 (1.1)				
Prefer not to answer		1 (0.6)				
Age mean ± SD	14.7 ± 1.43	15.1 ± 1.45	p=.04	14.5 ± 1.63	14.4 ± 1.60	p=.61
12 years	NA	NA		102 (12.6)	116 (14.1)	
13 years	56 (30.8)	36 (20.0)		163 (20.2)	163 (19.8)	
14 years	30 (16.5)	33 (18.3)		129 (16.0)	147 (17.9)	
15 years	33 (18.1)	40 (22.2)		143 (17.7)	144 (17.5)	
16 years	37 (20.3)	29 (16.1)		162 (20.0)	161 (19.6)	
17 years	26 (14.3)	42 (23.3)		110 (13.6)	92 (11.2)	

n=number. %=percent. R=Reference group SD=Standard deviation. NA= not applicable. Sex differences calculated using $\chi 2$ when expected cell counts n>5 or Fisher exact if expected cell counts n<5.

4.2 Descriptive statistics of study variables

Descriptive statistics (Mean, standard deviation, inter quartile range, median, range) of all study variables in both data sets (Independent, dependent, mediators, moderator variables and covariates) can be found in Table 3. Correlations between parenting practices and adolescents' cognitive factors can be found in **Error! Reference source not found.**Differences between boys and girls or mothers and fathers were also presented for each data set.

4.2.1 LiGHT participants

Boys and girls in LiGHT did not significantly differ in their consumption of F&V (p=.79) or SSBs (p=.79). On average, boys consumed F&V 1.99 times per day and SSBs .65 times per day. In contrast, on average girls consumed F&V 2.03 times per day and SSBs .66 times per day.

For adolescents' cognitive factors, significant differences between boys and girls were found for intrinsic motivation only. For F&V, boys reported significantly lower intrinsic motivation than girls (3.77 vs. 4.04, respectively, p=.00). For SSB consumption, boys also indicated significantly lower intrinsic motivation than girls (2.90 vs. 3.14, respectively, p=.01). With respect to self-efficacy and extrinsic motivation to eat more F&V and consume less SSBs, boys and girls did not differ significantly with reported scores on average in the moderate range (Average range from 3.26 to 3.74 on a 5-point scale).

No differences in parenting practices between mothers and fathers were detected in LiGHT. On average, parents relied more on structured parenting practices (Fathers: 3.75, Mothers: 3.83) compared to autonomy supportive (Fathers: 3.32, Mothers: 3.42) or controlling parenting practices (Fathers: 2.88, Mothers: 2.91).

4.2.2 FLASHE participants

Boys reported consuming less F&V per day at 1.38 times per day and more SSBs at 1.43 times per day, compared to girls at 1.51 and 1.18 times per day, respectively (p=.02 and p=.00, respectively) in FLASHE.

Similar to LiGHT, significant differences in intrinsic motivation were found between boys and girls, with boys reporting lower levels for both F&V (Boys: 3.82, Girls: 4.04) and SSB (Boys: 3.70, Girls: 3.97) consumption (p=.00). Girls also reported higher levels of self-efficacy (4.14) for F&V consumption compared to boys (3.92, p=.00). No differences in extrinsic motivation for F&V (p=.70) and SSB (p=.39) consumption or self-efficacy for SSB (p=.33) consumption were present.

Mothers reported using structured parenting practices on average more than fathers (3.91 vs. 3.83, p=.03). No differences in use of autonomy (p=.35) or controlling (p=.37) parenting practices were detected. Similar to LiGHT, parents reported greater use of structured parenting

practices compared to autonomy supportive (Fathers: 3.56, Mothers: 3.61) or controlling (Fathers: 3.02, Mothers: 3.06).

Table 3. Descriptive statistics of adolescent & parent variables in the LiGHT (n=362) and FLASHE (n=1633) samples.

	N	Mean ± SD	Median (IQR)	N	Mean ± SD	Median (IQR)	Range	Difference
LiGHT		BOYS			GIRLS			BOTH
F&V intake†	182	1.99. ± .1.43	1.43 (1.00, 3.00)	180	2.03 ± 1.41†	1.71 (1.00, 3.00)	0-6	p=.79
F&V self-efficacy	181	3.54 ± 1.08	4.00 (3.00, 4.00)	179	3.43 ± 1.10	4.00 (3.00, 4.00)	1-5	p=.36
F&V intrinsic	182	3.77 ± .84	4.00 (3.00, 4.50)	180	4.04 ± .78	4.00 (3.50, 4.50)	1-5	p=.00*
F&V extrinsic	181	3.26 ± .87	3.50 (3.00, 4.00)	180	3.29 ± .87	3.50 (2.50, 4.00)	1-5	p=.75
SSB intake†	182	.65 ± .83†	.29 (.29, 1.29)	180	.66 ± .82†	.29 (.29, 1.00)	0-6	p=.79
SSB self-efficacy	182	3.74 ± 1.06	4.00 (3.00, 5.00)	180	3.67 ± 1.06	4.00 (3.00, 5.00)	1-5	p=.50
SSB intrinsic	181	2.90 ± .93	3.00 (2.50, 3.50)	180	3.14 ± .82	3.00 (2.50, 4.00)	1-5	p=.01*
SSB extrinsic	182	3.41 ± .94	3.50 (3.00, 4.00)	179	3.43 ± .87	3.50 (3.00, 4.00)	1-5	p=.83
		FATHERS			MOTHERS			BOTH
Parenting practices								
Structure	125	3.75 ± .57	3.67 (3.67, 4.01)	237	3.83 ± .53	3.83 (3.50, 4.17)	1-5	p=.20
Autonomy	125	3.32 ± .67	3.33 (3.00, 3.67)	237	3.42 ± .73	3.33 (3.00, 4.00)	1-5	p=.21
Control	125	2.88 ± .72	3.00 (2.33, 3.33)	237	2.91 ± .72	3.00 (2.33, 3.33)	1-5	p=.71
FLASHE		BOYS			GIRLS			BOTH
F&V intake†	810	1.38 ± 1.20	1.00 (57, 1.71)	823	1.51 ± 1.24†	1.00 (.57, 2.00)	0-6	p=.02*
F&V self-efficacy	809	3.92 ± 1.14	4.00 (3.00, 5.00)	820	4.14 ± 1.03	4.00 (4.00, 5.00)	1-5	p=.00*
F&V intrinsic	803	3.82 ± .92	4.00 (3.00, 4.50)	816	4.04 ± .85	4.00 (3.50, 5.00)	1-5	p=.00*
F&V extrinsic	806	2.95 ± 1.05	3.00 (2.50, 3.50)	820	2.97 ± 1.09	3.00 (2.00, 4.00)	1-5	p=.70
SSB intake†	810	1.43 ± 1.45†	1.00 (.57, 1.93)	823	1.18 ± 1.38†	.86 (.29, 1.43)	0-6	p=.00*
SSB self-efficacy	808	3.55 ± 1.16	4.00 (3.00, 4.00)	821	3.61 ± 1.18	4.00 (3.00, 4.00)	1-5	p=.33
SSB intrinsic	799	3.70 ± .94	4.00 (3.00,4.50)	815	3.97 ± .89	4.00 (3.50, 4.50)	1-5	p=.00*
SSB extrinsic	803	3.10 ± 1.03	3.00 (2.50, 4.00)	818	3.14 ± 1.04	3.00 (2.50, 4.00)	1-5	p=.39
		FATHERS			MOTHERS			BOTH
Parenting practices								
Structure	416	3.83 ± .66	3.83 (3.33, 4.33)	1206	3.91 ± .63	4.00 (3.50, 4.33)	1-5	p=.03*
Autonomy	416	3.56 ±.78	3.67 (3.00, 4.00)	1206	3.61 ± .80	3.67 (3.00, 4.33)	1-5	p=.35
Control	416	3.02 ± .81	3.00 (2.67, 3.67)	1206	3.06 ± .79	3.00 (2.67, 3.67)	1-5	p=.37

n=Number; %=Percentage; SD=Standard Deviation; IQR= Interquartile Range; F&V=fruits & vegetables; SSB=Sugar sweetened beverages. Sex differences calculated using 2 sample t-tests. Significance level: p≤.05 (*).

†*Calculated in times consumed per day.*

4.3 Associations between parenting practices and adolescents' dietary behaviours (Aim 1)

Table 4 depicts the associations between parenting practices and adolescents' dietary behaviours in both LiGHT and FLASHE (Aim 1a). Evidence for the presence of moderation on the relationship between parenting practices and adolescent behaviours can be seen in Table 5. All pathways are controlled for adolescents' age and parental sex, educational attainment, income and ethnicity. Graphical illustrations of final significant models can be viewed in Figure 8 and Figure 9.

4.3.1 LiGHT participants

Controlling parenting practices were significantly associated with boys' consumption of F&V as well as SSBs (β=-.24 and β=.29, respectively) (Table 4). This implies that controlling parenting practices had an overall negative effect on boys' dietary behaviours. Adolescents' age was significantly associated with boys F&V consumption.

For girls, structured parenting practices had a significant positive association with F&V consumption (β=.34, p<.01) and a significant negative association with SSB consumption (β=-.25, p<.01). This suggests an overall positive effect on dietary consumption. In these models, adolescents' age had a significant negative association to boys' consumption of F&V only.

4.3.2 FLASHE participants

Boys' consumption of F&V was significantly associated with both structured and autonomy supportive parenting practices in FLASHE and these associations were positive (β=.27 and β=.18, respectively) (Table 4). Parental education attainment (>college/university degree) was found to significantly correlate with higher consumption of F&V compared to lower parental education attainment (<college/university degree). Similar to LiGHT, controlling parenting practices had a significant positive association to SSB consumption (β=.24, p<.01), suggesting an overall negative impact on consumption of SSB. Structured parenting practices on the other

hand were found to have a beneficial effect on SSB consumption as they were significantly associated with reduced intake of SSB (β=-.22, p<.01). Parent sex was suggested to act as a covariate on boys' SSB consumption.

Only structured parenting practices among girls in FLASHE were found to significantly correlate with F&V consumption (β=.23, p<.01). Higher parental education attainment was also found to have a significant positive association with F&V consumption. Similar to boys, structured parenting practices had a significant beneficial association to SSB consumption (β =-.18, p<.01) whereas controlling parenting practices had a positive influence on SSB consumption that was significant (β=.15, p<.01) among girls. No significant covariates were detected for girls' SSB consumption.

4.3.3 Parent sex as a moderator on the associations between parenting practices and adolescents' dietary behaviours.

No evidence of moderation by parent sex was detected in either LiGHT of FLASHE samples (Table 5).

Table 4. Association between parenting practices and adolescents' dietary behaviours in LiGHT (n=362) and FLASHE (n=1619) (Aim 1a).

	BOYS				GIRLS			
Dependent	Fruits & vegetables		Sugar sweetened beverages		Fruits & vegetables		Sugar sweetened beverages	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
LIGHT	**n=155**		**n=158**		**n=159**		**n=159**	
Independent								
Structure	.17	-.01, .34	-.14	-.31, .04	.34**	-.16, .52	-.25**	-.44, -.06
Autonomy	.00	-.19, .19	-.05	-.24, .14	-.11	-.29, .07	.10	-.08, .28
Control	-.24**	-.42, -.06	.29**	.11, .46	-.09	-.27, .09	.04	-.14, .22
Covariates								
Parent sex (psex)	-.18	-.49, .13	-.17	-.48, .13	.09	-.25, .41	-.11	-.44, .22
Education	.22	-.10, .53	-.15	-.47, .17	.15	-.17, .46	-.38	-.69, -.07
Income	.27	-.05, .58	-.30	-.62, .01	.29	-.01, .59	.05	-.26, .35
white^{R} vs. other	.17	-.25, .58	-.13	-.54, .28	.31	-.14, .76	-.54	-.99, -.10
Adolescents' age	-.23**	-.38, -.09	.16	.01, .31	-.12	-.27, .04	.09	-.07, .25
FLASHE	**n=744**		**n=723**		**n=764**		**n=741**	
Independent								
Structure	.27**	.19, .35	-.22**	-.31, -.14	.23**	.15, .32	-.18**	-.27, -.09
Autonomy	.18**	.09, .26	-.06	-.15, .04	.02	-.07, .11	.06	-.03, .15
Control	-.04	-.13, .04	.24**	.15, .32	.00	-.09, .08	.15**	.06, .23
Covariates								
Parent sex (psex)	-.07	-.22, .08	-.24**	-.40, -.09	-.13	-.29, .04	-.12	-.29, .05
Education	.21**	.07, .36	-.03	-.18, .12	.26**	.12, .41	-.15	-.30, -.01
Income	.03	-.14, .21	-.15	-.33, .04	.02	-.16, .19	-.05	-.23, .13
white^{R} vs. AA	.05	-.11, .20	-.16	-.33, .00	.10	-.07, .26	-.17	-.34, -.01
white^{R} vs. Hispanic	-.20	-.40, .00	-.04	-.25, .18	.06	-.15, .27	-.16	-.38, .05
white^{R} vs. Other	.12	-.08, .33	.11	-.11, .33	.02	-.23, .26	.12	-.13, .37
Adolescents' age	-.03	-.04, .10	.09	.02, .16	.01	-.06, .08	.02	-.05, .10

β=*Standardized coefficients (STDXY for continuous, STDY for binary).CI=confidence interval. n=number. %=percent. AA=African American. R=reference group. Reference group for other binary covariates as follows: parent sex (male), education (*<College/university) and income (≤99,999). *Significance level: p≤.01 (**).*

Table 5. Association between parenting practices and adolescents' dietary behaviours with parent sex as a moderator in LiGHT (n=362) and FLASHE (n=1619) (Aim 1b).

	BOYS				GIRLS			
Dependent	Fruits & vegetables		Sugar sweetened beverages		Fruits & vegetables		Sugar sweetened beverages	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
LIGHT	n=155		n=158		n=159		n=159	
Independent Structure Autonomy Control Moderator psex*structure psex*autonomy psex*control Covariates Parent sex (psex) Education Income white^{R} vs. other Adolescents' age	TNS. Model the same as 1a in table 4.3 for boys LiGHT.		TNS. Model the same as 1a in table 4.3 for boys LiGHT.		TNS. Model the same as 1a in table 4.3 for girls LiGHT.		TNS. Model the same as 1a in table 4.3 for girls LiGHT.	
FLASHE	n=744		n=723		n=764		n=741	
Independent Structure Autonomy Control Moderator psex*structure psex*autonomy psex*control Covariates Parent sex (psex) Education Income white^{R} vs. AA white^{R} vs. Hispanic white^{R} vs. Other Adolescents' age	TNS. Model the same as 1a in table 4.3 for boys FLASHE.		TNS. Model the same as 1a in table 4.3 for boys FLASHE.		TNS. Model the same as 1a in table 4.3 for girls FLASHE.		TNS. Model the same as 1a in table 4.3 for girls FLASHE.	

β=*Standardized coefficients (STDXY for continuous, STDY for binary). CI=confidence interval. n=number. %=percent. AA=African American. R=reference group. psex=parent sex. Reference group for other binary covariates as follows: parent sex (male), education (*<college/university) and income (≤99,999). *TNS=tested, not significant. Significance level: p≤.01 (**).*

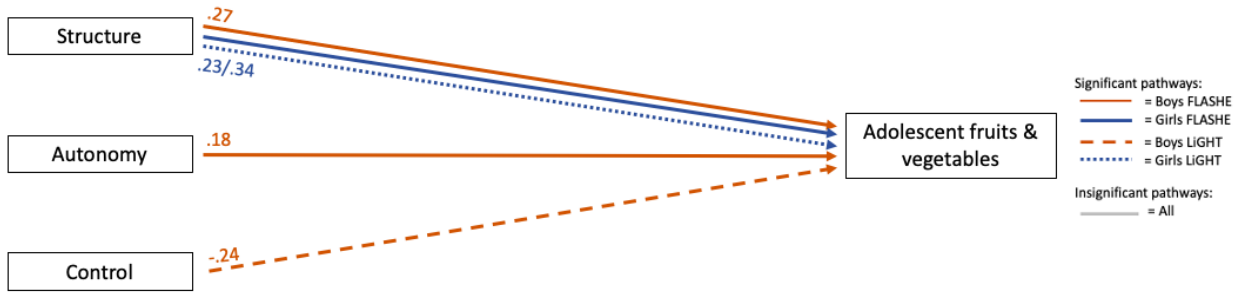

Figure 8. Final significant paths between parenting practices and adolescents' fruits & vegetable intake for LiGHT (n=362) and FLASHE (n=1619) (Aim 1a and Aim 1b). Standardized β coefficients presented (STDXY). Written as FLASHE/LiGHT were applicable. Models controlled for parent sex, education, ethnicity, income and adolescents' age.

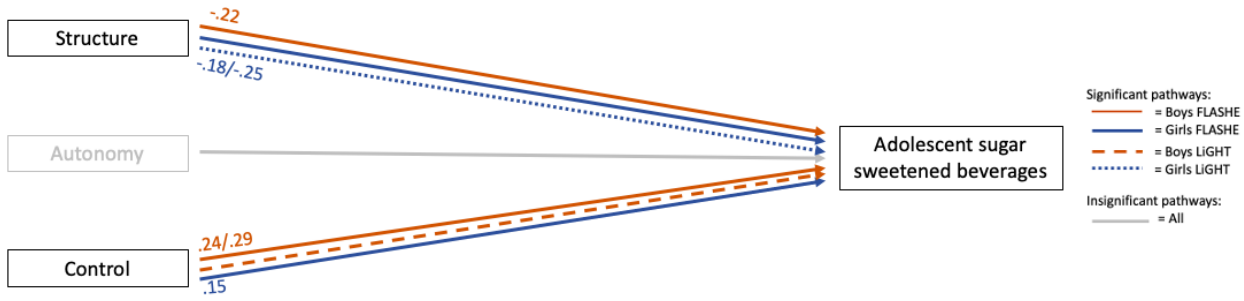

Figure 9. Final significant paths between parenting practices and adolescents' sugar sweetened beverage intake for LiGHT (n=362) and FLASHE (n=1619) (Aim 1a and Aim 1b). Standardized *β* coefficients presented (STDXY). Written as FLASHE/LiGHT were applicable. Models controlled for parent sex, education, ethnicity, income and adolescents' age.

4.4 Associations between adolescents' cognitive factors and adolescents' dietary behaviours (Aim 2)

Relationships between self-efficacy, intrinsic and extrinsic motivation to adolescents' dietary behaviours (Aim 2) can be seen in Table 6 below. All models controlled for adolescents' age, parent sex, education attainment, income and ethnicity. Graphical display of the significant relationships can be found in Figure 10 and Figure 11.

4.4.1 LiGHT participants

Self-efficacy was found to have a positive significant association to boys' F&V consumption (β=.34, p<.01) and a negative significant association to boys SSB consumption (β=-.32, p<.01). This implies that self-efficacy had an overall positive effect on an adolescent boys' diet in

LiGHT. Intrinsic motivation was further found to significantly correlate with a boys' F&V consumption (β=.32, p<.01).

For girls in LiGHT, only intrinsic motivation was significantly associated with F&V consumption (β=.23, p<.01) whereas self-efficacy was the only adolescents' cognitive factor significantly associated with SSB intake (β =-.36, p<.01). Taken together, both factors had a positive influence on overall diet quality.

No covariates were found to significantly affect the relationships between adolescents' cognitive factors and adolescents' dietary behaviours for boy or girls in LiGHT.

4.4.2 FLASHE participants

In boys, all three cognitive factors were found to be significantly correlated with increased F&V intake in FLASHE. The highest significantly associated beta value was found for self-efficacy (β=.34, p<.01), followed by intrinsic motivation (β=.22, p<.01) and extrinsic motivation (β=.15, p<.01). Parent educational attainment was a significant factor on F&V consumption with higher educational attainment (>college/university degree) correlating with greater consumption of F&V. Boys SSB intake was significantly correlated with both self-efficacy (β=-.13, p<.01) and intrinsic motivation (β=-.13, p<.01), with higher levels indicating reduced consumption. These associations suggest overall that adolescents' cognitive factors have a beneficial effect on boys' dietary behaviours. Adolescents' age and sex of parent were found to have a significant association with boys' SSB intake.

In FLASHE, the associations between girls' cognitive factors and F&V consumption mirror the findings of boys. All three cognitive factors were significantly associated with F&V consumption, with self-efficacy having the largest effect (β=.34, p<.01) compared to intrinsic (β=.20, p<.01) and extrinsic motivation (β=.09, p<.01). Parent educational attainment was also found to significant correlate with F&V consumption. In regard to SSBs, only significant associations between girls' self-efficacy and SSB were found (β=-.09, p<.01).

Table 6. Direct associations between adolescents' cognitive factors and adolescents' dietary behaviours in LiGHT (n=362) and FLASHE (n=1633) (Aim 2).

	BOYS				GIRLS			
Dependent	Fruits & vegetables		Sugar sweetened beverages		Fruits & vegetables		Sugar sweetened beverages	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
LIGHT	**n=157**		**n=161**		**n=164**		**n=164**	
Independent								
Self-efficacy	.34**	.20, .47	-.32**	-.48, -.16	.19	.04, .35	-.36**	-.51, -.21
Intrinsic	.32**	.17, .47	-.10	-.28, .08	.23**	.06, .40	-.07	-.22, .09
Extrinsic	.03	-.10, .17	.01	-.16, .18	.17	.03, .31	.05	-.10, .20
Covariates								
Parent sex (psex)	-.06	-.32, .19	-.20	-.49, .10	.16	-.14, .47	-.16	-.47, .15
Education	.26	.00, .52	-.07	-.38, .24	.18	-.11, .46	-.26	-.54, .03
Income	.12	-.14, .39	-.18	-.49, .12	.30	.03, .57	.00	-.28, .29
white^{R} vs. other	-.02	-.35, .32	-.01	-.40, .38	.19	-.22, .60	-.29	-.71, .13
Adolescents' age	-.14	-.27, -.02	.06	-.09, .21	-.11	-.24, .03	.07	-.07, .21
FLASHE	**n=761**		**n=732**		**n=771**		**n=744**	
Independent								
Self-efficacy	.34**	.27, .41	-.13**	-.21, -.05	.34**	.27, .40	-.09**	-.17, -.02
Intrinsic	.22**	.14, .30	-.13**	-.22, -.05	.20**	.12, .28	.00	-.08, .09
Extrinsic	.15**	.08, .21	.00	-.08, .09	.09**	.02, .16	-.05	-.13, .03
Covariates								
Parent sex (psex)	.00	-.13, .13	-.25**	-.41, -.09	.02	-.13, .16	-.14	-.31, .03
Education	.19**	.07, .32	-.05	-.20, .10	.30**	.18, .42	-.17	-.32, -.03
Income	.09	-.07, .24	-.14	-.32, .05	-.01	-.16, .15	.02	-.16, .20
Caucasian^{R} vs. AA	.09	-.04, .23	-.18	-.34, -.02	.13	-.02, .27	-.17	-.34, -.01
white^{R} vs. Hispanic	-.09	-.27, .09	-.08	-.29, .14	-.01	-.19, .18	-.14	-.36, .07
white^{R} vs. Other	.05	-.14, .23	.12	-.10, .34	.03	-.19, .25	.07	-.17, .32
Adolescents' age	-.02	-.08, .04	.09**	.02, .16	-.02	-.08, .04	.01	-.06, .08

β=*Standardized coefficients (STDXY for continuous, STDY for binary). CI=confidence interval. n=number. %=percent. AA=African American. R=reference group. Reference group for other binary covariates as follows: parent sex (male), education (*<College/university) and income (≤99,999). *Significance level: p≤.01 (**).*

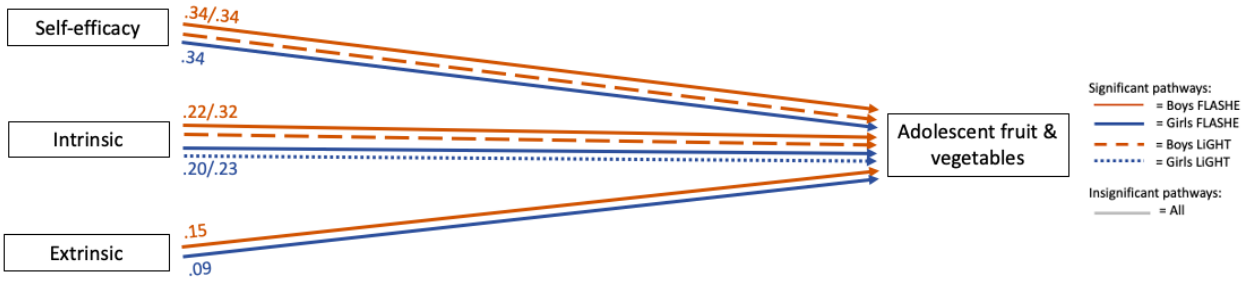

Figure 10. Significant model between adolescents' cognitive factors and fruits & vegetables intake for LiGHT (n=362) and FLASHE (n=1633) (Aim 2). Standardized β coefficients presented (STDXY). Written as FLASHE/LiGHT were applicable. Models controlled for parent sex, education, ethnicity, income and adolescents' age.

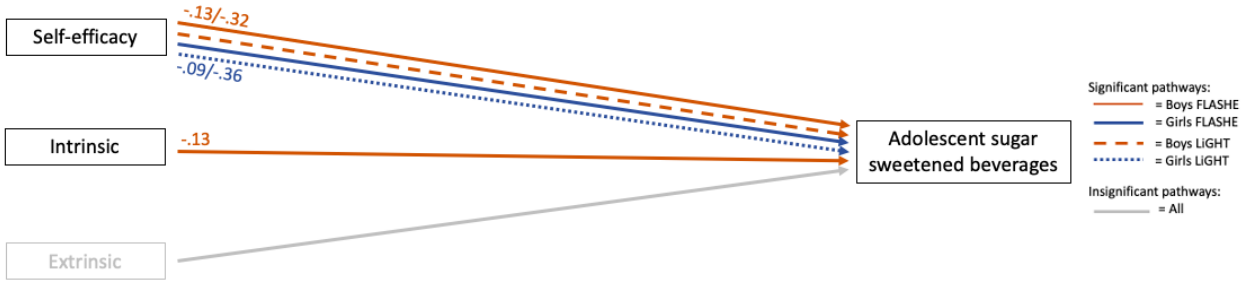

Figure 11. Significant model between adolescents' cognitive factors and sugar sweetened beverage intake for LiGHT (n=362) and FLASHE (n=1633) (Aim 2). Standardized *β* coefficients presented (STDXY). Written as FLASHE/LiGHT were applicable. Models controlled for parent sex, education, ethnicity, income and adolescents' age.

4.5 Associations between parenting practices and adolescents' dietary behaviours through adolescents' cognitive factors (Aim 3)

4.5.1 Fruit and vegetable intake

The direct and indirect pathways between parenting practices and adolescents' F&V consumption through adolescents' cognitive factors can be seen in Table 7 for LiGHT and FLASHE. Evidence of moderation by parent sex can be found in Table 8. Graphical depictions of the final significant models can be seen in Figure 12.

4.5.1.1 LiGHT participants

No significant mediation was detected for boys F&V consumption in LiGHT. Instead, significant direct effects of self-efficacy (β=.35, p<.01) and intrinsic motivation (β=.35, p<.01) were present. Though the overall indirect effect through controlling parenting practices on F&V consumption was found to be significant (β =-.16, p<.01), no individual indirect pathways through any of the three parenting practices and cognitive factors were significant (p>.01). This suggests that for boys, cognitive factors played a greater role in their F&V intake compared to parenting practices. Increases in adolescents' age were found to significantly correlate with reduced instances of F&V intake per day.

Among girls, structured parenting practices were found to have a direct effect on consumption of F&V (β=.28, p<.01) and a direct effect on extrinsic motivation (β=.33, p<.01). However, as the pathway between extrinsic motivation and F&V consumption was not found to achieve statistical significance (p>.01), only direct mediation through controlling parenting practices was present. Direct associations between self-efficacy (β=.19, p<.01) and intrinsic motivation (β=.24, p<.01) were also found. No covariates were significant in these models.

4.5.1.2 FLASHE participants

Significant complementary mediation was found for structured parenting practices through self-efficacy (β=.08, p<.01) and intrinsic motivation (β=.06, p<.01) for boys. Use of this parenting practices directly influenced boys' consumption of F&V (β=.12, p<.01), as well as their self-efficacy (β=.25, p<.01) and intrinsic motivation (β=.28, p<.01) for F&V consumption. Greater self-efficacy (β=.33, p<.01) and intrinsic motivation (β=.20, p<.01) in turn had a significant direct positive influence on boys' consumption of F&V. Though autonomy supportive and controlling parenting practices were not found to have any significant direct effects on F&V consumption, significant indirect effects were found. Specifically, the pathway from autonomy supportive parenting practices to F&V through self-efficacy (β=.06, p<.01) and intrinsic motivation (β=.05, p<.01) as well as controlling parenting practices through self-efficacy (β=-.04, p<.01). These associations suggest that autonomy supportive and structured parenting practices positively affect a boys' self-efficacy and intrinsic motivation, which in turn promotes

greater F&V consumption. Controlling parenting practices have a hindering effect on boys' self-efficacy (β=-.12, p<.01), reducing their consumption of F&V. All three cognitive factors were found to have significant direct positive associations with F&V consumption (Self-efficacy: β=.33, p<.01; Intrinsic motivation: β=.20, p<.01; Extrinsic motivation: β=.11, p<.01).

Similar to boys, structured parenting practices significantly mediated girls F&V consumption. Structured parenting practices had significant direct associations with a girls' self-efficacy (β=.20, p<.01), intrinsic motivation (β=.29, p<.01) and F&V consumption (β=.11, p<.01). As both self-efficacy (β=.34, p<.01) and intrinsic motivation (β=.19, p<.01) were found to have significant direct correlations with increased F&V consumption, complementary mediation was present. Total indirect effects of structured parenting practices through self-efficacy and intrinsic motivation were associated with increases in F&V (β=.15, p<.01). Significant indirect mediation was found for F&V consumption through self-efficacy, with autonomy supportive parenting practise having a positive effect (β=.04, p<.01) and controlling parenting practices having a negative effect (β=-.07, p<.01). This implies that autonomy supportive parenting practices increase girls' self-efficacy for F&V consumption, having a beneficial effect on dietary behaviours, whereas controlling parenting practices had the opposite effect.

Parental education attainment significantly correlated with consumption of F&V among boys and girls.

4.5.1.3 Evidence of moderation on the direct and indirect pathways between parenting practices and adolescents' consumption of fruits and vegetables through adolescents' cognitive factors

No significant interaction terms were detected. This implies that sex of parent did not moderate the direct or indirect pathways between parenting practices and adolescent F&V consumption.

Table 7. Associations between parenting practices and adolescents' fruit & vegetables consumption through adolescent factors in LiGHT (n=362) and FLASHE (n=1619) (Aim 3a).

Variables	Mediators (M)						Dependent (Y)	
	Self-efficacy		Intrinsic		Extrinsic		Fruits & vegetables	
Effects	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
LiGHT BOYS n=158								
Structure	.14 (-.02, .31)	.05^{NE} (-.01, .12)	.18 (.00, .35)	.06^{NE} (.00, .13)	.21 (.02, .39)	.01^{NE} (-.03, .05)	.07 (-.10, .23)	.12 (.02, .23)
Autonomy	.14 (-.05, .34)	.05^{NE} (-.02, .12)	.19 (.00, .40)	.07^{NE} (.00, .17)	.05 (-.18, .27)	.00^{NE} (-.02, .03)	-.12 (-.30, .05)	.12 (.01, .26)
Control	-.23 (-.42, -.04)	-.08^{NE} (-.16, -.01)	-.21 (-.41, -.03)	-.07^{NE} (-.17, -.01)	-.09 (-.30, .10)	.00^{NE} (-.03, .02)	-.09 (-.26, .08)	-.16** (-.29, -.04)
Self-efficacy							.35** (.21, .48)	
Intrinsic							.35** (.16, .52)	
Extrinsic							.03 (-.12, .20)	
LiGHT GIRLS n= 159								
Structure	.03 (-.20, .24)	.01^{NE} (-.04, .05)	.11 (-.09, .29)	03^{NE} (-.02, .08)	.33** (.15, .50)	.04^{D} (-.02, .10)	.28** (.07, .49)	.07 (-.04, .16)
Autonomy	.12 (-.09, .33)	.02^{NE} (-.02, .08)	.19 (.01, .36)	.04^{NE} (.00, .11)	-.03 (-.22, .17)	.00^{NE} (-.03, .02)	-.18 (-.38, .03)	.07 (-.02, .16)
Control	-.09 (-.28, .10)	-.02^{NE} (-.06, .02)	-.12 (-.31, .09)	-.03^{NE} (-.09, .02)	.09 (-.10, .27)	.01^{NE} (-.01, .04)	-.06 (-.24, .14)	-.04 (-.12, .05)
Self-efficacy							.19** (.05, .34)	
Intrinsic							.24** (.05, .41)	
Extrinsic							.10 (-.05, .27)	
FLASHE BOYS n=755								
Structure	.25** (.16, .33)	.08**^{CL} (.05, .12)	.28** (.19, .36)	.06**^{CL} (.03, .09)	.14** (.06, .22)	.02^{D} (.00, .03)	.12** (.05, .20)	.15** (.11, .20)
Autonomy	.17** (.08, .26)	.06**^{I} (.02, .09)	.24** (.15, .32)	.05**^{I} (.02, .08)	.08 (-.01, .18)	.01^{NE} (.00, .02)	.08 (-.01, .16)	.11** (.07, .16)
Control	-.12** (-.20, -.03)	-.04**^{I} (-.07, -.01)	-.11 (-.19, -.02)	-.02^{NE} (-.04, .00)	.19** (.10, .28)	.02^{NE} (.00, .04)	-.01 (-.09, .08)	-.04 (-.09, .01)
Self-efficacy							.33** (0.26, .40)	
Intrinsic							.20** (.11, .29)	
Extrinsic							.11** (.03, .19)	
FLASHE GIRLS n=777								
Structure	.20** (.11, .28)	.07**^{CL} (.04, .10)	.29** (.20, .37)	.05**^{CL} (.03, .08)	.16** (.08, .24)	.01^{D} (.00, .03)	.11** (.03, .20)	.13** (.09, .18)
Autonomy	.12** (.03, .21)	.04**^{I} (.01, .07)	.13** (.04, .22)	.02^{NE} (.01, .05)	.21** (.12, .29)	.01^{NE} (.00, .03)	-.06 (-.14, .03)	.08** (.03, .13)
Control	-.20** (-.27, -.12)	-.07**^{I} (-.10, -.04)	-.10 (-.18, -.02)	-.02^{NE} (-.04, .00)	.09 (.01, .18)	.01^{NE} (.00, .02)	.08 (.00, .16)	-.08** (-.12, -.04)
Self-efficacy							.34** (.27, .41)	
Intrinsic							.19** (.10, .27)	
Extrinsic							.06 (-.02, .14)	

Standardized β values presented (STDXY for continuous, STDY for binary) with 95% CI presented bootstrap intervals (n=5,000) in parenthesizes. All models controlled for parent sex (reference: male), education (reference: <college/university), ethnicity (reference: white), income (reference: ≤$99,999) and adolescents' age. Parent education was significant in FLASHE model for boys (β=.10, 95% CI:.07, .33) and girls only (β=.30, 95% CI:.18-.42). Adolescents' age was significant in LiGHT for boys (β=-.14, 95% CI: -.23, -.04). Mediation defined as complementary (CL), competitive (CP) or indirect (I), no mediation defined as direct (D) or no effect (NE) based on Zhao et al. (2010). n=number. X=independent variables. %=percent. Significance level: p≤.01 (**).

Table 8. Conditional associations between parenting practices and adolescents' dietary behaviours through adolescent factors with parent sex as a moderator in LiGHT (n=362) and FLASHE (n=1619) (Aim 3b).

	BOYS				GIRLS			
Dependent	Fruits & vegetables		Sugar sweetened beverages		Fruits & vegetables		Sugar sweetened beverages	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
LiGHT	n=158		n=158		n=159		n=159	
Direct conditional Structure*psex Autonomy*psex Control*psex Indirect conditional Structure*psex Self-efficacy Intrinsic Extrinsic Autonomy*psex Self-efficacy Intrinsic Extrinsic Control*psex Self-efficacy Intrinsic Extrinsic	TNS. Model the same as 3a in table 4.6 for boys LiGHT.		TNS. Model the same as 3a in table 4.8 for boys LiGHT.		TNS. Model the same as 3a in table 4.6 for girls LiGHT.		TNS. Model the same as 3a in table 4.8 for girls LiGHT.	
FLASHE	n=755		n=755		n=777		n=777	
Direct conditional Structure*psex Autonomy*psex Control*psex Indirect conditional Structure*psex Self-efficacy Intrinsic Extrinsic Autonomy*psex Self-efficacy Intrinsic Extrinsic Control*psex Self-efficacy Intrinsic Extrinsic	TNS. Model the same as 3a in table 4.6 for boys FLASHE.		TNS. Model the same as 3a in table 4.8 for boys FLASHE.		TNS. Model the same as 3a in table 4.6 for girls FLASHE.		TNS. Model the same as 3a in table 4.8 for girls FLASHE.	

*β=Standardized coefficients (STDXY). n=number. %=percent. CI=confidence intervals, bootstrap using n=5,000. Psex=parent sex. All models controlled for parent sex (reference: male), education (reference: <college/university), ethnicity (reference: white), income (reference: ≤$99,999) and adolescents' age. Adolescents' age was significant in FLASHE model for boys (*β:.06, CI:.02, .11*). Parent education was significant in FLASHE model for girls (β=.30, 95% CI:.18,.42. TNS=tested, not significant. Significance level: p≤.01 (**).*

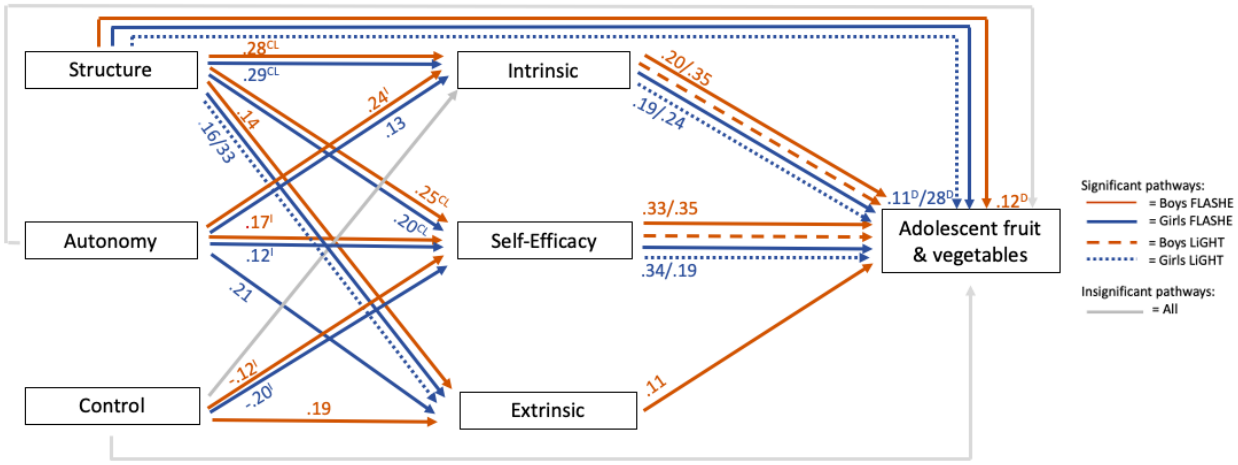

Figure 12. Final significant direct pathways and denotation of significant mediation between parenting practices and adolescent factors to adolescents' consumption of fruits & vegetables in LiGHT (n=362) and FLASHE (n=1619) (Aim 3a and 3b). Standardized β coefficients presented (STDXY). Written as FLASHE/LiGHT were applicable. Models controlled for parent sex, education, ethnicity, income and adolescents' age. Mediation type defined as complementary (CL) or indirect (I) based on principles outlined by Zhao et al. (2010). To calculate the magnitude of the indirect effect multiple beta coefficient of parenting practice to adolescents' cognitive factors by beta value between that same cognitive factor to F&V consumption.

4.5.2 Sugar sweetened beverages

The direct and indirect pathways between parenting practices and adolescent SSB consumption through adolescents' cognitive factors can be seen in Table 9 for LiGHT and FLASHE. The results of parent sex explored as a moderator can be found in Table 8 above. Graphical depictions of the final significant pathways can be seen in Figure 13.

4.5.2.1 LiGHT participants

Controlling parenting practices were found to have a significant positive direct association with boys' consumption of SSBs (β=.23, p<.01). Self-efficacy was found to have a significant negative direct association with SSB intake, with higher self-efficacy correlating with reduced consumption of SSBs (β=-.28, p<.01). Structured practices were found to directly affect extrinsic motivation (β=.23, p<.01), but no indirect effects were found to be statistically significant, implying no mediation.

Among girls, self-efficacy was also found to have a significant direct negative association to SSB intake (β=-.34, p<.01). Despite the fact that structured parenting practices were found to have a significant direct association to girls' self-efficacy (β=.32, p<.01) and self-efficacy in turn

was found to significantly correlate with SSB consumption, but the full indirect pathway between the two did not achieve statistical significance ($p>.01$). Similarly, structured parenting practices were found to have a significant positive association on girls' extrinsic motivation for SSB consumption ($\beta=.39$, $p<.01$), but extrinsic motivation was not found to significantly correlate with SSB consumption ($p>.01$).

No covariates were found to significantly affect the relationships between parenting practices and adolescents' consumption of SSBs through adolescents' cognitive factors.

4.5.2.2 FLASHE participants

Both structured ($\beta=-.17$, $p<.01$) and controlling ($\beta=.20$, $p<.01$) parenting practices were found to have a significant direct association with SSB consumption among boys. Structured parenting practices ultimately had a beneficial effect on SSB intake whereas controlling parenting practices had a hindering effect. As no pathways through adolescents' cognitive factors were found to be significant, no indirect mediation was present. Direct associations between the three cognitive factors and all three types of parenting practices were present with the exception of autonomy supportive practices on extrinsic motivation ($p>.01$). Sex of parent and adolescents' age were found to significantly correlate with SSB intake.

Similar to boys, both structured ($\beta=-.17$, $p<.01$) and controlling ($\beta=.15$, $p<.01$) parenting practices were found to have a significant positive direct association with girls' consumption of SSB in FLASHE. Significant direct associations between structured parenting practices and all three cognitive factors were found (Self-efficacy: $\beta=.20$, intrinsic: $\beta=.33$ and extrinsic: $\beta=.15$, $p<.01$). Controlling parenting practices further had a significant negative direct effect on girls' self-efficacy ($\beta=-.14$, $p<.01$) whereas autonomy supportive parenting practices had a significant positive association to girls' intrinsic motivation ($\beta=.14$, $p<.01$). As no significant associations between girls' cognitive factors and SSB intake were found, the overall impact for girls' SSB intake is largely coming from parenting practices and not personal cognitive factors. No covariates were found to significantly influence these relationships.

Table 9. Associations between parenting practices and adolescents' sugar sweetened beverage consumption through adolescent factors in LiGHT (n=362) and FLASHE (n=1619) (Aim 3a).

Variables	Mediators (M)						Dependent (Y)	
	Self-efficacy		Intrinsic		Extrinsic		Sugar sweetened beverages	
Effects	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
LiGHT BOYS n=158								
Structure	.13 (-.05, .31)	-.04^{NE} (-.10, .01)	.04 (-.14, .21)	.00^{NE} (-.03, .02)	.23** (.06, .41)	.01^{NE} (-.03, .06)	-.10 (-.29, .06)	-.04 (-.11, .04)
Autonomy	.08 (-.11, .27)	-.02^{NE} (-.08, .03)	.23 (.04, .41)	-.02^{NE} (-.08, .02)	.08 (-.11, .28)	.00^{NE} (-.02, .03)	-.01 (-.20, .17)	-.04 (-.12, .03)
Control	-.16 (-.35, .03)	.05^{D} (-.01, .12)	-.16 (-.35, .03)	.02^{D} (-.02, .06)	-.07 (-.29, .13)	.00^{D} (-.03, .02)	.23** (.06, .39)	.06 (-.01, .15)
Self-efficacy							-.28** (-.44, -.11)	
Intrinsic							-.10 (-.27, .07)	
Extrinsic							.03 (-.15, .20)	
LiGHT GIRLS n= 159								
Structure	.32** (.09, .54)	-.11^{NE} (-.22, -.02)	.23 (.01, .43)	-.01^{NE} (-.07, .03)	.39** (.22, .56)	.02^{NE} (-.05, .08)	-.15 (-.32, .04)	-.11 (-.23, .00)
Autonomy	-.01 (-.18, .19)	.00^{NE} (-.06, .07)	.03 (-.17, .23)	.00^{NE} (-.03, .02)	.00 (-.19, .18)	.00^{NE} (-.02, .02)	.10 (-.07, .27)	.00 (-.07, .07)
Control	-.13 (-.32, .07)	.04^{NE} (-.03, .12)	-.07 (-.26, .14)	.00^{NE} (-.02, .04)	-.13 (-.31, .06)	-.01^{NE} (-.04, .02)	.00 (-.19, .19)	.04 (-.04, .13)
Self-efficacy							-.34** (-.49, -.19)	
Intrinsic							-.06 (-.24, .12)	
Extrinsic							.04 (-.12, .19)	
FLASHE BOYS n=755								
Structure	.22** (.13, .31)	-.02^{D} (-.04, .00)	.27** (.19, .36)	-.03^{D} (-.06, .00)	.17** (.09, .26)	.00^{D} (-.02, .02)	-.17** (-.26, -.08)	-.05** (-.08, -.02)
Autonomy	.15** (.06, .24)	-.01^{NE} (-.03, .00)	.15** (.06, .25)	-.02^{NE} (-.04, .00)	.06 (-.04, .16)	.00^{NE} (-.01, .01)	-.03 (-.12, .06)	-.03** (-.05, -.01)
Control	-.21** (-.30, -.13)	.02^{D} (.00, .04)	-.15** (-.24, -.07)	.02^{D} (.00, .04)	.14** (.05, .23)	.00^{D} (-.01, .01)	.20** (.11, .29)	.04 (.01, .07)
Self-efficacy							-.09 (-.17, -.02)	
Intrinsic							-.10 (-.21, .00)	
Extrinsic							.01 (-.09, .09)	
FLASHE GIRLS n=777								
Structure	.20** (.12, .29)	-.01^{D} (-.03, .00)	.33** (.24, .41)	.01^{D} (-.02, .04)	.15** (.06, .23)	-.01^{D} (-.03, .01)	-.17** (-.25, -.08)	-.01 (-.04, .02)
Autonomy	.08 (-.01, .17)	-.01^{NE} (-.02, .00)	.01 (-.08, .10)	.00^{NE} (-.01, .01)	.14** (.05, .24)	-.01^{NE} (-.03, .01)	.07 (-.02, .16)	-.01 (-.03, .00)
Control	-.14** (-.23, -.06)	.01^{NE} (.00, .03)	-.08 (-.17, .01)	.00^{NE} (-.01, .01)	.09 (.00, .18)	-.01^{NE} (-.02, .00)	.15** (.06, .23)	.00 (-.02, .02)
Self-efficacy							-.07 (-.14, .01)	
Intrinsic							.03 (-.06, .12)	
Extrinsic							-.06 (-.16, .03)	

Standardized β values presented (STDXY for continuous, STDY for binary) with 95% CI presented bootstrap intervals (n=5,000) in parenthesizes. All models controlled for parent sex (reference: male), education (reference: <college/university), ethnicity (reference: white), income (reference: ≤$99,999) and adolescents' age. Parent sex (β=-.26, 95%CI: -.43, -.09) and adolescents' age (β=.06, 95% CI:.02, .11) were significant in FLASHE model for boys. Mediation defined as complementary (CL), competitive (CP) or indirect (I), no mediation defined as direct (D) or no effect (NE) based on Zhao et al. (2010). n=number. %=percent. X=Independent variables. Significance level: p≤.01 (**).

4.5.2.3 Evidence of moderation on the direct and indirect pathways between parenting practices and adolescents' consumption of sugar sweetened beverages through adolescents' cognitive factors

No significant evidence of moderation by parent sex was found in either data set for boys' or girls' SSB consumption.

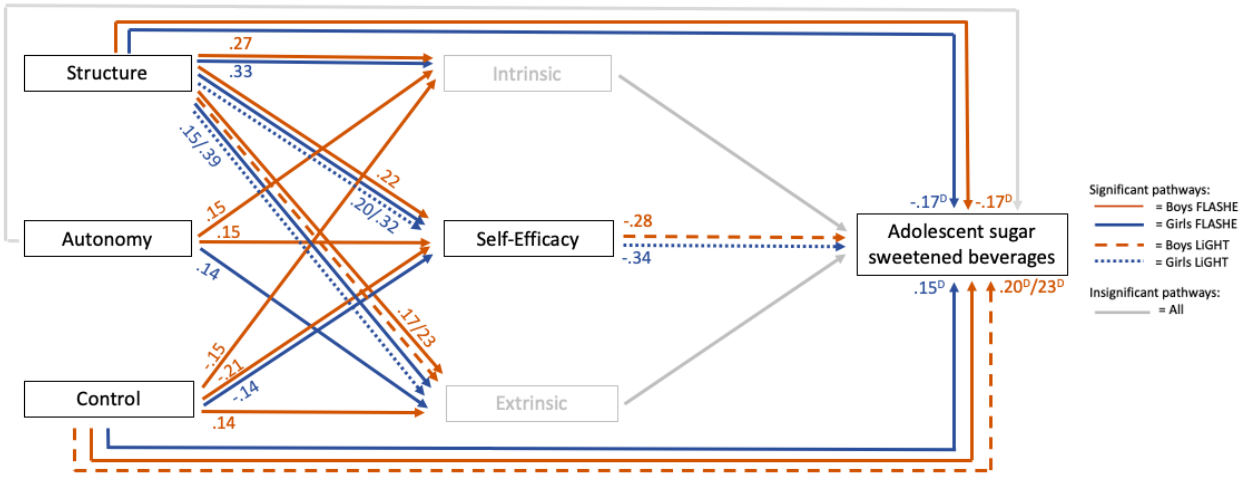

Figure 13. Final significant direct pathways and denotation of significant mediation between parenting practices and adolescent factors to adolescents' consumption of sugar sweetened beverages in LiGHT (n=362) and FLASHE (n=1619) (Aim 3a and 3b). Standardized β coefficients presented (STDXY). Written as FLASHE/LiGHT were applicable. Models controlled for parent sex, education, ethnicity, income and adolescents' age. Mediation type defined as complementary (CL) or indirect (I) based on principles outlined by Zhao et al. (2010). To calculate the magnitude of the indirect effect multiple beta coefficient of parenting practice to adolescents' cognitive factor by beta value between that same cognitive factor to F&V consumption.

Chapter 5: Discussion

The aim of this study was to explore the relationships between mothers' and fathers' parenting practices (i.e., structured, autonomy supportive and controlling) on boys' and girls' dietary behaviours (i.e., F&V and SSB consumption) through adolescents' cognitive factors (i.e., self-efficacy, intrinsic and extrinsic motivations). A novel aspect of this study is the focus on sex of both child and parent on these associations. The findings highlight the importance of accounting for adolescents' sex as associations between parenting practices and adolescents' dietary behaviours as well between adolescents' cognitive factors and dietary behaviours differed between boys and girls. These differences were also reflected in the mediation analyses as differences in how adolescents' dietary behaviours were associated with parenting practices through adolescents' cognitive factors emerged. When sex of parents was accounted for as a moderator, no significant moderation was detected. Overall, these findings suggest that boys' and girls' dietary behaviours may be affected differently by parenting practices and personal cognitive factors. In order to reduce the gender-based differences in boys' and girls' dietary behaviours and their subsequent influence on health outcomes, equal promotion of boys' and girls' commitment to healthy eating is essential within the home environment.

5.1 Direct associations between parenting practices and adolescents' dietary behaviours

Associations for all three types of parenting practices within this thesis fit in line with what was hypothesized. Structured and autonomy supportive parenting practices correlated with an increase in F&V intake and a decrease in the consumption of SSBs and these findings align with current literature (36,43,122,171,172,181). Controlling parenting practices correlated with a decrease in F&V consumption and an increase in SSB intake, which partially contrasts recent work (177). A recent cross-sectional study from the US supports the findings within this thesis with regards to SSB intake (Positive associations) but differs in that positive associations were also found for F&V intake within this study (172), contrasting the findings of this thesis. It is possible that adolescents within this thesis consumed a large number of meals away from their parents and elected to consume foods often restricted at home, such as SSBs instead of F&V in these instances (34,128). Considering the amount of time adolescents spend in independent

eating occasions and if they elect to follow parents' rules in these scenarios may help clarify the discrepancies between this thesis and this recent literature (34).

Importantly, significant differences in the associations between parenting practices and adolescents' intake of F&V and SSBs emerged between boys and girls, adding to the existing literature. First, controlling parenting practices were associated with a decrease in F&V consumption for boys only. There is some evidence in the literature that boys are exposed to controlling practices more so than girls (46). This may explain why controlling practices were only found to relate to boys' intake of F&V. It is also possible that parents utilized this parenting practice more with their adolescent boys as they may perceive them to be less food literate than girls (48,53)**.** Second, the association between autonomy supportive practices and increases in F&V intake was only observed among boys. This finding disagrees with a five year cohort study which found that boys received less parental encouragement to consume F&V with increasing age whereas no decrease in encouragement was reported among girls (38). Differences in how parental encouragement was measured and lack of formal statistical comparison between boys and girls could account for the discrepancies between the cited study and this thesis. It is possible that boys within this analysis were exposed to more autonomy supportive practices due to historical norms encouraging greater parental reinforcement of independence and autonomy over behaviours among boys compared to girls (135,138). Though it was not measured within this thesis, parents within these two samples could have promoted this notion by providing their boys with greater overall behavioural freedom, including autonomy in dietary behaviours.

These findings suggest that adolescent boys may respond to a wider range of parenting practices compared to girls. In home-based interventions, parents should be coached on key practices that influence their boys and girls dietary behaviours in health promoting ways.

5.2 Direct associations between adolescents' cognitive factors and dietary behaviours

The associations between boys' and girls' cognitive factors and intake of F&V are similar within this thesis. Contrary to what was hypothesized, self-efficacy, intrinsic and extrinsic motivation were all associated with increased intake of F&V, instead of just self-efficacy and intrinsic motivation. The findings for self-efficacy and intrinsic motivation align with SCT (Social cognitive theory) (44) and SDT (Self-determination theory) (45). However, the

associations between extrinsic motivation within this thesis disagree with SDT (45). From SDT, extrinsic motivation is thought to negatively affect F&V consumption by undermining the development of self-regulatory skills (45,227) but the opposite was observed in this thesis. It is possible that the association from SDT may not emerge as anticipated until late adolescence, when dietary intake becomes less controlled by parents (33,34,38,228) and adolescents have developed their own food identity (229). A recent analysis of 12- to 17-year-olds in the US aligns with the findings of this thesis (36) in that extrinsic motivation was found to have positive associations to F&V intake. The mean age of adolescents within this thesis (LiGHT:14.9 years; FLASHE:14.5 years) is almost identical to that of the US study opposing SDT theory (14.5 years). This age is consistent with mid-adolescence (230), where parents still retain a large amount of control over their adolescents' behaviours and this may explain the findings. It is also worth noting that associates between extrinsic motivation and adolescents' dietary behaviours were weaker than for adolescents' self-efficacy or intrinsic motivation. This may indicate that internal values and desires over dietary behaviours have a greater effect compared to external social pressures, fitting in line with the literature (34,39,45). It could also imply that adolescents are in a state of flux, fitting in line with gains in their autonomy at this life stage.

Differences between boys' and girls' cognitive factors and dietary behaviours also emerged. While this is partially consistent with what was hypothesized (In that differences would emerge), the directions of associations opposed current literature. Few studies have compared boys' and girls' cognitive factors with dietary intake. Studies that have examined this have suggested greater self-efficacy (46,54) and higher intrinsic motivation (56,121) in girls to be associated with dietary behaviours. In contrast, this thesis did not detect any differences in self-efficacy based upon gender and associations between intrinsic motivation were only present in boys for SSB intake. It is possible that differences in the constructs used to assess the three cognitive factors, variation in dietary outcomes investigated or accounting for self-efficacy and motivation in a single model, contribute to these discrepancies. A study from the US reported greater overall levels of intrinsic motivation among girls, yet found strong links between parenting practices and intrinsic motivation among boys (121). Boys may express lower levels of intrinsic motivation overall, but receive greater social support from their parents to develop this form of motivation through integrated pathways (45,121). This support could be present due to greater parental awareness for limiting SSB consumption among boys compared to girls in these samples in

response to public health concerns highlighting higher levels of SSB intake among boys in more recent years (25,26,28,109).

Differences in how parents influence boys' and girls' motivation for healthy eating may be present. These differences may contribute to discrepancies in the dietary behaviours boys and girls choose to pursue. Future work should consider the factors that may influence differences in boys' and girls' motivation for healthy eating and how this contributes to healthy eating in the long run.

5.3 Direct and indirect associations between parenting practices and adolescents' dietary behaviours through adolescents' cognitive factors

Associations between parenting practices and adolescents' dietary behaviours through the three cognitive factors partially match what was hypothesized in this thesis. As anticipated, mediation of boys' and girls' consumption of F&V was present. Both direct and indirect mediation through structured parenting practices and indirect mediation through autonomy support and controlling practices was detected, aligning with recent work (121,172). However, adolescents' SSB consumption was not found to be mediated, with only direct effects between structured and controlling parenting practices detected. This opposes recent findings (121,172) and what was hypothesized by this thesis. Though both of these studies also explored use of FLASHE data, differences in how parenting practices were operationalized (Single item constructs), use of adolescent report (Instead of parent report), broader dietary measures ('Unhealthy foods' including SSBs, chips, fried chicken, hamburgers, desserts) and only consideration of self-efficacy or motivation within models likely contributed to the differences in findings. Limited work has considered how associations between adolescents' dietary behaviours and parenting practices may be mediated through adolescents' cognitive factors in conjunction with one another. It may be important to include both self-efficacy and motivation in models to gain a more complete understanding of the mechanisms by which parenting practices affect adolescents' dietary behaviours. Overall, these findings suggest that boys' and girls' consumption of F&V may not operate through the same mechanisms as SSBs. Future

interventions should consider which pathways may offer advantages in promoting intake of more healthful foods compared to discouraging consumption of less healthful foods.

Differences in the associations between parenting practices and adolescents' dietary behaviours emerged between boys and girls only through indirect pathways within this thesis. As no other literature has explored the associations between the three types of food-related parenting practices and adolescents' cognitive factors (Self-efficacy and motivation) by adolescents' sex, it is important to highlight these novel findings. Understanding the factors associated with consumption of F&V or SSBs of boys and girls will help in the creation of future interventions that equally support boys' and girls' commitment to healthy eating. Of the differences that were detected, a few do seem to align with what gender theory predicts (135,138,143,151): 1. Autonomy supportive parenting practices acted through girls' extrinsic motivation but boys' intrinsic motivation for SSB consumption; and 2. Greater associations between parenting practices (Autonomy supportive and controlling) were evident among boys but not girls. Details of these associations are discussed below.

It is possible that girls perceive greater autonomy from their parents over their dietary behaviours as an opportunity to demonstrate actions that are modelled or promoted by their parents, consistent with the idea of intergenerational modeling of behaviours (143,151). This would then affect a girls' dietary behaviours through extrinsic pathways (45). In contrast, boys may view autonomy supportive practices as a time to express their own behavioural desires, consistent with theory suggesting boys are supported to carve out their own path (135,138), influencing dietary behaviours through intrinsic motivational pathways (45). Boys may further respond to a broader range of parenting practices compared to girls. Associations between controlling practices and autonomy supportive practices on motivation and self-efficacy in dietary behaviours were present among boys, but not girls. It is possible that parents may perceive their sons as less food-literate (53). This may contribute to parents trying to use more hands on or overt food-related parenting practices (Such as autonomy supportive or controlling practices) with their sons opposed to their daughters as means to influence their sons' dietary behaviours (161,177,231). Such views could have contributed to the results observed within this thesis.

The overall home environment parents create through structural practices appears to have a large role over boys' and girls' dietary behaviours. Boys may respond differently compared to girls in interventions with more active parental involvement (Via autonomy supportive or controlling practices), by affecting their self-efficacy or motivation for food consumption. Considering these differences is critical in future interventions within the home environment to ensure boys and girls are supported to develop motivation for healthy eating.

5.4 Moderation

The literature has found that mothers and fathers do have unique influences on their children's dietary behaviours (170,181), cognitive factors (193) or may use different types of parenting practices (47,177,182). Specifically, adolescents may rely more so on their mothers as a source of dietary modelling or authority for healthy eating (148,150,152,174,181), whereas fathers have been indicated to use more controlling parenting practices (34,46,47,177) and possess less dietary knowledge (148,150). This thesis differs from previous studies in that parenting practices were found to affect boys and girls similarly, regardless of sex of parent. It is possible that these discrepancies in findings are present for the following two reasons: 1. Differences between mothers and fathers may remain more prevalent during younger childhood and early adolescence (43,151,181,182), becoming less relevant when boys and girls receive greater autonomy to make their ow dietary decisions consistent with mid and late adolescence (152,229); and 2. Differences in the operationalization of parenting practices as more crude assessments of parenting practices seems to present (43,46,47,121,122,172,174,181) different findings then use of more broad constructs. Both of these factors could have contributed to a lack of moderation based upon parent gender within this thesis.

5.5 Differences between FLASHE and LIGHT participants

Overall patterns of associations differed in the FLASHE and LIGHT study samples. One possible explanation may be related to power issues in LiGHT. The LiGHT study sample was much smaller than the FLASHE sample, increasing the likelihood of a type II error and failing to detect significant associations (If present) (232,233). This may account for some of the variance in significant associations between FLASHE and LiGHT.

It is also possible that associations between parenting practices, adolescents' cognitive factors and dietary behaviours differs by population as in some cases, associations were present in the LiGHT sample but not in the FLASHE sample. Eating is an incredibly socially rooted activity whereby culture, ethnicity and social norms can all play a role in dictating what foods are accessible and acceptable to consume (33,129,130). Differences in cultures and population groups can further shape gender norms (50,134,137). Despite these social differences, it is important to recognize the confounding effects of socioeconomic status that can be present (234). Lower socioeconomic status has been found to correlate with less healthful dietary behaviours through differences in food availability, time to prepare meals or awareness of health guidelines (234). Some literature has suggested that African American adolescents consume less F&V (130) and more unhealthy foods (122) compared to their white peers. Additional literature has suggested that Hispanic adolescents have reported less motivation and greater barriers to healthy eating compared to white adolescents (173). However, within these studies differences in socioeconomic status could be confounding ethnic differences. In this thesis, the FLASHE sample consisted of a greater proportion of African American (16.8%) and Hispanic (4.3%) participants whereas LiGHT had a higher proportion of participants self-identifying as other, with most indicating Asian descent (16.3%). Statistically significant differences in income between LiGHT (≥$100,000: 39.5%) and FLASHE (≥$100,000: 20.6%) were also present (p=.00). It is possible that socio-cultural diversity between FLASHE and LiGHT participants or confounding socioeconomic factors such as income may explain the discrepancies in the results between FLASHE and LiGHT (11).

5.6 Study limitations and strengths

5.6.1 Limitations

Despite this study's contribution to furthering the understanding of how mothers and fathers influence the dietary behaviours of their boys and girls, several limitations need to be taken into account. As this study relied upon cross-sectional surveys, it is impossible to untangle the bi-directional effect of parenting practices on adolescents' dietary behaviours (42,47,235). Parents

may use different parenting practices in response to their adolescents' behaviors or health risk. Use of different types of parenting practices may also cause different behaviours among adolescents. For example, it is possible a parent may rely on controlling practices more if they view their adolescent as less capable of monitoring their dietary behaviours. It is equally possible that by using controlling practices, an adolescent fails to develop food literacy skills and thus, becomes less capable of monitoring their own dietary behaviours.

As adolescent gender is a social construct and sex is a biological categorization, it is possible that associations between parenting practices, adolescents' dietary behaviours and cognitive factors may have differed if adolescent gender was considered instead of biological sex. Literature has suggested that gender differences are present on boys' and girls' dietary behaviours (236,237). As no indication of adolescent gender was available from FLASHE, biological sex was operationalized as a proxy for adolescent gender instead. However, due to high agreement between adolescent reported sex and gender in LiGHT (Boys: 98.9%; Girls: 96.7%), it is likely that biological sex may act as an acceptable proxy for gender in this analysis.

Limitations surrounding the study instruments used within this thesis are also present. All surveys in LiGHT and FLASHE relied upon self-report, making it possible that social desirability influenced participant responses and introduced internal bias into study findings. Adolescents may have over-estimated their consumption of F&V and under reported their intake of SSBs, affecting detected associations. Parents may also have over reported their use of certain parenting practices that they feel are socially acceptable. Despite the fact that these self-reported questionnaires were validated and had moderate psychometric properties (Cronbach alpha ranges: 0.65-.80), shortening of validated scales could have contributed to reduced sensitivity of these measures and further reduced internal validity of results. For example, literature considering parenting practices as single item constructs (i.e., parental encouragement) instead of as more crude measures of parenting practices (i.e., autonomy supportive) likely do not present the same relationships (122,172). It is possible that by considering individual constructs for parental practices, the associations between certain parenting practices and adolescents' dietary behaviours would have differed.

Differences between boys and girls at baseline in regard to their dietary intake and cognitive factors within the two samples may have influenced the likelihood of detecting significant

associations in one group compared to the other. For example, significant differences in age between boys and girls (14.7 years vs. 15.1 years) in LiGHT may have contributed to discrepancies in why controlling parenting practices showed significant associations for boys but not girls. Parental control has been documented to decrease with adolescents' age (34), and could be contributing to why associations among adolescent girls within this sample were not detected. Additionally, differences between these two samples and the general populations in which they were recruited from are likely. Though considered nationally representative on socio-demographic factors (Parent income, educational attainment and ethnicity), participants who elected to participate may have differ from the general Canadian or US populations in other unmeasured factors, adolescents' dietary practices, adolescents' cognitive factors or parental use of different types of parenting practices. Caution should be expressed when generalizing the findings of this thesis to the broader Canadian and US populations.

Lastly, it is possible that mothers and fathers may rely on congruent or incongruent food-related parenting practices (49), which could have a greater overall effect on adolescents' behaviours compared to parent gender. Incongruent practices between a mother and a father have been thought to have a negative effect on adolescents' dietary behaviours, regardless of whether a mother or father is using a certain parenting practice (49). As only parenting practices of one parent was considered within this thesis, it is impossible to consider if both parents express the use of reported practices to the same extent. This may have affected the associations between parenting practices and adolescents' dietary behaviours and could have further influenced the likelihood of detecting moderating effects.

5.6.2 Strengths

Despite the above limitations, this thesis also had several strengths. Consideration of adolescents' cognitive factors within the associations of parenting practices to adolescents' dietary behaviours has not been robustly considered in the literature. Instead, associations between parenting practices (34,35) or adolescents' cognitive factors (43,55,56,167,193) on adolescents' dietary behaviours have been explored separately. Path analysis through adolescents' cognitive factors offers benefits in considering the mechanisms by which parents and their food-related practices affect adolescents' dietary behaviours (46). Understanding these

mechanisms may help in the development of more effective interventions that utilize the home environment (46).

This thesis was also one of the first to consider the interplay between both sex of parents and sex of adolescents. Little work within the adolescent population group has considered differences in the associations between mothers' and fathers' parenting practices on boys' and girls' dietary behaviours (33,43). Understanding if boys and girls are similarly affected by parenting practices on their cognitive factors and dietary behaviours will help in the development of more effective interventions that supports both boys and girls to maintain more health promoting dietary behaviours as they age (38,238).

Literature has suggested that inclusion of fathers in home-based interventions produces more beneficial outcomes on child behavioural change (239). As typical participation rates of fathers within child obesity studies is quite low (17.0%) (240), issues with sampling bias and uncovering true associations between fathers' influences on their adolescents' dietary behaviours likely occurs due to an over representation of mothers. This thesis had higher proportions of participating fathers (LiGHT: 34.5%; FLASHE: 25.5%), contributing towards the goal of furthering an understanding of the role fathers play within their adolescents' dietary behaviours (49,152), helping to fill this current gap in the literature.

Lastly, by using two different samples it is possible to consider if relationships between parenting practices and adolescents' dietary behaviours hold constant across different population groups. This cross validation of detected associations helps demonstrate if similar intentions can be effective in diverse population groups or if population specific interventions may offer greater advantages.

5.7 Study implications and future directions

To further the understanding as to how parents affect their adolescents' dietary behaviours the following recommendations are suggested for future study: 1. Examine associations between parenting practices and adolescents' dietary behaviours in a longitudinal sample to test causality and determine whether these associations shift during adolescence; 2. Collect data from both mothers and fathers in two-parent households to gain a greater understanding of the role of each parent on an adolescent; 3. Test whether these associations are different in non-traditional family

household (i.e., same sex parents or single parents) as it is possible modelling of gender based norms and roles may be less prevalent compared to heterosexual two-parent households (241); and 4. Use of more comprehensive and less subjective measures of parenting practices to help reduce bias caused by social desirability (49) and account for the dynamic use of multiple types of parenting practices in different scenarios.

Interventions including the home environment have been found to offer advantages compared to those without (242). Understanding how parenting practices influence adolescents' dietary behaviours, both directly and indirectly, may contribute to more effective future interventions that utilize parents (46). The results of this thesis suggest that boys' and girls' dietary behaviours are affected differently by parenting practices. Tailoring future interventions within the home environment to adolescents' gender may better support boys and girls uptake and retention of health prompting dietary behaviours (238).

Chapter 6: Conclusion

Literature considering the impact of parenting practices on adolescents' dietary behaviours has been well documented (34,35,152,162–164). Furthermore, cognitive factors including self-efficacy (44,54), intrinsic and extrinsic motivation (45,173) have been suggested to impact adolescents' dietary behaviours. It is unclear to what extent these associations are similar among boys and girls or if sex of parent matters (34,38,47). To address this gap, this thesis conducted a path analysis, stratified by boys and girls, and further considered the impact of parental sex as a moderator on these associations.

From this analysis, key findings included: 1. Boys and girls may not respond to parenting practices related to their dietary behaviours in the same way; 2. Boys and girls appear to be similarly affected by self-efficacy but may differ in how motivation for healthy eating influences consumption of F&V and SSBs; 3. Parenting practices may influence boys' and girls' dietary behaviours differently through indirect pathways, including associations through cognitive factors; and 4. Parent sex does not appear to be a key factor affecting the associations between parenting practices and adolescents' dietary behaviours.

The findings from this thesis suggest that utilizing the home environment, regardless of parent sex, through structured practices may have advantages on boys and girls dietary behaviours. Interventions utilizing more active parent involvement (Through controlling or autonomy supportive practices) may affect boys and girls differently through motivational pathways.

References

1. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: Public-health crisis, common sense cure. *Lancet.* 2002;360(9331):473–82.

2. Sahoo K, Sahoo B, Choudhury AK, Sufi NY, Kumar R, Bhadoria AS, et al. Childhood obesity: Causes and consequences. *J Fam Med Prim Care.* 2015;4(2):187–92.

3. Singh AS, Mulder C, Twisk JWR, Van Mechelen W, Chinapaw MJM. Tracking of childhood overweight into adulthood: A systematic review of the literature. *Obes Rev.* 2008;9(5):474–88.

4. Patton GC, Coffey C, Carlin JB, Sawyer SM, Williams J, Olsson CA, et al. Overweight and obesity between adolescence and young adulthood: A 10-year prospective cohort study. *J Adolesc Heal.* 2011;48(3):275–80.

5. Willers SM, Brunekreef B, Smit HA, van der Beek EM, Gehring U, de Jongste C, et al. BMI Development of Normal Weight and Overweight Children in the PIAMA Study. *PLoS One*. 2012;7(6):e39517.

6. Alles MS, Eussen SRBM, van der Beek EM. Nutritional challenges and opportunities during the weaning period and in young childhood. *Ann Nutr Metab.* 2014;64:284–93.

7. Gluckman PD, Hanson MA, Morton SMB, Pinal CS. Life-long echoes - A critical analysis of the developmental origins of adult disease model. *Biol Neonate*. 2005;87(2):127–39.

8. Juonala M, Magnussen CG, Berenson GS, Venn A, Burns TL, Sabin MA, et al. Childhood Adiposity, Adult Adiposity, and Cardiovascular Risk Factors. *N Engl J Med.* 2011;365(20):1876–85.

9. Arnold M, Pandeya N, Byrnes G, Renehan AG, Stevens GA, Ezzati M, et al. Global burden of cancer attributable to high body-mass index in 2012: A population-based study. *Lancet Oncol.* 2015;16(1):36–46.

10. Statistics Canada. Children's body mass index - World Health Organization classification system, inactive [Internet]. [cited 2019 Dec 21]. Available from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310032201&pickMembers%5B0%5D=3.3

11. Skinner AC, Ravanbakht SN, Skelton JA, Perrin EM, Armstrong SC. Prevalence of obesity and severe obesity in US children, 1999-2016. *Pediatrics.* 2018;141(3):e20173459.

12. Rao DP, Kropac E, Do MT, Roberts KC, Jayaraman GC. Childhood overweight and obesity trends in Canada. Health Promot Chronic Dis Prev Can. 2016;36(9):194-8."

13. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of obesity among adults and

youth: United States. Hyattsville (MD): NCHS data brief; 2017. 1-8.

14. Binkley JK, Eales J, Jekanowski M. The relation between dietary change and rising US obesity. *Int J Obes*. 2000;24:1032–9.

15. Romieu I, Dossus L, Barquera S, Blottière HM, Franks PW, Gunter M, et al. Energy balance and obesity: What are the main drivers? Cancer Causes Control. 2017;28(3):247–58.

16. Duffey KJ, Popkin BM. Energy density, portion size, and eating occasions: Contributions to increased energy intake in the United States, 1977-2006. PLOS Med. 2011;8(6):e1001050–8.

17. Gropper SAS, Smith JL. Vitamin D. In: Advanced Nutrition and Human Metabolism. 6th ed. Belmont, CA: Wadsworth/Cengage Learning; 2013.1–586.

18. Alberga A, JR. S, Goldfield G, Prud' homme D, Kenny G. Overweight and obese teenagers: Why is adolescence a critical period? *Pediatr Obes*. 2012;7:261–73.

19. Todd AS, Street SJ, Ziviani J, Byrne NM, Hills AP. Overweight and obese adolescent girls: The importance of promoting sensible eating and activity behaviors from the start of the adolescent period. *Int J Res Public Heal.* 2015;12:2306–29.

20. Tugault-Lafleur CN, Black JL. Differences in the quantity and types of foods and beverages consumed by Canadians between 2004 and 2015. *Nutrients*. 2019;11(3):526–50.

21. Dietitians of Canada. How Many Vegetables and Fruit Do you Need? [Internet]. 2018 [cited 2020 Aug 17]. Available from: https://www.unlockfood.ca/en/Articles/Canada-s-Food-Guide/How-many-Vegetables-and-Fruit-do-you-need.aspx

22. U.S. Department of Health and Human Services and U.S. Department of Agriculture. Dietary Guidelines for Americans 2015-2020. 8th Edition. [Internet]. 2015 [cited 2020 aug 17]. Available from: http://health.gov/dietaryguidelines/2015/guidelines/

23. Government of Canada. Eating well with Canada's food guide 2007 [Internet]. 2019 [cited 2019 Sep 21]. Available from: https://www.canada.ca/en/health-canada/services/canada-food-guide/about/history-food-guide/eating-well-with-canada-food-guide-2007.html

24. Langlois K, Garriguet D, Gonzalez A, Sinclair S, Colapinto CK. Change in total sugars consumption among Canadian children and adults. *Heal Reports.* 2019;30(1):10–9.

25. Davis LE, Davison CM. Prevalence and patterns of sugar-sweetened beverage consumption in Canadian youth: A northern focus. *Arctic.* 2017;70(4):414–24.

26. Centers for Disease Control and Prevention. Youth Online [Internet]. 2019 [cited 2019 Oct 12]. Available from: https://nccd.cdc.gov/youthonline/App/Results.aspx

27. Rasmussen M, Krølner R, Klepp KI, Lytle L, Brug J, Bere E, et al. Determinants of fruit and vegetable consumption among children and adolescents: A review of the literature. Part I: Quantitative studies. *Int J Behav Nutr Phys Act*. 2006;3:22–41.

28. Jessri M, Nishi SK, L'Abbe MR. Assessing the nutritional quality of diets of Canadian children and adolescents using the 2014 health Canada Surveillance Tool Tier System. *BMC Public Heal*. 2016;16(1):381–95.

29. Lillico HG, Hammond D, Manske S, Murnaghan D. The prevalence of eating behaviors among Canadian youth using cross-sectional school-based surveys. *BMC Public Heal* 2014;14(1):323–35.

30. Black JL, Billette JM. Fast food intake in Canada: Differences among canadians with diverse demographic, socio-economic and lifestyle characteristics. *Can J Public Heal.* 2015;106(2):e52–8.

31. Moore L V., Thompson FE, Demissie Z. Percentage of youth meeting federal fruit and vegetable intake recommendations, Youth Risk Behavior Surveillance System, United States and 33 States, 2013. *J Acad Nutr Diet*. 2017;117(4):545–53.

32. Courtenay WH. Engendering health: A social constructionist examination of men's health beliefs and behaviors. *Psychol Men Masculinity.* 2000;1(1):4–15.

33. Story M, Neumark-Sztainer D, French S. Individual and environmental influences on adolescent eating behaviours. *J Am Diet Assoc.* 2002;Supplement:s41–51.

34. Reicks M, Banna J, Cluskey M, Gunther C, Hongu N, Richards R, et al. Influence of parenting practices on eating behaviors of early adolescents during independent eating occasions: Implications for obesity prevention. *Nutrients.* 2015;7(10):8783–801.

35. Vaughn AE, Ward DS, Fisher JO, Faith MS, Hughes SO, Kremers SPJ, et al. Fundamental constructs in food parenting practices: A content map to guide future research. *Nutr Rev.* 2016;74(2):98–117.

36. Parks CA, Blaser C, Smith TM, Calloway EE, Oh AY, Dwyer LA, et al. Correlates of fruit and vegetable intake among parents and adolescents: Findings from the Family Life, Activity, Sun, Health, and Eating (FLASHE) study. *Public Heal Nutr.* 2018;21(11):2079–87.

37. Bauer KW, Neumark-Sztainer D, Fulkerson JA, Hannan PJ, Story M. Familial correlates of adolescent girls' physical activity, television use, dietary intake, weight, and body composition. *Int J Behav Nutr Phys Act*. 2011;8(1):1–10.

38. Bauer KW, Laska MN, Fulkerson JA, Neumark-Sztainer D. Longitudinal and secular trends in parental encouragement for healthy eating, physical activity, and dieting throughout the adolescent years. *J Adolesc Heal*. 2010;49(3):306–11.

39. Stevenson C, Doherty G, Barnett J, Muldoon OT, Trew K. Adolescents' views of food

and eating: Identifying barriers to healthy eating. *J Adolesc.* 2007;30(3):417–34.

40. Issner JH, Mucka LE, Barnett D. Increasing Positive Health Behaviors in Adolescents with Nutritional Goals and Exercise. *J Child Fam Stud*. 2017;26(2):548–58.

41. Brown R, Ogden J. Children's eating attitudes and behaviour: A study of the modelling and control theories of parental influence. *Health Educ Res*. 2004;19(3):261–71.

42. Loth K, Friend S, Horning M, Neumark-Sztainer D, Fulkerson J. Directive and non-directive food-related parenting practices: Associations between an expanded conceptualization of food-related parenting practices and child dietary intake and weight outcomes. *Appetite.* 2016;107:188–95.

43. Pearson N, Ball K, Crawford D. Predictors of changes in adolescents' consumption of fruits, vegetables and energy-dense snacks. *Br J Nutr.* 2011;105(5):795–803.

44. Bandura A. Health promotion by social cognitive means. *Heal Educ Behav*. 2004;31(2):143–64.

45. Deci EL, Ryan RM. The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychol Inq.* 2000;11(4):227–68.

46. Pearson N, Ball K, Crawford D. Parental influences on adolescent fruit consumption: The role of adolescent self-efficacy. *Health Educ Res.* 2012;27(1):14–23.

47. Loth K, MacLehose R, Fulkerson J, Crow S, Neumark-Sztainer D. Food-related parenting practices and adolescent weight status: A population-based study. *Pediatrics.* 2013;131(5):e1443–50.

48. Wardle J, Haase AM, Steptoe A, Nillapun M, Jonwutiwes K, Bellisle F. Gender differences in food choice: The contribution of health beliefs and dieting. *Ann Behav Med*. 2004;27(2):107–16.

49. Davison KK, Haines J, Garcia EA, Douglas S, McBride B. Fathers' food parenting: A scoping review of the literature from 1990 to 2019. *Pediatr Obes*. 2020;1–10.

50. Ridgeway CL, Correll SJ. Unpacking the gender system a theoretical perspective on gender beliefs and social relations. *Gend Soc.* 2004;18(4):510–31.

51. Jones J, Mosher WD. Fathers' involvement with their children: United states, 2006-2010. National Health Statistics Reports. Hyatts Ville (MD): US department of health and human services; 2013 Dec. National health statisctics report number 71. 1-22.

52. Parker K, Wang W. Modern parenthood roles of moms and dads converge as they balance work and family. Wahington (DC): Pew Resarch Center; 2013 Mar. 68.

53. Lai Yeung WLT. Gender perspectives on adolescent eating behaviors: A study on the eating attitudes and behaviors of junior secondary students in Hong Kong. *J Nutr Educ*

Behav. 2010;42(4):250–8.

54. Godinho JRS, Alves HMB. Behavioural factors in young people's fruit consumption. *Int J Consum Stud.* 2017;41(1):104–19.

55. Fitzgerald A, Heary C, Kelly C, Nixon E, Shevlin M. Self-efficacy for healthy eating and peer support for unhealthy eating are associated with adolescents' food intake patterns. *Appetite*. 2013;63:48–58.

56. Dwyer LA, Bolger N, Laurenceau JP, Patrick H, Oh AY, Nebeling LC, et al. Autonomous motivation and fruit/vegetable intake in parent–adolescent dyads. *Am J Prev Med*. 2017;52(6):863–71.

57. World Health Organization. Evidence for gender responsive actions to prevent and manage overweight and obesity [Internet]. 2011[cited Oct 2019]. Available from: http://www.euro.who.int/__data/assets/pdf_file/0016/158101/316637_WHO_brochure_226x226_2-overweight_obesity.pdf?ua=1

58. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ.* 2007;85:660–7.

59. Mceneny J, Blair S, Woodside J V, Murray L, Boreham C, Young IS. high-density lipoprotein subfractions display proatherogenic properties properties in overweight and obese children. *Pediatric.* 2013;74(3):1–5.

60. Koopman LP, Mertens LL. Impact of childhood obesity on cardiac structure and function. *Curr Treat Options Cardiovasc Med.* 2014;16(11):345–65.

61. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013. *Lancet.* 2014;384(9945):766–81.

62. NCD Risk Factor Collaboration(NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. *Lancet*. 2017;390:2627–42.

63. Fryar CD, Carroll MD, Ogden CL. Prevalence of overweight, obesity, and severe obesity among children and adolescents aged 2–19 years: United States, 1963–1965 through 2015–2016. Hyatts Ville (MD): National Center for Health Statistics; 2018 Sept. 1-6.

64. Bay JL, Morton SM, Vickers MH. Realizing the potential of adolescence to prevent transgenerational conditioning of non-communicable disease risk: Multi-sectoral design frameworks. *Healthcare*. 2016;4:39–55.

65. Andersen IG, Holm JC, Homøe P. Obstructive sleep apnea in children and adolescents

with and without obesity. *Eur Arch Oto-Rhino-Laryngology*. 2019;276(3):871–8.

66. Narang I, Mathew JL. Childhood Obesity and Obstructive Sleep Apnea. *J Nutr Metab.* 2012;1–8.

67. Wills M. Orthopedic complications of childhood obesity. *Pediatr Phys Ther*. 2004;16(4):230–5.

68. Briggs MS, Bout-Tabaku S, Buell J, White S, Rosenstein PF, Schmitt LC. A preliminary evaluation of the associations among functional performance tasks and quality of life in obese and healthy weight youth. *J Sports Sci*. 2019;37(1):20–8.

69. Cote AT, Harris KC, Panagiotopoulos C, Sandor GGS, Devlin AM. Childhood Obesity and Cardiovascular Dysfunction. *J Am Coll Cardiol*. 2013;62(15):1309–19.

70. Nasreddine L, Naja F, Tabet M, Habbal MZ, El-Aily A, Haikal C, et al. Obesity is associated with insulin resistance and components of the metabolic syndrome in Lebanese adolescents. *Ann Hum Biol*. 2012;39(2):122–8.

71. Sinha RA, Fisch G, Teague B, Tamborlane W V, Banyas B, Allen K, et al. Prevalence of impaired glucose tolerance among children and adolescents with marked obesity. *N Engl J Med*. 2002;346(11):802–10.

72. Ram W, Dziura J, Burgert TS, Tamborlane W V, Taksali SE, Yeckel CW, et al. Obesity and the Metabolic Syndrome in Children and Adolescents. *N Engl J Med*. 2004;350:2362–74.

73. Arslanian S. Type 2 diabetes in children: Clinical aspects and risk factors. *Horm Res.* 2002;57(Supplement 1):19–28.

74. Haroun D, Mechli R, Sahuri R, AlKhatib S, Obeid O, El Mallah C, et al. Metabolic syndrome among adolescents in Dubai, United Arab Emirates, is attributable to the high prevalence of low HDL levels: a cross-sectional study. *BMC Public Health.* 2018;18(1):1284–92.

75. Johnson WD, Kroon JJM, Greenway FL, Bouchard C, Ryan D, Katzmarzyk PT. Prevalence of Risk Factors for Metabolic Syndrome in Adolescents. *Arch Pediatr Adolesc Med.* 2009;163(4):371–7.

76. Srinivasan SR, Myers L, Berenson GS. Predictability of chilhood adiposity and insulin for developing insulin resistance syndrome (Syndrome X) in young adulthood. *Diabetes.* 2002;51:204–9.

77. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: A systematic analysis for the Global Burden of Disease Study 2010. *Lancet.* 2012;380(9859):2224–60.

78. Ferrara CT, Geyer SM, Liu Y-F, Evans-Molina C, Libman IM, Besser R, et al. Excess BMI in childhood: A modifiable risk factor for type 1 diabetes development? *Diabetes Care*. 2017;40(5):698–701.

79. Palad CJ, Yarlagadda S. Weight stigma and its impact on paediatric care. *Curr Opin Endocrinol Diabetes Obes.* 2019;26(1):19–24.

80. Hayden-wade HA, Stein RI, Ghaderi A, Saelens BE, Zabinski MF, Wilfley DE. Prevalence, characteristics, and correlates of teasing experiences among overweight children vs. non-overweight peers. *Obes Res*. 2005;13(8):1381–92.

81. Lee KS, Vaillancourt T. Body mass index, peer victimization, and body dissatisfaction across 7 years of childhood and adolescence: Evidence of moderated and mediated pathways. *Dev Sci.* 2019;22(2):1–12.

82. Janssen I, Craig WM, Boyce WF, Pickett W. Associations Between Overweight and Obesity With Bullying Behaviors in School-Aged Children. *Pediatrics.* 2004;113(5):1187–94.

83. Annis NM, Cash TF, Hrabosky JI, Milkewicz Annis N, Cash TF, Hrabosky JI. Body image and psychosocial diffrences among stable average weight, currently overweight, and formerly overweight women: The role of stigmatizing experiences. *Body Image.* 2004;1(2):155–67.

84. Chisuwa-Hayami N, Haruki T. Associations of body-related teasing with weight status, body image, and dieting behavior among Japanese adolescents. *Heal Promot Perspect.* 2017;7(2):80–7.

85. Puhl RM, Latner JD. Stigma, Obesity, and the Health of the Nation's Children. *Psychol Bull.* 2007;133(4):557–80.

86. Warkentin T, Borghese MM, Janssen I. Associations between weight-related teasing and psychosomatic symptoms by weight status among school-aged youth. *Obes Sci Pract.* 2016;3(1):44–50.

87. Tas D, Tüzün Z, Düzçeker Y, Akgül S, Kanbur N. The effects of parental and peer factors on psychiatric symptoms in adolescents with obesity. *Eat Weight Disord*. 2019;25(3)1–9.

88. Neumark-Sztainer D, Falkner N, Story M, Perry C, Hannan PJ, Mulert S. Weight-teasing among adolescents: Correlations with weight status and disordered eating behaviors. *Int J Obes.* 2002;26(1):123–31.

89. Wang C, Li Y, Li K, Seo DC. Body weight and bullying victimization among US adolescents. *Am J Health Behav*. 2018;42(1):3–12.

90. Silva DFO, Sena-Evangelista KCM, Lyra CO, Pedrosa LFC, Arrais RF, Lima SCVC. Motivations for weight loss in adolescents with overweight and obesity: A systematic review. *BMC Pediatr.* 2018;18(1):364–72.

91. Calzo JP, Sonneville KR, Haines J, Blood EA, Field AE, Austin SB. The Development of associations among body mass index, body dissatisfaction, and weight and shape concern in adolescent boys and girls. *J Adolesc Heal.* 2012;51:517–23.

92. Furnham A, Badmin N, Sneade I. Body image dissatisfaction: Gender differences in eating attitudes, self-esteem, and reasons for exercise. *J Psychol.* 2002;136(6):581–96.

93. Presnell K, Bearman SK, Stice E. Risk factors for body dissatisfaction in adolescent boys and girls: A prospective study. *Int J Eat Disord*. 2004;36(4):389–401.

94. Kopczyńska E, Zielińska K. Feeding the body, feeding the gender: Dietary choices of men and women in Poland. *East Eur Polit Soc Cult*. 2016;30(1):147–68.

95. Guo SS, Chumlea WC, Roche AF, Siervogel RM. Age- and maturity-related changes in body composition during adolescence into adulthood: The Fels longitudinal study. *Int J Obes*. 1997;21:1167–75.

96. Moreno LA, Rodríguez G. Dietary risk factors for development of childhood obesity. *Curr Opin Clin Nutr Metab Care.* 2007;10:336–41.

97. Mâsse LC, de Niet-Fitzgerald JE, Watts AW, Naylor PJ, Saewyc EM. Associations between the school food environment, student consumption and body mass index of Canadian adolescents. *Int J Behav Nutr Phys Act.* 2014;11(1):29–38.

98. Lytle LA, Seifert S, Greenstein J, Mcgovern P. How Do Children's Eating Patterns and Food Choices Change over Time? Results from a Cohort Study. *Am J Health Promot.* 2000; 14(4)22-28

99. Drewnowski A, Rehm CD. Energy intakes of US children and adults by food purchase location and by specific food source. *Nutr J*. 2013;12:59–69.

100. Chatelan A, Castetbon K, Pasquier J, Allemann C, Zuber A, Camenzind-Frey E, et al. Association between breakfast composition and abdominal obesity in the Swiss adult population eating breakfast regularly. *Int J Behav Nutr Phys Act.* 2018;15(1):115–26.

101. Fogelholm M, Anderssen S, Gunnarsdottir I, Lahti-Koski M. Dietary macronutrients and food consumption as determinants of long-term weight change in adult populations: a systematic literature review. *Food Nutr Res.* 2012;56(1):1–45.

102. Ambrosini GL, Emmett PM, Northstone K, Howe LD, Tilling K, Jebb SA. Identification of a dietary pattern prospectively associated with increased adiposity during childhood and adolescence. *Int J Obes*. 2012;36(10):1299–305.

103. Johnson L, Mander AP, Jones LR, Emmett PM, Jebb SA. Energy-dense, low-fiber, high-fat dietary pattern is associated with increased fatness in childhood. *Am J Clin Nutr*. 2008;87(4):846–54.

104. WHO/FAO expert Consultation. Diet, nutrition and the prevention of chronic diseases.

Geneva (CH): WHO technical report series; 2003. Report number 916. 1-160.

105. Ledoux TA, Hingle MD, Baranowski T. Relationship of fruit and vegetable intake with adiposity: A systematic review. *Obes Rev.* 2011;12:143–50.

106. Movassagh EZ, Baxter-Jones ADG, Kontulainen S, Whiting SJ, Vatanparast H. Tracking dietary patterns over 20 years from childhood through adolescence into young adulthood: The saskatchewan pediatric bone mineral accrual study. *Nutrients.* 2017;9:990–1004.

107. Liu D, Zhao LY, Yu DM, Ju LH, Zhang J, Wang JZ, et al. Dietary patterns and association with obesity of children aged 6–17 years in medium and small cities in China: Findings from the CNHS 2010–2012. *Nutrients.* 2018;11:3–15.

108. Keller A, Bucher Della Torre S. Sugar-sweetened beverages and obesity among children and adolescents: A review of systematic literature reviews. *Child Obes*. 2015;11(4):338–46.

109. Yoshida Y, Simoes EJ. Sugar-sweetened beverage, obesity, and type 2 diabetes in children and adolescents: Policies, taxation, and programs. *Curr Diab Rep*. 2018;18(6):31–47.

110. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: A systematic review. *Am J Clin Nutr*. 2006;84:274–88.

111. Torre SB Della, Keller A, Depeyre JL, Kruseman M. Sugar-sweetened beverages and obesity risk in children and adolescents: A systematic analysis on how methodological quality may influence conclusions. *J Acad Nutr Diet.* 2016;116(4):638–59.

112. Ludwig DS, Peterson KE, Gortmaker SL. Relationship between consumption of sugar-sweetened drinks and childhood obesity: A prospective, observational analysis. *Lancet.* 2001;357:505–8.

113. Malik VS, Popkin BM, Bray GA, Després JP, Hu FB. Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. *Circulation.* 2010;121(11):1356–64.

114. Hardy LL, Bell J, Bauman A, Mihrshahi S. Association between adolescents' consumption of total and different types of sugar-sweetened beverages with oral health impacts and weight status. *Aust N Z J Public Health*. 2018;42(1):22–7.

115. Dimeglio DP, Mattes RD. Liquid versus solid carbohydrate: effects on food intake and body weight. *Int J Obes*. 2000;24:794–800.

116. Perng W, Fernandez C, Peterson KE, Zhang Z, Cantoral A, Sanchez BN, et al. Dietary patterns exhibit sex-specific associations with adiposity and metabolic risk in a cross-sectional study in urban Mexican adolescents. *J Nutr.* 2017;147(10):1977–85.

117. Zhen S, Ma Y, Zhao Z, Yang X, Wen D. Dietary pattern is associated with obesity in Chinese children and adolescents: Data from China Health and Nutrition Survey (CHNS).

Nutr J. 2018;17(1):68–77.

118. Hu FB. Dietary pattern analysis: A new direction in nutritional epidemiology. *Curr Opin Lipidol.* 2002;13(1):3–9.

119. Barlow SE. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics.* 2007;Suppl:1-31

120. Government of Canada. Canada's food guide [Internet]. 2019 [cited Jan 2020]. Available from: https://food-guide.canada.ca/en/

121. Zhang Z, Farris KL, Sun MC, Dailey RM, Donovan EE. Parenting practices, autonomous motivation, and adolescent diet habits. *J Res Adolesc.* 2020;in press.:1–17.

122. Yuhas M, Porter KJ, Hedrick V, Zoellner JM. Using a socioecological approach to identify factors associated with adolescent sugar-sweetened beverage intake. *J Acad Nutr Diet.* 2020; in press:1-11.

123. Vaitkeviciute R, Ball LE, Harris N. The relationship between food literacy and dietary intake in adolescents: A systematic review. *Public Health Nutr.* 2015;18(4):649–58.

124. Stokols D. Translating social ecological theory into guidelines for community health promotion. *Am J Heal Promot.* 1995;10(4):282–98.

125. Brindal E, Wilson C, Mohr P, Wittert G. Eating in groups: Do multiple social influences affect intake in a fast-food restaurant? *J Health Psychol.* 2015;20(5):483–9.

126. Vartanian LR. Impression management and food intake. Current directions in research. *Appetite.* 2015;86:74–80.

127. Ebbeling CB, Sinclair KB, Pereira MA, Garcia-Lago E, Feldman HA, Ludwig DS. Compensation for energy intake from fast food among overweight and lean adolescents. *JAMA.* 2004;291(23):2828–34.

128. Chapman G, Maclean H. "Junk food" and "healthy food": Meanings of food in adolescent women's culture. *J Nutr Educ.* 1993;25(3):108–13.

129. Contento IR, Williams SS, Michela JL, Franklin AB. Understanding the food choice process of adolescents in the context of family and friends. *J Adolesc Heal.* 2006;38(5):575–82.

130. Granner ML, Sargent RG, Calderon KS, Hussey JR, Evans AE, Watkins KW. Factors of fruit and vegetable intake by race, gender, and age among young adolescents. *J Nutr Educ Behav.* 2004;36(4):173–80.

131. Musaiger AO, Al-Mannai M, Tayyem R, Al-Lalla O, Ali EYA, Kalam F, et al. Perceived barriers to healthy eating and physical activity among adolescents in seven arab countries:

A cross-cultural study. *Sci World J*. 2013;2013:1–11.

132. Neumark-Sztainer D, Story M, Perry C, Casey MA. Factors influencing food choices of adolescents: Findings from focus-group discussions with adolescents. *J Am Diet Assoc.* 1999;99(8):929–37.

133. West C, Zimmerman DH. Doing Gender. *Gend Soc*. 1987;1(2):125–51.

134. Ridgeway CL. Framed before we know it: How gender shapes social relations. *Gend Soc.* 2009;23(2):145–60.

135. Kågesten A, Gibbs S, Blum RW, Moreau C, Chandra-Mouli V, Herbert A, et al. Understanding factors that shape gender attitudes in early adolescence globally: A mixed-methods systematic review. *PLoS One.* 2016;11(6):1–36.

136. Bem SL. Gender schema theory: A cognitive account of sex typing. *Psychol Rev.* 1981;88(4):354–64.

137. Connell RW, Messerschmidt JW. Hegemonic masculinity rethinking the concept. *Gend Soc.* 2005;19(6):829–59.

138. Basu S, Zuo X, Lou C, Acharya R, Lundgren R. Learning to be gendered: Gender socialization in early adolescence among urban poor in Delhi, India, and Shanghai, China. *J Adolesc Heal*. 2017;61(4):S24–9.

139. Herman JL, Flores AR, Brown TNT, Wilson BDM, Conron KJ. Age of Individuals who Identify as Trans.Los Angeles (CA): The Williams Institute; 2017 Jan. 1-13.

140. Smith A, Stewart D, Poon C, Peled M, Saewyc E, McCreary Centre Society. From Hastings street to Haida Gwaii: Provincial results of the 2013 BC Adolescent Health Survey. Vancouver (BC): McCreary Center Society; 2014. 93.

141. Clark TC, Lucassen MFG, Bullen P, Denny SJ, Fleming TM, Robinson EM, et al. The health and well-being of transgender high school students: Results from the New Zealand adolescent health survey (youth'12). *J Adolesc Heal*. 2014;55(1):93–9.

142. Perry DG, Pauletti RE. Gender and adolescent development. *J Res Adolesc.* 2011;21(1):61–74.

143. Dotti Sani GM, Quaranta M. The best is yet to come? Attitudes toward gender roles among adolescents in 36 countries. *Sex Roles*. 2017;77(1–2):30–45.

144. Demetriou DZ. Connell's concept of hegemonic masculinity: A critique. *Theory Soc.* 2001;30(3):337–61.

145. Martin CL, Ruble DN, Szkrybalo J. Cognitive theories of early gender development. *Psychol Bull*. 2002;128(6):903–33.

146. Collins RL. Content analysis of gender roles in media: Where are we now and where should we go? *Sex Roles*. 2011;64(3):290–8.

147. Blair-Loy M, Hochschild A, Pugh AJ, Williams JC, Hartmann H. Stability and transformation in gender, work, and family: Insights from the second shift for the next quarter century. *Community, Work Fam.* 2015;18(4):435–54.

148. Beagan B, Chapman GE, D'Sylva A, Bassett BR. "It's just easier for me to do it": Rationalizing the family division of foodwork. *Sociology.* 2008;42(4):653–71.

149. Updegraff KA, McHale SM, Zeiders KH, Umaña-Taylor AJ, Perez-Brena NJ, Wheeler LA, et al. Mexican–American adolescents' gender role attitude development: The role of adolescents' gender and nativity and parents' gender role attitudes. *J Youth Adolesc*. 2014;43(12):2041–53.

150. Ristovski-Slijepcevic S, Chapman GE, Beagan BL. Being a "good mother": Dietary governmentality in the family food practices of three ethnocultural groups in Canada. *Health*. 2010;14(5):467–83.

151. Croft A, Schmader T, Block K, Baron AS. The second shift reflected in the second generation: Do parents' gender roles at home predict children's aspirations? *Psychol Sci.* 2014;25(7):1418–28.

152. Fielding-Singh P. Dining with dad: Fathers' influences on family food practices. *Appetite.* 2017;117:98–108.

153. Cordero-Coma J, Esping-Andersen G. The intergenerational transmission of gender roles: Children's contribution to housework in Germany. *J Marriage Fam.* 2018;80(4):1005–19.

154. Steno AM, Friche N. Celebrity chefs and masculinities among male cookery trainees in vocational education. *J Vocat Educ Train*. 2015;67(1):47–61.

155. Vartanian LR, Herman CP, Polivy J. Consumption stereotypes and impression management: How you are what you eat. *Appetite.* 2007;48(3):265–77.

156. Cavazza N, Guidetti M, Butera F. Ingredients of gender-based stereotypes about food. Indirect influence of food type, portion size and presentation on gendered intentions to eat. *Appetite.* 2015;91:266–72.

157. Thunfors P, Collins BN, Hanlon AL. Health behavior interests of adolescents with unhealthy diet and exercise: Implications for weight management. *Health Educ Res.* 2009;24(4):634–45.

158. Rozin P, Hormes JM, Faith MS, Wansink B. Is Meat Male? A Quantitative Multimethod Framework to Establish Metaphoric Relationships. *J Consum Res*. 2012;39(3):629–43.

159. Salvy SJ, Elmo A, Nitecki LA, Kluczynski MA, Roemmich JN. Influence of parents and friends on children's and adolescents' food intake and food selection. *Am J Clin Nutr*.

2011;93(1):87–92.

160. Darling N, Steinberg L. Parenting style as context: an integrative model. *Psychol Bull.* 1993;113(3):487–96.

161. O'Connor TM, Mâsse LC, Tu AW, Watts AW, Hughes SO, Beauchamp MR, et al. Food parenting practices for 5 to 12year old children: A concept map analysis of parenting and nutrition experts input. *Int J Behav Nutr Phys Act*. 2017;14:122–39.

162. Smit CR, De Leeuw RNH, Bevelander KE, Burk WJ, Buijs L, Van Woudenberg TJ, et al. An integrated model of fruit, vegetable, and water intake in young adolescents. *Heal Psychol.* 2018;37(12):1159–67.

163. Pedersen S, Grønhøj A, Thøgersen J. Following family or friends. Social norms in adolescent healthy eating. *Appetite.* 2015;86:54–60.

164. Zabinski MF, Norman GJ, Patrick K, Calfas KJ, Sallis JF, Rupp JW, et al. Psychosocial correlates of fruit, vegetable, and dietary fat intake among adolescent boys and girls. *J Am Diet Assoc*. 2006;106(6):814–21.

165. Niermann CY, Kremers SP, Renner B, Woll A. Family health climate and adolescents' physical activity and healthy eating: A cross-sectional study with mother-father-adolescent triads. *PLoS One*. 2015;10(11):e0143599–617.

166. Mokhtari S, Grace B, Pak Y, Reina A, Durand Q, Yee JK. Motivation and perceived competence for healthy eating and exercise among overweight/obese adolescents in comparison to normal weight adolescents. *BMC Obes*. 2017;4(1):36–45.

167. Girelli L, Hagger M, Mallia L, Lucidi F. From perceived autonomy support to intentional behaviour: Testing an integrated model in three healthy-eating behaviours. *Appetite*. 2016;96:280–92.

168. Haerens L, Craeynest M, Deforche B, Maes L, Cardon G, De Bourdeaudhuij I. The contribution of psychosocial and home environmental factors in explaining eating behaviours in adolescents. *Eur J Clin Nutr*. 2008;62(1):51–9.

169. Vereecken C, Haerens L, de Bourdeaudhuij I, Maes L. The relationship between children's home food environment and dietary patterns in childhood and adolescence. *Public Health Nutr*. 2010;13(10A):1729–35.

170. Hebestreit A, Intemann T, Siani A, Dehenauw S, Eiben G, Kourides YA, et al. Dietary patterns of European children and their parents in association with family food environment: Results from the I.Family Study. *Nutrients.* 2017;9(2):126–43.

171. Fleary SA, Ettienne R. The relationship between food parenting practices, parental diet and their adolescents' diet. *Appetite*. 2019;135:79–85.

172. Ma Z, Hample D. Modeling parental influence on teenagers' food consumption: An

analysis using the Family Life, Activity, Sun, Health, and Eating (FLASHE) survey. *J Nutr Educ Behav*. 2018;50(10):1005–14.

173. Wippold GM, Tucker CM, Smith TM, Rodriguez VA, Hayes LF, Folger AC. Motivators of and barriers to health-promoting behaviors among culturally diverse middle and high school students. *Am J Heal Educ*. 2018;49(2):105–12.

174. Vanhelst J, Béghin L, Drumez E, Duhamel A, De Henauw S, Ruiz JR, et al. Adolescents' diet quality in relation to their relatives' and peers' diet engagement and encouragement: The Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study. *Public Health Nutr*. 2018;21(17):3192–201.

175. Birch LL, Fisher JO. Mothers' child-feeding practices influence daughters' eating and weight. *Am J Clin Nutr*. 2000;71(5):1054–61.

176. Ello-Martin JA, Ledikwe JH, Rolls BJ. The influence of food portion size and energy density on energy intake: Implications for weight management. *Am J Clin Nutr.* 2005;82(Supplement):S236–41.

177. Scaglioni S, De Cosmi V, Ciappolino V, Parazzini F, Brambilla P, Agostoni C. Factors influencing children's eating behaviours. *Nutrients*. 2018;10(6):706–14.

178. Berge JM, MacLehose RF, Larson N, Laska M, Neumark-Sztainer D. Family food preparation and its effects on adolescent dietary quality and eating patterns. *J Adolesc Heal*. 2016;59(5):530–6.

179. Hannon PA, Bowen DJ, Moinpour CM, McLerran DF. Correlations in perceived food use between the family food preparer and their spouses and children. *Appetite*. 2003;40(1):77–83.

180. Lavelle F, Benson T, Hollywood L, Surgenor D, McCloat A, Mooney E, et al. Modern transference of domestic cooking skills. *Nutrients*. 2019;11(4):1–13.

181. Campbell KJ, Crawford DA, Salmon J, Carver A, Garnett SP, Baur LA. Associations between the home food environment and obesity-promoting eating behaviors in adolescence. *Obesity.* 2007;15(3):719–30.

182. Brann LS, Skinner JD. More controlling child-feeding practices are found among parents of boys with an average body mass index compared with parents of boys with a high body mass index. *J Am Diet Assoc*. 2005;105(9):1411–6.

183. Ventura AK, Mennella JA. Innate and learned preferences for sweet taste during childhood. *Curr Opin Clin Nutr Metab Care*. 2011;14(4):379–84.

184. Chansukree P, Rungjindarat N. Social cognitive determinants of healthy eating behaviors in late adolescents: A gender perspective. *J Nutr Educ Behav.* 2017;49(3):204–10.

185. Franko DL, Cousineau TM, Rodgers RF, Roehrig JP, Hoffman JA. Social-cognitive

correlates of fruit and vegetable consumption in minority and non-minority youth. *J Nutr Educ Behav.* 2013;45(2):96–101.

186. Teixeira PJ, Patrick H, Mata J. Why we eat what we eat: The role of autonomous motivation in eating behaviour regulation. *Nutr Bull*. 2011;36(1):102–7.

187. Trude ACB, Kharmats AY, Hurley KM, Steeves EA, Talegawkar SA, Gittelsohn J. Household, psychosocial, and individuallevel factors associated with fruit, vegetable, and fiber intake among lowincome urban African American youth. *BMC Public Health*. 2016;16(1):872–83.

188. Bandura A. Self-efficacy: Toward a Unifying Theory of Behavioral Change. *Psychol Rev.* 1977;84(2):191–215.

189. Imoisili OE, Park S, Lundeen EA, Yaroch AL, Blanck HM. Daily adolescent sugar-sweetened beverage intake is associated with select adolescent, not parent, attitudes about limiting sugary drink and junk food intake. *Am J Heal Promot*. 2020;34(1):76–82.

190. Deci EL;, Ryan RM. Facilitating optimal motivation and psychological well-being across life's domains. *Can Psychol.* 2008;49(1):14–23.

191. Larson NI, Neumark-Sztainer D, Hannan PJ, Story M. Family meals during adolescence are associated with higher diet quality and healthful meal patterns during young adulthood. *J Am Diet Assoc*. 2007;107(9):1502–10.

192. Fleary SA, Joseph P, Chang H. Applying the information-motivation-behavioral skills model to explain adolescents' fruits and vegetables consumption. *Appetite*. 2020;147:1–9.

193. Figueroa R, Kalyoncu ZB, Saltzman JA, Davison KK. Autonomous motivation, sugar-sweetened beverage consumption and healthy beverage intake in US families: Differences between mother-adolescent and father-adolescent dyads. *Public Heal Nutr*. 2019;22(6):1010–8.

194. dos Santos MM, Marreiros CS, da Silva HBS, de Oliveira ARS, Cruz KJC. Associations between taste sensitivity, preference for sweet and salty flavours, and nutritional status of adolescents from public schools. *Rev Nutr.* 2017;30(3):369–75.

195. Bo S, De Carli L, Venco E, Fanzola I, Maiandi M, De Michieli F, et al. Impact of snacking pattern on overweight and obesity risk in a cohort of 11-to 13-year-old adolescents. *J Pediatr Gastroenterol Nutr*. 2014;59(4):465–71.

196. Utter J, Denny S, Lucassen M, Dyson B. Adolescent cooking abilities and behaviors: Associations with nutrition and emotional well-being. *J Nutr Educ Behav*. 2016;48(1):35–41.

197. Larson NI, Story M, Eisenberg ME, Neumark-Sztainer D. Food preparation and purchasing roles among adolescents: Associations with sociodemographic characteristics and diet quality. *J Am Diet Assoc*. 2006;106(2):211–8.

198. Hoare E, Dash SR, Jennings GL, Kingwell BA. Sex-specific associations in nutrition and activity-related risk factors for chronic disease: Australian evidence from childhood to emerging adulthood. *Int J Environ Res Public Heal*. 2018;15(2):214–26.

199. Ronto R, Ball L, Pendergast D, Harris N. Adolescents' perspectives on food literacy and its impact on their dietary behaviours. *Appetite.* 2016;107:549–57.

200. National Cancer Institute. Family Life, Activity, Sun, Health, and Eating (FLASHE) study [Internet]. 2017 [cited Sept 2019]. Available from https://cancercontrol.cancer.gov/brp/hbrb/flashe-study

201. Westat. Family Life, Activity, Sun, Health, and Eating (FLASHE) study methodology report. Rockville (MD): Westat; 2015 Jul. 1-70.

202. Centers for Disease Control and Prevention. National Youth Physical Activity and Nutritional Study (NYPANS) [Internet]. 2020 [cited Jan 2020]. Available from https://www.cdc.gov/healthyyouth/data/yrbs/nypans.htm

203. Eaton DK, Olsen EOM, Brener ND, Scanlon KS, Kim SA, Demissie Z, et al. A comparison of fruit and vegetable intake estimates from three survey question sets to estimates from 24-hour dietary recall interviews. *J Acad Nutr Diet*. 2013;113(9):1165–74.

204. Olsen EOM, Eaton DK, Park S, Brener ND, Blanck HM. Comparing methods for assessing beverage intake among high school students. *Am J Heal Behav*. 2014;38(1):114–23.

205. National Cancer Institute. Dietary Screener Questionnaire in the NHANES 2009-2010: Background [Internet]. 2020 [cited Jan 2020]. Available from: http://epi.grants.cancer.gov/nhanes/dietscreen/.

206. Thompson FE, Midthune D, Subar AF, Kahle LL, Schatzkin A, Kipnis V. Performance of a short tool to assess dietary intakes of fruits and vegetables, percentage energy from fat and fibre. *Public Health Nutr*. 2004;7(8):1097–106.

207. Muraki I, Imamura F, Manson JE, Hu FB, Willett WC, Van Dam RM, et al. Fruit consumption and risk of type 2 diabetes: Results from three prospective longitudinal cohort studies. *BMJ*. 2013;347:1–15.

208. Imamura F, O'Connor L, Ye Z, Mursu J, Hayashino Y, Bhupathiraju SN, et al. Consumption of sugar sweetened beverages, artificially sweetened beverages, and fruit juice and incidence of type 2 diabetes: Systematic review, meta-analysis, and estimation of population attributable fraction. *BMJ*. 2015;351:h3576–88.

209. Collin LJ, Judd S, Safford M, Vaccarino V, Welsh JA. Association of sugary beverage consumption with mortality risk in US adults: A secondary analysis of data from the REGARDS Study. *JAMA Netw open*. 2019;2(5):e193121.

210. Newby PK, Tucker KL. Empirically derived eating patterns using factor or cluster

analysis: A review. *Nutr Rev*. 2004;62(5):177–203.

211. Self-Determination Theory. Perceived Competence Scales (PCS). Available from: https://selfdeterminationtheory.org/perceived-competence-scales/

212. Williams GC, Freedman ZR, Deci EL. Supporting autonomy to motive patients with diabetes for glucose control. *Diabetes Care.* 1998;21(10):1644–51.

213. Self-Determination Theory. Self-Regulation Questionnaires (SRQ). Available from: http://selfdeterminationtheory.org/self-regulation-questionnaires/

214. Levesque CS, Williams GC, Elliot D, Pickering MA, Bodenhamer B, Finley PJ. Validating the theoretical structure of the Treatment Self-Regulation Questionnaire (TSRQ) across three different health behaviors. *Health Educ Res*. 2007;22(5):691–702.

215. Birch L, Fisher J, Grimm-Thomas K, Markey C, Sawyer R, Johnson S. Confirmatory factor analysis of the Child Feeding Questionnaire: A measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite*. 2001;36(3):201–10.

216. Musher-Eizenman D, Holub S. Comprehensive Feeding Practices Questionnaire: Validation of a new measure of parental feeding practices. *J Pediatr Psychol.* 2007;32(8):960–72.

217. Wardle J, Sanderson S, Guthrie C, Rapoport L, Plomin R. Parental feeding style and the inter-generational transmission of obesity risk. *Obes Res*. 2002;10(6):453–62.

218. Darling N, Cumsille P, Martínez M. Individual differences in adolescents' beliefs about the legitimacy of parental authority and their own obligation to obey: A longitudinal investigation. *Child Dev.* 2008;79(4):1103–18.

219. Muthen LK, Muthen BO. Mplus User's Guide. Los Angeles (CA): Muthen & Muthen; 2017 Apr. Version eight. 1-944.

220. Zhao X, Lynch JG, Chen Q. Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *J Consum Res.* 2010;37(2):197–206.

221. Preacher KJ, Hayes AF. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behav Res Methods, Instruments Comput*. 2004;36(4):717–31.

222. Hayes AF. Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Commun Monogr*. 2009;76(4):408–20.

223. Fairchild AJ, McDaniel HL. Statistical commentary best but oft-forgotten) practices: Mediation analysis. *Am J Clin Nutr*. 2017;105:1259–71.

224. Hayes AF. An index and test of linear moderated mediation. *Multivariate Behav Res.* 2015;50(1):1-23.

225. Hayes AF. Partial, conditional, and moderated moderated mediation: Quantification, inference, and interpretation. *Commun Monogr*. 2018;85(1):4–40.

226. STATA Corp. Statistical Software: Release 16. College Station, TX: StatCorp LP; 2019.

227. Deci EL, Ryan RM. Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology*. 2008;49:1-4.

228. Tugault-Lafleur CN, Black JL, Barr SI. Examining school-day dietary intakes among Canadian children. *Appl Physiol Nutr Metab.* 2017;42(10):1064–72.

229. Ferris KA. Adolescent autonomy development and problematic eating patterns [master's thesis]. West Virginia, US: West Virginia University;2012.1-79.

230. World Health Organization. Orientation programme on adolescent health for health-care providers.Geneva (CH): World Health Organization; 2003. 1-403.

231. Ogden J, Reynolds R, Smith A. Expanding the concept of parental control: A role for overt and covert control in children's snacking behaviour? *Appetite*. 2006;47(1):100–6.

232. MacKinnon DP, Fairchild AJ. Current directions in mediation analysis. *Curr Dir Psychol Sci.* 2009;18(1):16–20.

233. Aguinis H, Gottfredson RK. Best-practice recommendations for estimating interaction effects using moderated multiple regression. *J Organ Behav*. 2010;31(6):776–86.

234. Wai Li AS, Figg G, Schüz B. Socioeconomic status and the prediction of health promoting dietary behaviours: A aystematic review and meta-analysis based on the Theory of Planned Behaviour. *Appl Psychol Heal Well-Being*. 2019;11(3):382–406.

235. Khandpur N, Charles J, Blaine RE, Blake C, Davison K. Diversity in fathers' food parenting practices: A qualitative exploration within a heterogeneous sample. *Appetite*. 2016;101:134–45.

236. Vollrath ME, Hampson SE, Júlíusson PB. Children and eating. Personality and gender are associated with obesogenic food consumption and overweight in 6- to 12-year-olds. Appetite. 2012;58(3):1113–7.

237. Leech RM, McNaughton SA, Timperio A. The clustering of diet, physical activity and sedentary behavior in children and adolescents: A review. *Int J Behav Nutr Phys Act.* 2014;11(4):1–9.

238. Symons Downs D, DiNallo JM, Savage JS, Davison KK. Determinants of eating attitudes among overweight and non-overweight adolescents. *J Adolesc Heal.* 2007;41(2):138–45.

239. Lundahl BW, Tollefson D, Risser H, Lovejoy MC. A meta-analysis of father involvement in parent training. *Res Soc Work Pract.* 2008;18(2):97–106.

240. Davison KK, Gicevic S, Aftosmes-Tobio A, Ganter C, Simon CL, Newlan S, et al. Fathers' representation in observational studies on parenting and childhood obesity: A systematic review and content analysis. *Am J Public Health.* 2016;106(11):e14–21.

241. Oakley M, Farr RH, Scherer DG. Same-sex parent socialization: Understanding gay and lesbian parenting practices as cultural socialization. *J GLBT Fam Stud*. 2017;13(1):56–75.

242. Niemeier BS, Hektner JM, Enger KB. Parent participation in weight-related health interventions for children and adolescents: A systematic review and meta-analysis. *Prev Med*. 2012;55(1):3–13.

Appendices

Appendix A: Comparison of measures used in LiGHT and FLASHE data sets

Table 10. Comparison of constructs and questions asked in LiGHT and FLASHE data sets.

	FLASHE		LiGHT	
Construct	Question	Scoring	Question	Scoring
Adolescents				
Demographics				
Sex	"Are you male or female?"	Male, Female	"What sex is listed on your birth certificate?"	Male, female
Gender			"How do you describe yourself?"	Male, female, other, prefer not to answer
Cognitive factors influencing dietary behaviours				
Self-efficacy	"I feel confident in my ability to eat F&V every day"	Strongly disagree to strongly agree (Likert 5 categories)	"I feel confident that I can eat at least 6-8 fruits and vegetables, every day"	Strongly disagree to strongly agree (Likert 5 categories)
	"I feel confident in my ability to limit the amount of junk food and sugary drinks I eat and drink"	"	"I feel confident that I can cut sugary drinks from my diet."	"
Motivation "I would eat F&V every day because…" [FLASHE] "There are many reasons why people eat fruits and vegetables every day. Select how much you agree or disagree with each statement…" [LIGHT]	"I would feel bad about myself if I didn't"	"	"I would feel bad about myself if I didn't"	"
	"I have thought about it and decided that I want to eat F&V every day"	"	"I simply enjoy eating a variety of fruits and vegetables"	"
	"Others would be upset with me if I didn't"	"	"Others would be upset with me if I didn't"	"
	"It's an important thing for me to do"	"	"It is personally important to me to eat enough fruits and vegetables"	"
"I would try to limit how much junk food and sugary drinks I have because…" [FLASHE] "There are many reasons why people limit how much junk food and sugary drinks they have.	"I would feel bad about myself if I didn't"	"	"I would feel bad about myself if I didn't limit junk food and sugary drinks"	"
	"I have thought about it and decided that I want to limit junk food and sugary"	"	"I simply don't like the taste of many junk food items or sugary drinks"	"
	"Others would be upset with me if I didn't"	"	"Others would be upset with me if I didn't limit junk food and sugary drinks"	"

Select how much you agree or disagree with each statement…" [LIGHT]				
	"It's an important thing for me to do"	"	"It is personally important to me to limit junk food and sugary drinks"	"
Dietary behaviours				
"During the past 7 days how many times did you drink…" [FLASHE]	"100% fruit juice like orange, apple, grape etc. don't count fruit flavored drinks"	Did not drink in past 7 days, 1-3 times in the past 7 days, 4-6 times in the past 7 days, 1 time per day, 2 times per day, 3 or more times per day	"Drink 100% fruit juice such as apple or orange juice? DO NOT count punch, Kool-Aid, sports drinks, fruit cocktails or fruit-flavored drinks"	None, 1-3 times in the past 7 days, 4-6 times in the past 7 days, 1 time per day, 2 times per day, 3 times per day, 4+ times per day
"In the last 7 days how many times did you have…" [LiGHT]	"Sweetened fruit drinks and teas like Capri Sun, Sunny D, Arizona Ice tea etc. Don't count 100% fruit juice or artificially sweetened or diet drinks"	"	"Drink fruit-flavored drink (such as Kool-Aid®, Sunny D®, or lemonade), sports or high energy drinks (such as Gatorade®, Red Bull®), blended sweetened tea or coffee drinks (such as iced tea, Starbucks® latte or Frappucino®, Chai tea), or other sweetened drinks? DO NOT count 100% fruit juices and diet drinks"	"
	"Regular soda or pop like coke, pepsi, sprite, dr.pepper etc. don't count diet or zero calorie sodas"	"	"Regular soda or pop that contains sugar? DO NOT count diet sodas or diet drinks"	"
	"Sports drinks like Gatorade, Powerade etc. don't count low calorie sports drinks like G2 or Powerade Zero"	"	/	/
	"Energy drinks like Rockstar, red bull"	"	/	/
"During the past seven days, how many times did you eat…" [FLASHE & LiGHT]	"Fruit like apple, banana, melons etc. count fresh, frozen, canned or dried. Don't count fruit juices"	"	"Fruit (fresh, frozen, canned, dried) don't count juice"	"
	"Green salad with or without other vegetables"	"	"A green leafy or lettuce salad, with or without other vegetables?"	"
	"fried potatoes like French fries, tater tots, hash browns etc."	"		
	"Other kinds of potatoes that aren't fried like	"	"Potatoes? DO NOT count French fries, fried potatoes, or potato chips"	"

	baked, mashed, boiled etc"			
	Non-fried vegetables like carrots, broccoli, collards, green beans etc. Don't count green salad or potatoes"	"	"Excluding the vegetables you have already reported, in the last 7 days, how many times did you eat other fresh, frozen, or canned vegetables (do not count fries or chips)?"	"
Parents				
Demographics				
Sex	"Are you male or female?"	Male, Female	"What sex is listed on your birth certificate?"	Male, female
Socioeconomic Status				
Education	"What is the highest grade or level of education you completed"	Less than high school, a high school degree/GED, some college but not a college degree, a 4 year college degree or higher	"What is the highest level of education you have attained?"	Some college or university, college or non-university certificate or diploma, bachelors, university degree above a bachelors, professional degree (ex. MD)
Income	"Thinking about all family members in your household, what is your combined total annual income, meaning the total pre-tax income from all sources earned in past 12 months"	$0-19999, $20000-49999, $50000-99999, $100000 plus	"What is your best estimate of total combined income before taxes and deductions of all household members from all sources in the past 12 months?"	< $50000, $50000-$69999, $70000-$79999, $80000-$99999, $100000-$124999, $125000-$149999, $150000 plus, prefer not to answer
Ethnicity				
	"Which one or more of the following would you say is your race? Please select all that apply"	Non-Hispanic White only, Non-Hispanic Black or African American only, Hispanic, Non-Hispanic Other	"People living in Canada come from different cultural and racial backgrounds. What is this child's racial or ethnic background? Please read all categories and select all that apply:"	White/European, Aboriginal (e.g., First Nations, Métis, Inuit, etc.), Chinese, South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.), Black, South East Asian (e.g., Vietnamese, Malaysian, Filipino, etc.), Japanese, Other (specify)
Parenting Practices				
Availability "How often are the following available in your home" [FLASHE]	"I buy F&V for my teenager"	Strongly agree-strongly disagree (Likert 5)	"I buy F&V for my teenager"	Strongly agree – strongly disagree (Likert 5)
	"I don't buy a lot of junk food or sugary drinks for my teenage"	"	"I don't buy a lot of junk food or sugary drinks for my teenager"	"
Control	"I have to make sure my teenager eats enough F&V"†	"	"I have to make sure that my teenager eats enough F&V"†	"

	"I make my teenager eat F&V"	/	"I make my teenager eat F&V"	"
	"I have to make sure my teenager doesn't eat too much fast food or sugary drinks"†	"	"I have to make sure that my teenager doesn't eat too much junk food or drink too many sugary drinks"†	"
	"I decide how much junk food and sugary drinks my teenager can have"	"	"I decide how much junk food or sugary drinks my teenager can have"	
Modelling	"I try to eat F&V when my teenager is around"	"	"I try to eat F&V when my teenager is around"	"
	"I try to avoid eating junk food or sugary drinks in front of my teenager"	"	"I try to avoid eating junk food or drinking sugary drinks when my teenager is around"	Strongly agree – strongly disagree (Likert 5)
Encouragement	"I encourage my teenager to try different kinds of F&V"	"	"I encourage my teenager to try different kinds of F&V"	"
Negotiation	"My teenager and I decide together how many F&V he/she have to eat"	"	"My teenager and I decide together how many F&V he/she has to eat"	"
	"My teenager and I decide together how much junk food or sugary drinks he/she can have"	"	"My teenager and I decide together how much junk food or sugary drinks he/she can have"	
Food rules	"It's okay for me to make rules about how my F&V my teenager can have"	"	"It's okay for me to make rules about how many F&V my teenager can have"	"
	"It's okay for me to make rules about how much junk food or sugary drinks my teenager can have"	"	"It's okay for me to make rules about how much junk food or sugary drinks my teenager can have"	
Emotional reward	"If my teenager has a bad day, I let him/her have junk food and sugary drinks to feel better"	"	"If my teenager has had a bad day, I let him/her have junk food and sugary drinks to feel better"	"

† Items dropped from analysis due to ambiguity in literature surrounding these practices as control or structured practices.

Appendix B: Parenting practices measured in light and FLASHE data sets

Table 11. Parenting practices assessed in this thesis from LiGHT and FLASHE studies characterized according to published work.

Survey Item	Parenting Practice	Construct	FLASHE	LiGHT
I buy F&V for my teenager.	Structured	Availability	✓	✓
I don't buy a lot of junk food or sugary drinks for my teenage.	Structured	Availability	✓	✓
I make my teenager eat F&V.	Controlling	Force	✓	✓
I decide how much junk food and sugary drinks my teenager can have.	Controlling	Force	✓	✓
I try to eat F&V when my teenager is around.	Structural	Modelling	✓	✓
In the last 7 days, how many times did your family eat dinner together?	Structural	Modelling		✓
I try to avoid eating junk food or sugary drinks in front of my teenager.	Structural	Modelling	✓	✓
I encourage my teenager to try different kinds of F&V.	Autonomy Supportive	Encouragement	✓	✓
My teenager and I decide together how many F&V he/she have to eat.	Autonomy Supportive	Negotiation	✓	✓
My teenager and I decide together how much junk food or sugary drinks he/she can have.	Autonomy Supportive	Negotiation	✓	✓
It's okay for me to make rules about how my F&V my teenager can have.	Structured	Food Rules	✓	✓
It's okay for me to make rules about how much junk food or sugary drinks my teenager can have.	Structured	Food Rules	✓	✓
If my teenager has a bad day, I let him/her have junk food and sugary drinks to feel better.	Controlling	Emotional Reward	✓	✓

Parenting practise categorized based upon the work of O'Connor et al. (2017).

Appendix C: Correlations between parenting practices and adolescent factors in LiGHT and FLASHE data sets

Table 12. Correlations between parenting practices and adolescent factors.

	FLASHE			LiGHT		
Parenting practices	Structure	Autonomy	Control	Structure	Autonomy	Control
Structure	1.00			1.00		
Autonomy	.57	1.00		.54	1.00	
Control	.42	.53	1.00	.41	.48	1.00
Adolescent factors	Self-efficacy	Intrinsic	Extrinsic	Self-efficacy	Intrinsic	Extrinsic
Fruits & vegetables						
Self-efficacy	1.00			1.00		
Intrinsic	.54	1.00		.49	1.00	
Extrinsic	.16	.44	1.00	.20	.42	1.00
Sugar sweetened beverages						
Self-efficacy	1.00			1.00		
Intrinsic	.39	1.00		.41	1.00	
Extrinsic	.12	.47	1.00	.29	.44	1.00

R values presented.