Source of Nutrition Information in Relation to Weight Loss Behaviours Among Young Canadian Adults Trying to Lose Weight

by

Miriam Price

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Author’s Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Weight loss efforts are pervasive among young adults and worrisome as they are associated with poor mental health and development of eating disorders. Data on weight loss behaviours are limited among Canadian youth, as is knowledge of environmental variables (e.g., information sources) that are associated with such behaviours. Current literature predominantly considers weight loss behaviours individually, despite evidence that health behaviours co-occur. This simplistic method of conceptualizing weight loss behaviours may have implications for research examining correlates and implications of strategies used to lose weight. The purpose of this study was to examine patterns of weight loss behaviours and nutrition information sources utilized among young Canadians (16-30 years of age) who reported trying to lose weight over the past year, and to examine associations between the sources consulted and weight loss methods utilized. Cross-sectional data were drawn from the first wave of the Canada Food Study, a cohort study of young adults from five urban areas. Factor analysis was used to identify patterns of weight loss behaviours. Four factors, or patterns, were identified: Dietary Changes, Purging and Restrictive Behaviours, Non-Prescribed Supplements and Formulas, and Health-Promoting Behaviours. Factor analysis was also used to examine covariation among the sources of nutrition information reported, again identifying four factors: Government and Health Association Materials, Health and Weight Loss Specialists, Commercial Sources, and Easily Accessible Sources. Building on insights from the factor analyses to operationalize variables, Poisson regression modelling was used to examine associations between information sources and weight loss behaviours. Associations were found between the nutrition information source used and weight loss behaviours. The findings of this study challenge others to re-examine the ways

in which weight loss behaviours are conceptualized, and provide insights into the possible implications of relying on certain types of sources of nutrition information for weight loss behaviours.

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Table of Contents

List of Figures

List of Tables

Chapter 1- Introduction and Overview

Attempting to lose weight is an extremely pervasive behaviour among young Canadian adults; recent online surveys of students and staff (mean age, 28 years) at a Canadian university found that more than one in three women and one in five men reported currently trying to lose weight (1). This is of concern since health behaviours developed during this period of time may persist over the lifetime (2). Over the short- and long-term, weight loss attempts are associated with negative implications, such as body dissatisfaction, risk of developing an eating disorder, and depression (3). Additionally, those who engage in dieting tend to regain more weight than was lost (4).

Young Canadians engage in a variety of weight loss behaviours, which include dieting (dietary restraint and/or dietary change), exercising, supplement use, among others (1), with multiple behaviours often used in combination (5). These behaviours may include those that could be conceptualized as more healthy (e.g., eating more fruits and vegetables, related behaviours such as exercising) or less healthy (e.g., fasting, using diet pills, smoking), although such conceptualizations are arbitrary since the degree to which individuals restrict certain foods or beverages or exercise is an important consideration in terms of the health-promoting or –compromising potential (5,6).

The behaviours that individuals engage in to try to lose weight may be influenced by the information sources they seek or are exposed to in relation to nutrition, diet, and weight. For example, surveys of American women ages 16-24 years have shown that those who reported seeking weight loss information on the internet were more likely than those who did not use the

internet for this purpose to exercise, use laxatives, use diet pills, vomit after eating, skip meals, smoke more cigarettes, and avoid eating carbohydrates to lose weight (7). Credible information sources can be thought of those that provide unbiased, up-to-date, evidence-based claims from an expert in the field or a trusted institution (8,9). However, it is not known whether individuals use multiple sources in combination (credible along with less credible), and how this relates to the weight loss behaviours in which they engage.

The following literature review provides an overview of research related to weight loss behaviours and weight loss information sources. This is followed by Chapter 3, which describes the research questions and hypotheses. In Chapter 4, the data source and variables are described, followed by an overview of the sample in terms of the key variables. In chapter 5, the methods and results of factor analyses to examine patterns of weight loss behaviours and nutrition information sources consulted is presented. Chapter 6 presents the regression analyses that were used to examine associations between weight loss behaviours and nutrition information sources used. Chapter 7 then provides an integrated discussion of the findings and their implications, as well as highlighting directions for future research.

Chapter 2- Literature Review

2.1 Weight Loss Behaviours

The following provides an overview of weight loss, or dieting, behaviours used by both adults and adolescents, as little research has examined the period of transition between adolescence and adulthood, the population of interest for the study described here.

There are a variety of weight loss behaviours that are currently being used by both adult and adolescents. Among American adults, prevalent weight loss behaviours include eating fewer calories, eating less fat, exercising (10), switching to lower calorie foods, and drinking more water (11). Meal skipping, enrolling in weight loss programs, and the use of diet pills, diuretics and supplements are less common but nonetheless used (10,11). Among American college women aged 18-24, the most common weight loss behaviours reported included exercising, eating low-fat or fat-free foods, eating less than they wanted to, and consuming fewer sugary drinks and foods (12). It is estimated that there are over 1000 different commercial weight loss diets (e.g., Atkins, Zone, Weight Watchers, Mediterranean Diet) available, with more continuing to appear (13); the most commonly followed commercial diet used among college women in 2006 were Atkins or South Beach and Weight Watchers (12).

Despite the number available, diets (which typically aim to achieve the goal of calorie restricting) have been shown to be largely ineffective as weight loss is rarely maintained, and weight regain is often greater than the amount lost (4). In fact, among adolescents with obesity, those who reported dieting (e.g., fasting, using a food substitute) at baseline were 50% as likely

to achieve a lower body weight (transition from obesity to overweight or non-overweight BMI classification) 10 years later compared to those who had not dieted (14).

A range of factors have been found to be associated with engagement in weight loss behaviours. These include body mass index (BMI), gender, age, race/ethnicity, socioeconomic status, body image and satisfaction, and health literacy. Individuals with overweight and obesity are more likely to engage in dieting than individuals defined as normal weight (10,15). However, research among American college women aged 18-24 found that, although slightly more women with overweight (91%) and obesity (86%) reported ever having dieted, 80% of women considered normal weight also reported dieting, indicating that regardless of weight class, dieting is very prevalent (15). Specific behaviours that are more prevalent among individuals with overweight or obesity when compared to their normal weight peers include reducing calorie consumption, eating less than they wanted to, and the use of unhealthful weight management behaviours (e.g., laxatives, diuretics and diet pills) (12,16,17,18). As well, engagement in health-promoting weight loss behaviours such as consumption of fruits and vegetables and exercising are lower among young Americans in grades 7, 9 and 11 with overweight or obesity compared to their non-overweight peers (10,16). On the other hand, among adult American women aged 16-40 years, those with overweight or obesity were shown to be more likely to engage in healthy weight loss behaviours (6) when compared to those defined as normal weight.

Some studies suggest that women are more likely to reduce calorie consumption, eat less fat, join a weight loss program, and use diet pills whereas men are more likely to skip meals and exercise to lose weight (10,11). Age is also relevant. A study of Canadian females found that the prevalence of unhealthy weight loss behaviours (e.g., binge eating, vomiting and diet pills)

increased through adolescence (age 12 to 18), and that early adulthood is a period during which weight concerns and poor dieting behaviours may increase (2,19,20).

A relationship also exists between race/ethnicity and weight loss behaviours; a cross-sectional analysis of 2007-2012 NHANES data of American adults age 20-65 found that non-Hispanic Blacks were less likely to attempt weight loss than non-Hispanic Whites and also less likely to change diet (e.g., ate less food, ate less fat, consuming low-calorie foods) or exercise to lose weight and less likely to consult with professionals regarding weight loss (21). Racial/ethnic differences in weight loss attempts and dieting behaviours may reflect differences in what is considered the ideal body according to identified culture (22). Further, cross-sectional research with middle-aged Australian adults found that those of low-income and low-education were more likely to have a higher BMI (ratio of body weight to height used to classify by body status) and less likely to engage in weight-control behaviours when compared to their more-advantaged peers (23). Similar weight-control strategies were used among all income-classes, except that low-income adults were less likely to engage in exercising to control weight, and more likely to minimize their sitting time (23).

Among adolescents, body image and dissatisfaction are also strong predictors of dieting (changing eating behaviours to lose weight) (15). For example, poor body image has been found to predict engagement in dieting and unhealthy weight loss strategies at a 5 year follow up among American adolescents (18). Although body dissatisfaction is most common in women, it is also high among men (24). Body dissatisfaction has also been found to be associated with race; among adolescents from Project EAT 2010 (a study of the eating, exercising, and weight-related behaviours of Minnesota middle and high school students), Asian American girls and

boys reported the highest rates of body dissatisfaction. Additionally, among boys in this sample, the relationship between body dissatisfaction and unhealthy weight control behaviours was moderated by race (25).

Health literacy, one's ability to understand health information and factors that may promote or hinder health (26), may also impact the types of weight loss strategies used. A mixed-methods study of African American women found that those with adequate health literacy were 2 times more likely to exercise to lose weight than those of low health literacy (27). This study included nine possible weight loss behaviours (e.g., fasting, reducing fried foods, laxatives, consuming less sweets); however, exercise was the only variable that differed significantly by health literacy (27).

2.1.1 Conceptualizing the Health-Promoting or Health-Compromising Potential of Weight Loss Behaviours

Weight loss behaviours are often categorized as "healthy" or "unhealthy" (6,28). These categories are subjective; for example, the use of food substitutes (powder or drink) has been categorized as both unhealthy and healthy (6,29). One reason that these behaviours cannot be simply categorized as healthy or not is because the degree/dose can affect whether and the extent to which each is health promoting or compromising. For example, exercising is generally considered an important aspect of a healthy lifestyle (30). However, certain patterns of exercising behaviours are associated with disordered eating behaviours (31). Indeed, exercise can be health compromising when used compulsively (e.g., to reduce distress regarding weight or

engaged in despite injury or illness) or when used as a compensatory technique (e.g., to compensate for food intake). A cohort study of university men and women found that compulsive and compensatory exercise predicted disordered eating and eating disorder diagnosis (31). Therefore, the occurrence of this behaviour, which has been considered a "healthy" behaviour, may actually be a health-compromising behaviour in particular circumstances.

A more nuanced way of looking at weight behaviours may be consistent with our understanding of the complexity of health behaviours. For instance, research demonstrates that health behaviours cluster among adolescents and adults (32,33). A systematic review of research examining the clustering of four health risk behaviours (smoking, excess alcohol consumption, poor nutrition, and physical inactivity) found that these behaviours co-occur (34); for example, individuals engaging in smoking are more likely to engage in other risky behaviours as well. Despite evidence that health behaviours co-occur, weight loss behaviours continue to be considered in isolation.

Although, to the authors knowledge, a formal study of the associations among weight loss behaviours has not been conducted until now, studies have utilized cluster analysis which may give insight into which behaviours are used simultaneously. Cluster analysis has been used to group individuals based on similarity among individual characteristics related to weight-control behaviours (35,36). Cluster analysis of Australian women aged 22-27 years identified 4 unique cluster groups based on common behaviours and characteristics among these women: Dieters, Healthy Living, Do Nothing, and Perpetual Dieters (36). The largest cluster was Dieters, 90% of whom tried to lose weight in the past year, the majority controlled their weight through healthy weight management behaviours (e.g., reduced meal sizes, reduced fat and sugar intake

and vigorous physical activity). Women in the Healthy Living cluster seldom reported engaging in weight loss attempts, weight control strategies included vigorous exercise, cutting down on meal sizes, reducing fat and sugar intake. The Do Nothing group reported not actively trying to lose weight, did not report using any of the weight control behaviours, and were the group with the highest body satisfaction and lowest mean BMI. Almost all of those in the Perpetual Dieters cluster reported trying to lose weight in the past year, and they also reported the highest use of all of the weight control behaviours, including both healthy and unhealthy behaviours (36).

Overall, the research demonstrates that health behaviours co-occur and that approaches that dichotomize weight loss behaviours may be overly simplistic. Categorizations such as "healthy" and "unhealthy" are subjective as the implications for health depend on degree/dose of the behaviour. Cluster analysis has been conducted, and has identified subgroups of the population that share common characteristics related to weight control; however, to my knowledge, research has not examined patterns of weight loss behaviours reported.

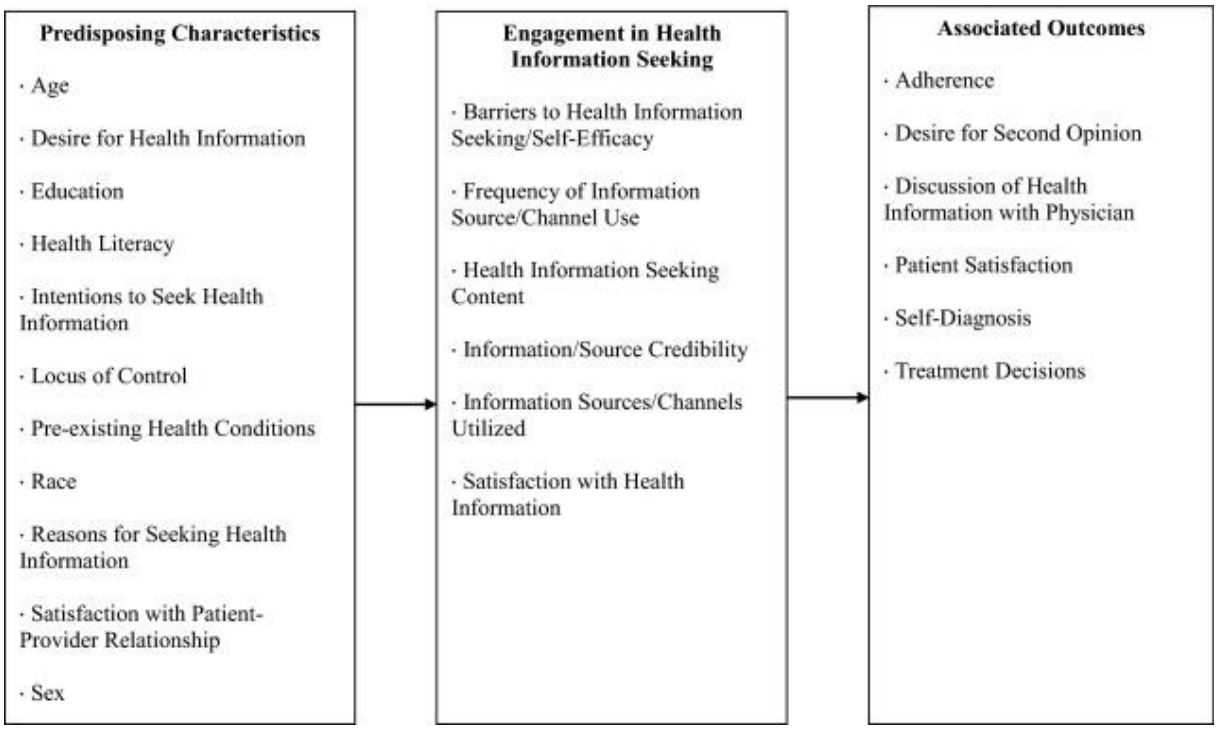
2.2 Health Information Seeking Behaviours

Evidence suggests that the types of weight loss behaviours adopted may be influenced by the sources of weight loss information used (5,7,37,38,39). Individuals frequently seek health information due to the abundance of information available and the increased emphasis on self-monitoring by health practitioners (40). The term "health information seeking behaviours" consists of the type and amount of information accessed, the actions required to obtain the information, and the sources used (40). Lambert and Loiselle (2007) suggest that health

information seeking behaviours are influenced by an interaction between personal (e.g., personality, available resources) and contextual factors (e.g., one's social network). Health information seeking behaviours have been studied as methods for coping with uncertainty about health status, involving patients in medical decision making, and spurring behaviour change (40). Research demonstrates that individuals prefer using multiple sources of health information, which may consist of a combination of personal (e.g., friends) and impersonal (e.g., book) sources (40). Multiple sources may be used to gather as much information as possible, or to validate information obtained from previous sources (40). This research focuses on the health information seeking behaviours specifically associated with weight loss attempts and the concomitant sources used.

One model that has been used to conceptualize the mechanisms underlying health information seeking behaviours is proposed by Anker, Reinhart, and Feeley (2011). According to the authors, an individual's personal characteristics leads an individual to engage in health information seeking behaviours which predicts health-related outcomes. This model can be seen in **Figure 1**.

Figure 1. ***Model by Anker, Reinhart, and Feeley (2011) demonstrating health information seeking mechanisms***



In the context of the current research, an individual's weight loss behaviours may be predicted by their health information seeking process (which includes the chosen channel and the credibility of this channel), which is predicted by individual factors such as health literacy (41). For example, someone with low health literacy might consult with friends for weight loss information, which could predict their chosen action for how to lose weight. The characteristic of the information seeking process of interest to the present study is the health information channel used to inform weight loss and the credibility of this channel.

2.2.1 Conceptualizing the Credibility of Sources of Information on Nutrition and Weight Loss

The credibility of information sources related to nutrition, fitness, and weight may vary widely. Credible sources are those that can be trusted to provide reliable information (8,9). The information from credible sources is provided by an expert within the field or a trusted institution, is non-partisan, unbiased, regularly updated, and provides evidence-based claims (8,9). Source credibility is especially important to consider when examining online sources of information, which are unregulated (42). However, studies in the USA have shown that consumers do not seem to consider the credibility of online sources when searching for health information (42) and that the source does not have a significant effect on perceptions of information quality (9). This is concerning given that the internet is a commonly-used source of health information (43), and a source of misinformation (44).

It is difficult to categorize sources of weight loss information by source credibility as even sources that are typically considered to be credible (i.e., medical professionals) may promote pseudoscientific beliefs related to weight loss. For example, there are celebrity doctors such as Dr. Mehmet Oz who promotes non-evidence based claims to his audience. An analysis of 40 episodes of the Dr. Oz show (January 7- May 1, 2013) found that 46% of his recommendations made during these television episodes had at least one study supporting their use; however, 15% of his claims were contradictory to research on the topic and 39% did not rely on any research (45). Interestingly, 39% of his recommendations were related to dietary intake. Therefore, it is difficult to categorize health information sources by source credibility.

2.2.2 Sources of Weight Loss Information

Canadians trying to lose weight may seek information from various sources to inform their behaviours. With regards to weight loss information source, the knowledge sources used to inform weight loss behaviours may provide advice about fitness, nutrition, diet, and/or weight loss explicitly. Therefore, for the following section, sources used for fitness, nutrition, diet, and weight loss are reviewed.

An online survey of Canadian adults, most aged 25-55 years, found the most used sources of nutrition information were magazines, books, the internet, food labels, and brochures (46). More recent data from Australia indicate that the most frequently used sources of nutrition information by adults were the internet (62.9%), friends (59.8%), family (58.8%), magazines (57.7%) followed by general practitioner (53.6%) (47). Further longitudinal analysis of nutrition information sources used by Canadians in 2004, 2006 and 2008 found that the most common sources of nutrition information reported by Canadians were food product labels, the internet, and newspapers/magazines. Interestingly, the only source that increased over time was the internet (48). However, the above-mentioned studies are not specific to individuals trying to lose weight and may not be representative of sources used specifically to inform weight loss. Among a sample of American women with a mean age of 35 years who reported trying to lose weight, 48% reported obtaining weight loss information from television, 41% from friends and relatives, 37% from women's magazines, 32% from physicians, and 31% from the internet (27).

The sources of information used may vary in relation to individual characteristics. Overall, individuals with higher education level report greater overall use of nutrition information sources (48). A study of Canadian adults found that those who were college or

university educated consulted magazines, newspapers, books, government materials, food labels, acquaintances, fitness or weight loss programs, health association materials and the internet to a slightly greater extent than those with high school education or less (48). Those with lower educational attainment (high school or less) were more likely to consult with a medical professional, food company materials, and advertisements than those with higher education (48). As well, while those with higher education were less likely to consult with a doctor for nutrition information (48), less-educated older adults (50+ years) report relying on their doctors to a greater extent (49). A relationship also exists between age and nutrition information sources; older adults are more likely to consult with a medical professional or health association materials, while younger adults are more likely to gather nutrition information from acquaintances, fitness or weight loss programs, or from the internet (48). Health literacy is also relevant (50), with women with adequate health literacy (measured using Rapid Estimate of Adult Literacy in Medicine- a reading recognition test) being shown to be almost 5 times more likely to use the internet for dieting information and half as likely to use the television as women with low health literacy (27).

Below, the existing research on associations between weight loss information sources and weight loss behaviours is reviewed, with attention to six channels for weight loss information: health professionals, alternative health practitioners, friends and family, the internet, commercial sources, and government- sponsored materials.

Health professionals

Health professionals, including physicians/doctors, nurses, and dietitians, are rated by the public as the most credible source for diet advice (46). However, they are not the most utilized, particularly among individuals who fall outside the 'normal' weight category (46,47,51). Self-report questionnaires of American women aged 34-54 with overweight and obesity demonstrate that they are unlikely to consult their physician for weight loss advice (51), perhaps due to perceived weight stigma that these patients experience (52,53). In fact, 75% of a sample of 259 females with obesity reported that they relied on their physicians 'not at all' or 'a slight amount' for help in weight management (51). This implies that many of these individuals look elsewhere for weight management advice (54).

Despite the unpopularity of physicians for dieting information, some research suggest that doctors' weight management advice is useful in terms of motivating engagement in healthy weight loss behaviours. Indeed, among American adults, doctors' advice to lose weight has been found to improve the probability of behavioral changes related to weight (e.g., eating fewer calories and exercising) (55). A systematic review of US studies addressing physician weight loss advice and patient behavior change found that of 11 studies identified, eight revealed a positive relationship between doctors' advice to lose weight and attempt at dietary change (56). As well, in a sample of 16-19-year olds with overweight and obesity drawn from the 1999-2002 NHANES, those told they were overweight by a doctor reported smaller portion sizes of food and beverages and lower calorie intake per kg of body weight on 24-hour recalls when compared to those not receiving advice (57). Those told of their overweight status were also more likely to consume 1% or skim milk (57). However, a literature review has found that underreporting of dietary intake is common among individuals with obesity (58), as these individuals may be

reporting dietary intake that they perceive as more socially desirable. Therefore, these studies may be influenced by social desirability bias.

Alternative health practitioners

Alternative medicine is defined as "any health-improving technique outside the mainstream of conventional medicine" (59). Chiropractors, naturopaths, homeopaths, and holistic nutritionists are some examples of alternative health practitioners, whereas alternative weight loss treatments might include acupuncture, aromatherapy, hypnosis, thigh creams, and supplements such as chitosan and chromium (60). A review of 18 alternative treatments for obesity demonstrated that none had sufficient sound scientific evidence to support their use in weight loss management (60). Indeed, the Canadian Medical Association (CMA) reports that there is insufficient evidence to support the use of herbal remedies, supplements, and homeopathy for weight management among those with obesity (61).

Nonetheless, complementary and alternative medicine (CAM) are used. Among individuals with at least one self-reported feature of metabolic syndrome (FeMS) (diabetes, hypertension, hyperlipidemia or obesity), the most common CAM methods used in the previous 12 months were nutritional supplements, massage therapy, acupuncture, yoga, aromatherapy, and herbal supplements. The use of CAM (appetite suppressants, herbal products or weight loss supplements) was found to be related to a greater reported number of weight loss attempts over the life time, suggesting that these alternative treatments may be used as many other treatments have failed (62). Of 3,500 American adults over the age of 18 years, one in three reported using a

dietary supplement for weight loss and 50% believed dietary supplements were approved for safety and efficacy, although they were not (62).

Friends and family

The use of friends and family for nutrition information is common; an Australia study found that friends (59.8%) and family (58.8%) were among the top three sources for nutrition information (47). Family and friends may be a popular channel for such information because they serve as motivators to engage in weight loss behaviours (37,63,64). The influence of family members on weight loss behaviours seems to be particularly strong in relation to that of friends. In a study of youth ages 8-19 years, encouragement to diet by mothers was associated with daughter's engagement in unhealthful weight control strategies (e.g., eating very little, skipping breakfast, smoking) (37). On the other hand, among girls, peer encouragement to diet was associated with fewer unhealthy weight loss behaviours (37).

Encouragement to diet by parents is also related to early onset of dieting (before the age of 11); daughters encouraged to diet by both parents were eight times more likely to begin dieting before the age of 11 (63). Parents may also model dieting behaviours that are subsequently mimicked by their children (65). Indeed, a sample of 1,709 women aged 12-58 years with a family member who dieted or engaged in an unhealthful dieting behaviour (diet pills and purging) were at higher odds of engaging in these behaviours themselves compared to those without this exposure (66). Findings from Project EAT found that mothers' dieting behaviours

were associated with their adolescent daughter's engagement in unhealthy and extreme weight control behaviours (67).

Internet

The internet is a popular source for health information; 68% of a sample of American adults reported using the internet for information on nutrition and diet (43). The quality of information and credibility of the internet sources vary significantly. Credible internet sources such as government and health agency materials are mixed with less credible materials that a general search on the internet related to nutrition or dieting will produce (68). Among Australian adults with obesity, telephone interviews indicated that three in four used the internet to find weight-loss strategies (69). The web-sources used by these adults for weight loss strategies include government-sponsored sites, community weight loss group sites, and weight loss company websites, but the most-accessed websites are for commercial diets (69). In fact, around half of participants reported they searched for specific websites after seeing a diet advertised, which may explain the large number of commercial diet websites accessed (69).

The quality of health information on the internet is not monitored, and thus, an abundance of false and inaccurate information may be available to individuals looking for weight loss advice (42). A systematic analysis of the first 45 internet sites that appeared after searching "weight loss diets" was compared to clinical weight management guidelines and demonstrated that information quality varies greatly (68). Indeed, only three websites provided sound diet advice, such as considerations related to well-balanced diets. Eleven websites promoted the use

of diet replacements, 15 promoted vitamin/mineral/herbal supplements, and some promoted the use of very low-calorie diets (68). Despite the varying quality of information online, 67% of a sample of American adults indicated that they believed the health information from online sources was just as good or better than the information they received from their doctors (43).

Furthermore, the use of the internet as a diet information source has been found to be related to unhealthful weight-loss behaviours. For example, among women in Texas aged 16-24 years, the odds of engaging in the use of diuretics and diet pills were eight and four times higher, respectively, for those who reported using the internet for weight loss information versus those who did not (7). However, the internet was also associated with exercising; in fact, women using the internet were 31% more likely to exercise to lose weight (7). However, there was no indication as to how healthful the exercise patterns were.

Commercial sources

Commercial sources include those that acquire a profit from the information or services that they provide and include celebrities, weight loss programs, mobile applications, and personal trainers. Celebrities have a strong presence on social media and are powerful public figures who can either promote or discourage behaviours, including health behaviours (70,71). Celebrities are often paid to endorse numerous products for commercial businesses, including food and beverage products and weight loss programs. However, one study suggested that 81% of celebrity food endorsements were for energy-dense and nutrient-poor products (72). Popular commercial weight loss programs are also endorsed by celebrities. Currently, actor Rob Lowe is

the face of Atkins (73), and musician DJ Khaled is endorsing Weight Watchers (74). Other weight loss programs include low-carbohydrate diets (Atkins, Carbohydrate Addicts, Zone and South Beach), low-fat diets (Ornish and Pritikin), and low-calorie diets (Weight Watchers and Jenny Craig) (75,76). Celebrities such as Gwyneth Paltrow are non-experts in the field of nutrition and weight loss and are typically not a credible source of information. However, the public may view celebrities as reliable sources because of their success, and because of the human tendency to make decisions based on the decisions of others (71).

Mobile applications can be used to administer weight loss programs or track weight loss progress. Researchers from Australia found that there are over 1000 mobile applications available for diet and weight loss through the iPhone application store and Google Play (77). In terms of associated weight loss behaviours, a systematic review of 12 articles examining the effectiveness of phone applications for weight loss and exercise found significant decreases in body weight, but no significant differences in exercise frequency when compared to a control group (78). Another study of primary care patients with overweight and obesity in the US examined the use of MyFitnessPal, a mobile fitness application, as a complementary weight loss tool. Although there was no significant difference between those who included the application in their treatment and those who did not in terms of weight loss, those who used the application reported increasing their calorie counting behaviour (79).

Personal trainers report that an important aspect of their job is to provide nutritional advice to their clients, and report to feel very confident in doing so (80). However, they also report a gap between the knowledge they attained in their education and the knowledge needed to adequately advise their clients (80). Analysis of webpages of businesses advertising for

Fitness services in Australia found that most of the businesses advertised for services beyond the scope of their educational expertise, which was evaluated by comparing the services that they advertised and the Roles and Responsibilities of Registered Fitness Professionals (80). Overall, although personal trainers may be valuable in helping individuals attain fitness goals, they are not necessarily credible sources in terms of providing nutritional advice to clients who may be trying to lose weight, and no research has explored the relationship between accessing weight loss and nutrition information from personal trainers and weight loss behaviours.

Media sources

Media sources include any channels of mass communication and include magazines, newspapers, books, television, radio, social media, and blogs. Magazines are a popular source of diet and fitness information (81). A cross-sectional study examining the prevalence of diet and exercise articles among 31 issues of an American women's health and fitness magazine found that 39 of 819 articles were related to weight loss, exercising, and dieting. The most common products advertised were weight loss pills (46%), followed by fat burners, hunger reduction strategies, and fat blockers (81). Frequency of reading magazines that feature weight loss advice has been found to predict engagement in unhealthy weight control behaviours five years later among adolescents in the United States (5). In fact, females reading these magazines had two times greater odds of partaking in unhealthy weight control behaviors (e.g., fasting, eating very little, using food substitutes like powders or drinks, skipping meals, and smoking) compared to those who hardly or never read such magazines. Also, the odds of using extreme weight control

behaviors such as self-induced vomiting and laxatives use was three times higher among females who were frequent readers compared to females who did not read these magazines (5).

Viewing commercials aired on television impacts eating behaviours (82,83,84). An online survey of Australian children aged 10-16 years found that higher commercial viewing was related to higher consumption of unhealthful foods and drinks (82). Similar research conducted with Australian adults found that exposure to television advertising was related to the consumption of fast foods (84). Overall, advertising of poor quality foods seems prevalent, and impacts the eating behaviours of viewers (85).

Social media is self-reported by young adults as an influence on their health behaviours and specifically, their diet and exercise behaviours (86). However, research has not examined the relationship between accessing nutrition and weight loss information from social media and blogs and weight loss behaviours. However, information regarding weight management behaviours is reinforced through advertisements on social media platforms. Facebook displays advertisements based on users' interests and account activity. Of a sample of American undergraduate university freshmen ages 18-20 years, 72% created posts about fitness (87). Specifically, these posts discussed over-eating, under-eating, poor eating habits, nutrition/good eating habits, exercise, concerns about being under- or overweight, dieting/restricting food intake, and negative body image (87). Analysis of 800 advertisements that appeared on their Facebook accounts demonstrated that 10% promoted the use of fad diets, while others were related to local fitness events and fitness apparel (87). This targeting may impact individual's likelihood of engaging in fad diets.

Particularly popular on social media are posts about weight loss/fitness motivation, cleanses or detox diets, or diet plans/fitness challenges. An online survey of Australian youth aged 15-29 years found that 38% reported following or liking at least one such health and fitness social media page (38). Most consumers of these social media pages were females ages 15-17 years who reported eating disorder symptoms and misuse of detox/laxative teas or diet pills. Of concern is that approximately 70% of these consumers had viewed health/fitness social media pages in the past six months, with a possible association between consumption of these pages and unhealthful weight loss techniques (38).

Online blogs that discuss healthy eating and fitness are also popular sources of advice. An analysis of healthy-living blogs that received a health-related blogging award found that only four of 21 of the bloggers disclosed that they had no previous training in the health field, despite all 21 lacking any formal training in this domain (88). Content analysis found that the blogs emphasized the thin ideal and delivered other messages about food that were supportive of disordered eating behaviours (88). The use of these blogs may normalize unhealthful eating behaviours, and may be especially problematic for individuals with existing disordered eating patterns or poor body image (88).

Government-sponsored sources

Government sponsored materials typically include materials created by licensed or registered professionals or monitored by government officials to assure the accuracy of the

materials. In the case of nutritional information, government sponsored materials might include sources such as food/nutrition labelling and Canada's Food Guide.

Among Canadian adults in 2008, food product labels were reported as the most popular source for nutrition information (48). Another study of food label use and weight loss behaviours over 12 months by low-income US women aged 16-40 years found that about 13-16% read food labels frequently. Those who read labels were more likely to report using healthy weight loss methods such as eating less (39%); switching to lower-calorie foods (28.9%); beginning to exercise or exercising more (34.7%); consuming more fruits, vegetables or salads (41.2%); and eating less sugar, candy and sweets (35.1%). Unhealthy weight loss behaviours were also used by women reading nutrition labels, behaviours included taking diet pills, medication, herbs or supplements without a prescription (39).

Research has not examined the relationship between accessing Canada's Food Guide and weight loss behaviours. However, research suggests that this is a not a particularly popular source for nutrition information (89,90). A study conducted among Canadian adults found that although most had looked at Canada's Food Guide (CFG) at least once in their lives, less than half had looked at the CFG in the past year. Further, less than 1% were able to recall the correct number of servings from the food groups (91).

2.3 Summary

Weight loss behaviours are common, and weight loss attempts during young adulthood are especially concerning as the use of health-compromising weight loss behaviours increases

throughout adolescence, and young adulthood is a period of increased concern over weight, and during which poor dietary habits increase. As well, this is a period of transition between adolescence and adulthood during which health behaviours are developed that may persist over the lifetime (2). Behaviours used to lose weight have been categorized into behaviours deemed either healthy such as exercising, eating more fruits and vegetables, or unhealthy such as using diet pills, and smoking (5,6). However, due to the subjectivity involved in categorizing these behaviours, and the evidence that health behaviours co-occur, a new method of conceptualizing types of weight loss behaviours is needed.

Further, among individuals trying to lose weight, the type of weight loss behaviours used may be associated with sources of weight loss information. Sources for information on nutrition, diet, or weight loss may vary in credibility, however it is conceptually difficult to categorize sources of information based on credibility and it is possible that multiple sources are used at once. Thus, there is need to investigate the sources used for such information and associated behaviours as research has found associations between the use of the internet, encouragement by parents, consulting with social media pages, consumption of magazines featuring weight loss advice, and food label use, each with weight loss behaviours (5,7,37,38,39).

Chapter 3- Study Rationale, Research Questions, and Hypotheses

3.1 Study Rationale

Weight loss behaviours are highly prevalent among young Canadian adults (1). Such behaviours may co-occur, with implications for health (5). Additionally, the weight loss behaviours in which one engages may relate to the sources of nutrition and weight loss information consulted or encountered (5,7,37,38,39). Utilization rates of presumably more credible sources of information, such as health professionals, are low in relation to potentially less credible sources, such as friends, family, internet, magazines (43,46,47,51), and there is evidence that sources considered credible and less credible may be used in combination (40). As many health behaviours are established during the adolescent-adult transition period, and high levels of weight loss attempts have been reported by youth, there is a need to better investigate how the use of these information sources may impact the types of weight loss behaviours used by Canadian youth.

Research on this topic among Canadian populations is limited; much has been conducted in the United States, where access to health care differs (92), with possible implications for sources of weight loss information consulted. Further, much of the existing research has focused on women; however, men also engage in weight loss behaviours (11). Finally, the typical categorization of weight loss behaviours (healthy vs. unhealthy) used in such research (5,7,37,38,39) may not accurately represent the complexity of such behaviours, with implications for the future research examining weight loss behaviours. Addressing these gaps in the literature can inform programs and policies related to weight and health by promoting the use of

information sources most associated with healthful methods and considering weight loss behaviours as behaviour patterns instead of considering these behaviours in isolation.

3.2 Research Questions

Drawing upon data for young Canadian adults, aged 16-30 years, who participated in the Canada Food Study (CFS) and reported trying to lose weight in the past 12 months, this study addressed the following:

1. Do self-reported weight loss behaviours cluster? Do sources of nutrition information used by individuals attempting weight loss cluster?
2. Are patterns of nutrition information sources (identified through factor analysis) associated with patterns in reported weight loss behaviours (identified through factor analysis), independent of potential confounders (age, gender identity, race/ethnicity, socioeconomic status, weight status, body image/satisfaction, and health literacy)?

3.3 Hypotheses

I hypothesized that

1. Patterns of weight loss behaviours will emerge, and that weight loss behaviours that are typically considered health-promoting will occur along with other health-promoting behaviours (e.g., exercise, reducing sweets, increasing fruit and vegetable intake). The

same is predicted for health-compromising behaviours (e.g., use of diuretics, laxatives, meal replacements). However, I hypothesised that some patterns of behaviours that consist of both health-promoting and –compromising behaviours (co-occurrence of health-promoting behaviours along with health-compromising behaviours) will emerge. I also hypothesized that patterns of sources used for nutrition information will emerge and that sources typically considered to be credible (e.g., health professionals, government and health associations) will occur alongside sources that are considered less credible (e.g., celebrities, TV and magazines).

2. Positive associations will be observed between use of credible nutrition information sources and weight loss behaviour patterns that are predominantly health-promoting, and between use of less credible sources of nutrition information and patterns of weight loss behaviours that are predominantly health-compromising, when controlling for potential confounders (age, gender identity, socioeconomic status, race/ethnicity, BMI/weight status, body image, health literacy).

Chapter 4- Data and Variables

4.1 Research Design

This research made use of data from the CFS, which included 3,000 Canadians between the ages of 16 and 30 years. This data set includes self-reported weight loss behaviors (e.g., reducing calories, skipping meals), height and weight, sources of nutrition information used (e.g., health professionals, alternative health practitioners, Canada's Food Guide), indicators of mental health such as body dissatisfaction and depression, and a plethora of related nutrition variables.

4.2 Canada Food Study

Data from the first wave of the CFS, conducted in fall 2016, were used. The CFS received approval from the University of Waterloo Research Ethics Committee (ORE# 21631).

4.2.1 Study Recruitment

Participants were recruited by in-person intercepts by research assistants in five Canadian cities: Vancouver, Edmonton, Toronto, Montreal, and Halifax. Eligibility criteria included living in one of these cities; being between 16 and 30 years of age; having access to the internet as well as to a computer, laptop or tablet; and not having already completed the survey. Participants

received $2 for signing up to participate in the study and $20 for completion of two online surveys.

A total of 6,720 individuals were enrolled in the study, 48.1% of individuals completed or partially completed the survey. Participants were excluded from the study if they did not complete the seven-day food source frequency questions or if they did not pass the data integrity check; a total of 234 participants were excluded. The final sample included 3,000 participants.

Sample weights developed by the study team were applied to better represent the Canadian population; therefore, estimates are weighted based on 2016 population estimates for age and sex (93).

4.2.2 Data Collection

Following recruitment, eligible participants were asked to complete two online surveys. The first included questions regarding dietary patterns and behaviours, perceived weight, weight loss history, nutrition knowledge, nutrition sources, and sociodemographic characteristics (see Appendix B for questions from the CFS). The second survey entailed an online 24-hour dietary recall. Data from the first survey on dietary patterns and behaviours were used for the present analysis.

4.2.3 Analytic Sample

Given the interest in weight loss behaviours, the analysis was limited to participants who reported attempting to lose weight in the past 12 months. Participants were asked: "During the past 12 months, have you tried to lose weight?", with options of “Yes”, “No”, “Don’t know”, and “Refuse to answer”. This question was derived from the NHANES Weight History Questionnaire (94). A total of 1473.32 (weighted sample, 1562 unweighted) individuals indicated that they had tried to lose weight in the past 12 months. However, respondents were removed from analyses if they did not respond to the key variables of interest (sources of nutrition information and weight loss behaviours). Therefore, the final weighted sample consists of 1452.15 (1538 unweighted).

4.3 Measures

4.3.1 Weight Loss Behaviours

Weight loss behaviours are the dependent variable of interest to the analysis. If respondents indicated they had tried to lose weight in the past 12 months, they were asked "How did you try to lose weight in the past 12 months?", with 17 possible weight loss behaviours, such as "Skipped meals or fasted" and "Ate less fat", as well as an open-ended option to indicate behaviours not listed (**Figure 2**). This question was adapted from the NHANES Diet History Questionnaire (94).

Preliminary analyses showed that 95% of respondents used 2 or more weight loss behaviours, and the average number of weight loss behaviours used was 5.37.

4.3.2 Sources of Nutrition Information

A variable specific to information sources used for weight loss is not available. As a proxy, a question related to sources of information for food and nutrition information was used. This was deemed reasonable since the sample for the present analysis is limited to those who reported trying to lose weight in the past 12 months; therefore, sources used for information regarding food and nutrition by individuals reporting trying to lose weight are presumed to have been used to inform weight loss behaviours. Participants were asked, "In the past 12 months, did you get information on food or nutrition from any of the following sources?", with 19 possible sources, e.g., “Health professional (e.g., family doctor, nurse, or dietician)”, “Alternative health practitioner (e.g., chiropractor, naturopath, homeopath, holistic nutritionist)”, “Health association materials or website (e.g., Heart & Stroke, Cancer Society, Dietitians of Canada)”, along with an open-ended option. This question was adapted from the Canadian Community Health Survey (CCHS) Canada's Food Guide (CFG) module and Tracking Nutrition Trends (TNT) integrated content; however, the reference period was changed to 12 instead of 6 months for consistency with other questions included in the CFS (93).

Preliminary analyses found that 54.2% of respondents used 2 or more sources, and the median number of information sources used is 3 (mean, 3.29).

4.3.3 Covariates

Covariates were selected *a priori* from literature on weight loss behaviours. Body mass index (BMI), health literacy, body image, socio-economic status, age, gender, race/ethnicity were included in models because these variables are related to weight loss behaviours.

As previously mentioned, weight loss attempts are more common among individuals with overweight and obesity (10,15), and type of weight loss behaviour seems to vary by gender, with men being more likely to exercise to lose weight (10,11). Unhealthful weight reduction behaviours increase with age through adolescence (2,19,20), and prevalence of weight loss attempts differ by race/ethnicity, perhaps due to differences in ideal body according to culture (21,22). Individuals of low socioeconomic status have been found to be less likely to engage in weight loss behaviours (23). Body image is a strong predictor of engagement in weight loss attempts (15), and is also associated with race (25), and gender (24). Lastly, health literacy may impact the types of weight loss behaviours used, with a study finding those of adequate health literacy being more likely to exercise than those of low health literacy (27).

Body Mass Index. BMI was calculated based on self-reported height (how tall are you without shoes?) and weight (how much do you weigh without clothes or shoes?) and categorized according to guidelines from the World Health Organization: affected by underweight (<18.50), normal range (18.50-24.99), affected by overweight (≥25.00), and affected by obesity (≥30.00). BMI is calculated by dividing an individual's weight (in kilograms) by the square of their height (in meters). BMI calculated using self-reported measures has been found to be correlated with

measured BMI (95). However, research suggests that self-reported weight is underreported and self-reported height is overreported, resulting in lower rates of self-reported overweight and obesity than those based on measured height and weight (95).

Frequency counts for BMI category in the present study show a significant amount of missing data, 13.27% of the sample had insufficient data to calculate BMI. A separate category was therefore included, as missing data may indicate selective non-response; for example, reluctance to answer the question due to perceived stigma about their body weight or height (95).

Health Literacy. The Newest Vital Sign (NVS) (96) was used to assess health literacy among study participants. This assessment tool involves the presentation of a Nutrition Facts panel from an ice cream container, and participants are asked to respond to questions requiring interpretation of the information contained. An example of one of the NVS questions is, "If you eat the entire container, how many calories will you eat?". Participants are asked to input a numerical value or indicate that they do not know or refuse to answer. Two questions ("Pretend that you are allergic to the following substances: penicillin, peanuts, latex gloves, and bee stings. Is it safe for you to eat this ice cream?" and "if no, why not?") from the NVS were combined to form a single question on the Canada Food Study survey. Scores on the NVS are calculated by summing the number of questions answered correctly (96). Scores of 0-1 suggest high likelihood of limited health literacy, 2-3 suggest the possibility of limited health literacy, and 4-5 indicate adequate health literacy (96). In a sample of American adults recruited from primary care practices, the NVS was correlated with the Test of Functional Health Literacy in Adults (TOFHLA), which is another well-known measure of health literacy (97).

In the present study, 3.31% of the analytic sample did not have adequate data to compute a health literacy score. A separate category was included for missing values for the health literacy questions, because missing data may represent a selective response whereby individuals refused to answer perhaps due to stigma surrounding health literacy.

Body Image. Body image was assessed using a single item from the Body Image State Scale (BISS) (98). Participants were prompted to indicate how they feel about their body size and shape at that moment by completing the statement, "Right now I feel…", with responses ranging from "Extremely satisfied with my body size and shape" to "Extremely dissatisfied with my body size and shape". The BISS has been found to be internally consistent, with Cronbach's alphas of 0.77 for women and 0.72 for men, and stable over time among 174 American college students (99). As well, the BISS was found to be correlated with results of the Body Area Satisfaction Scale (BASS), which is another measure of body image (99).

Given cell sizes, the response categories were collapsed into 6 groups: "Don't know/Refuse to answer" "Mostly Satisfied", "Slightly Satisfied", "Neither dissatisfied nor satisfied", "Slightly Dissatisfied", "Mostly Dissatisfied". There were no missing values for this measure among the analytic sample.

Age. A continuous age variable was used, with values ranging from 16-30 years. There were no missing values for this measure among the analytic sample.

Socioeconomic Status. Perceived income adequacy was used as an indicator of socioeconomic status. Respondents were asked, "Thinking about your total monthly income,

how difficult or easy is it for you to make ends meet?". Response options ranged from "Very Difficult" to "Very Easy". A similar measure of subjective financial situation (SFS) was used in a sample of young adults aged 18-24 years; when compared with other measures of SES, the SFS was a stronger predictor of health outcomes than other measures of SES such as respondent education and parental education (100).

Income adequacy was categorized as "Don't know/Refuse to answer/Missing", "Very difficult", "Difficult", "Neither easy nor difficult", "Easy", and "Very Easy". There were 48.2 individuals (weighted) who did not respond to this question and these missing values were combined with those who responded, "Don't know/Refuse to answer".

Race. The race of participants was queried by asking "People living in Canada come from many different cultural and racial backgrounds. Are you… (Select all that apply)". Participants were given the options of "White", "Chinese", "South Asian", "Black", "Filipino", "Latin American", "Southeast Asian", "Arab", "West Asian", "Japanese", "Korean", "Other-please specify". Due to small cell sizes, race was categorized into 6 groups: "White only", "Chinese only", "South Asian only", "Black only", "Aboriginal inclusive (includes mixed)", and "Mixed/Other/Not Stated/Missing", all of which were used in analyses.

Gender Identity. Lastly, gender identity was queried by asking "What is your current gender identity?". Possible responses included: Man, Woman, Trans male/trans man, trans female/trans woman, gender queer/gender nonconforming, with an open-ended answer to identify another possible response. This measure is recommended for assessing lived gender for

population surveys (101). Recent research has reported that transgendered youth and adults may be at increased risk for eating disorders and dangerous weight control behaviours (102). However, due to small cell sizes, this variable was categorized as “Man”, “Woman”, and “Other” (Trans male/trans man; Trans female/trans woman; Gender Non-Conforming), and “Don’t know/Refuse to answer”. There were no missing values among the analytic sample.

4.4. Description of the Sample and Key Variables

Table 1 describes the characteristics of the sample. Over half (52.1%) of participants reported attempting to lose weight in the past year. The median age of the sample was 23 years. Most of the sample identified as white (47.1%) female (59.1%), and categorized as normal weight (43.9%) according to reported heights and weights. Most were either slightly satisfied or slightly dissatisfied with their body size and shape (42.5%), found it neither easy nor difficult to meet ends meet (38.9%), and had adequate health literacy (64.1%).

Table 1. *Socio-Demographic characteristics of analytic weighted sample (N=1,452.15)*

Characteristic	Response	Frequency (n)	Percent (%)
Age	16	76.65	5.28
	17	72.97	5.02
	18	89.27	6.15
	19	93.55	6.44
	20	103.97	7.16
	21	104.53	7.20
	22	91.79	6.32
	23	96.42	6.64
	24	107.01	7.37
	25	95.42	6.57
	26	103.67	7.14
	27	111.51	7.68
	28	89.70	6.18
	29	110.84	7.63
	30	104.85	7.22
Perceived Income Adequacy	Don't know/Refuse to answer/Missing	145.63	10.03
	Very Difficult	98.02	6.75
	Difficult	241.89	16.66
	Neither easy nor difficult	565.08	38.91
	Easy	253.81	17.48
	Very easy	147.73	10.17
Race	White only	684.27	47.12
	Chinese only	117.25	8.07
	South Asian only	110.41	7.60
	Black only	75.52	5.20

	Aboriginal inclusive (includes mixed)	61.23	4.22
	Mixed/Other/Not Stated/Missing	403.41	27.78
Gender Identity	Male	573.90	39.52
	Female	857.52	59.05
	Other/Non-Binary	15.69	1.03
	Don't Know/ Refuse to answer	5.04	0.35
BMI	Underweight	30.78	2.12
	Normal weight	637.24	43.88
	Overweight	399.05	27.48
	Obese	192.35	13.25
	Missing	192.73	13.27
Health Literacy	High likelihood of limited literacy	188.66	12.99
	Possibility of limited literacy	284.10	29.56
	High likelihood of adequate literacy	931.31	64.13
	Missing	48.08	3.31
Body Image	Don't know/ Refuse to answer	5.57	0.38
	Mostly satisfied	279.37	19.24
	Slightly satisfied	491.33	33.83
	Neither dissatisfied nor satisfied	59.36	4.09
	Slightly dissatisfied	438.70	30.21
	Mostly dissatisfied	177.81	12.24

Independent t-tests were used to compare the analytic group used for the present study with the rest of the sample for age (**Table 2**), and a chi-square test was used to compare samples with regards to body image, health literacy, BMI, gender identity, race, and perceived income adequacy (**Table 3**). The analytic sample (those reporting trying to lose weight in the past year) had similar perceived income adequacy, race, age, and health literacy as the rest of the sample

(those responding “no” or “don’t know/refuse to answer” to weight loss question, and those who did not respond to this question). However, the samples differed in relation to body image, gender, and weight status, as highlighted in **Table 4**. The analytic sample comprised of a larger proportion of women (59% in analytic sample, 39% in rest), reported more dissatisfaction with their body shape and size (43% of analytic sample slightly or mostly dissatisfied, 15% of rest of sample), and included more individuals with overweight and obesity (41% in analytic sample, 12% in other) than did the rest of the sample. The response “don’t know/ refuse to answer” was similar for both groups for the body image question, and missingness was similar among both groups for BMI.

Table 2. *Independent t-test comparing socio-demographic variables between analytic sample (N=1538) and rest of sample (N=1325)*

	Analytic sample		Rest of the sample		
Parameter	**Mean**	**SD**	**Mean**	**SD**	***t (p)***
Age	23.34	(4.11)	23.31	(4.32)	0.22(0.8265)

Table 3. *Chi-square tests comparing socio-demographic variables between analytic sample (N=1538) and rest of sample (N=1325)*

Parameter	Response	Analytic sample (%)	Rest of sample (%)	Chi-Square (X^2)
Perceived Income Adequacy	Don’t know/Refuse to answer/Missing	145.63 (5.10)	162.86 (5.71)	**11.20***
	Very Difficult	98.02 (3.43)	59.83 (2.10)	
	Difficult	241.89 (8.47)	259.13 (9.08)	
	Neither easy nor difficult	565.08 (19.80)	531.43(18.62)	

	Easy	253.81 (8.89)	248.47 (8.70)	
	Very easy	147.73 (5.18)	140.633 (4.93)	
Race	White only	684.27 (23.97)	675.85 (23.68)	3.62
	Chinese only	117.25 (4.11)	119.98 (4.20)	
	South Asian only	110.41 (3.87)	87.69 (3.07)	
	Black only	75.52 (2.65)	84.36 (2.96)	
	Aboriginal inclusive (includes mixed)	61.30 (2.15)	52.09 (1.82)	
	Mixed/Other/Not Stated/Missing	403.41 (14.13)	382.38 (13.40)	
Gender Identity	Male	573.90 (20.10)	844.16 (29.57)	**122.80****
	Female	857.52 (30.04)	541.62 (18.97)	
	Other/Non-Binary	15.70 (0.55)	11.11 (0.39)	
	Don't Know/ Refuse to answer	5.04 (0.18)	5.46 (0.19)	
BMI	Underweight	30.78 (1.08)	142.74 (5.00)	**348.43****
	Normal weight	637.24 (22.32)	885.66 (31.03)	
	Overweight	399.05 (13.98)	120.62 (4.23)	
	Obese	192.35 (6.74)	47.90 (1.68)	
	Missing	192.73 (6.75)	205.43 (7.20)	

Health Literacy	High likelihood of limited literacy	188.66 (6.61)	199.62 (6.99)	1.13
	Possibility of limited literacy	284.10 (9.95)	261.58 (9.16)	
	High likelihood of adequate literacy	931.31 (32.63)	894.45 (31.33)	
	Missing	48.09 (1.68)	46.70 (1.64)	
Body Image	Don't know/ Refuse to answer	5.57 (0.20)	6.67 (0.23)	**372.41****
	Mostly satisfied	279.37 (9.79)	673.58 (23.60)	
	Slightly satisfied	491.33 (17.21)	426.51 (14.94)	
	Neither dissatisfied nor satisfied	59.37 (2.08)	82.82 (2.90)	
	Slightly dissatisfied	438.71 (15.37)	170.50 (5.97)	
	Mostly dissatisfied	177.81 (6.23)	42.27 (1.48)	

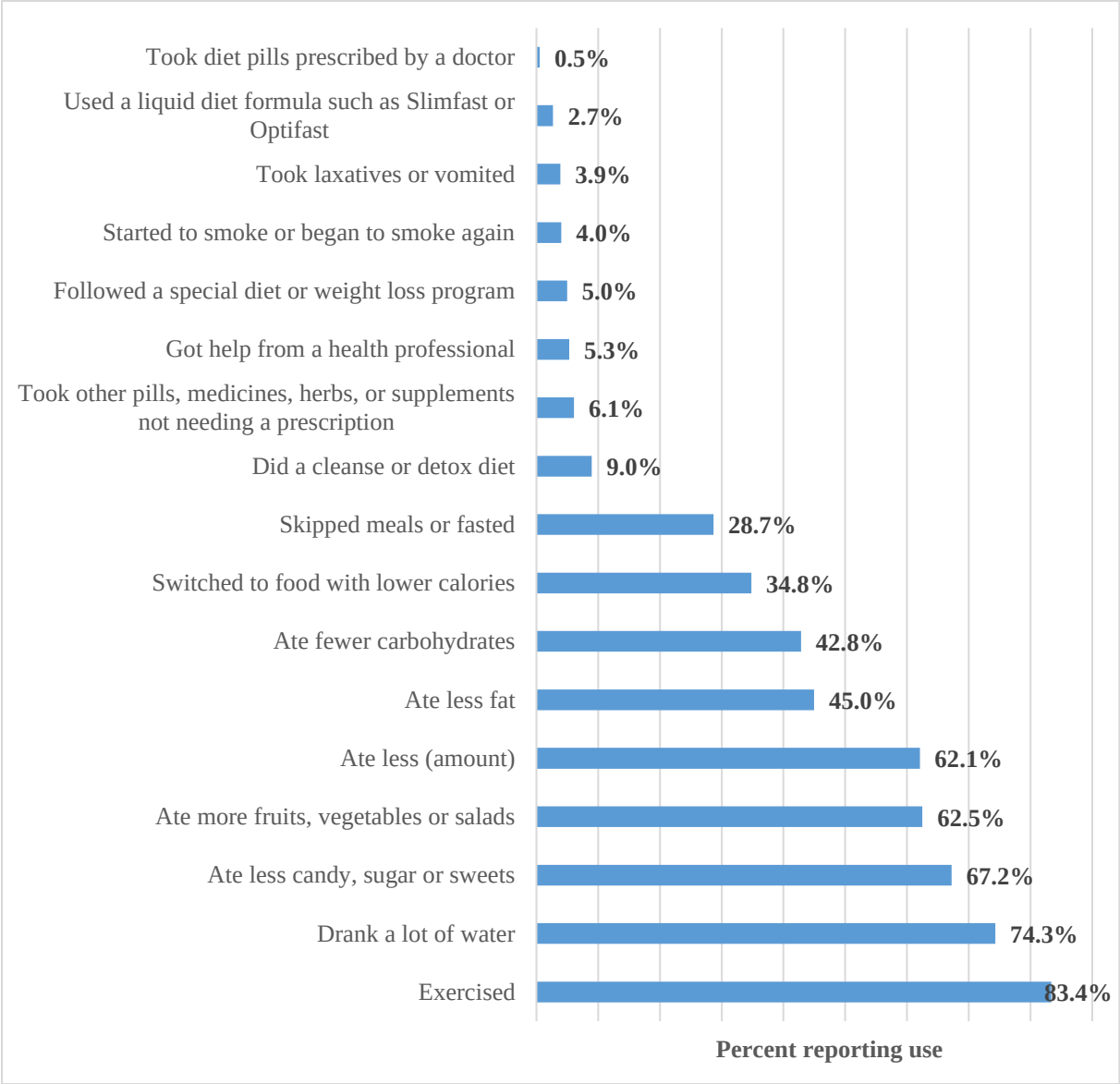
**p-value of <0.05, **p-value of <0.001*

Table 4. *Characteristic differences between analytic sample (N= 1538) and others (N=1325)*

Characteristic	Analytic sample	Rest of sample
Female	59.1%	38.6%
Slightly or mostly dissatisfied with body size or shape	42.5%	15.2%
Overweight or obese	40.7%	12.0%

Among the analytic sample, the median number of weight loss behaviours reported was 5 (mean, 5.37). The most commonly-reported weight loss behaviour was exercise, reported by over eight in 10 individuals (**Figure 2**). Over half reported each of drinking a lot of water; eating less candy, sugar, or sweets; and eating more fruits, vegetables, or salads. Over 40% reported changing the macronutrient content of their diets, either by eating less fat or fewer carbohydrates. Taking diet pills, using a liquid diet formula, and starting to smoke were each reported by less than 5% of participants.

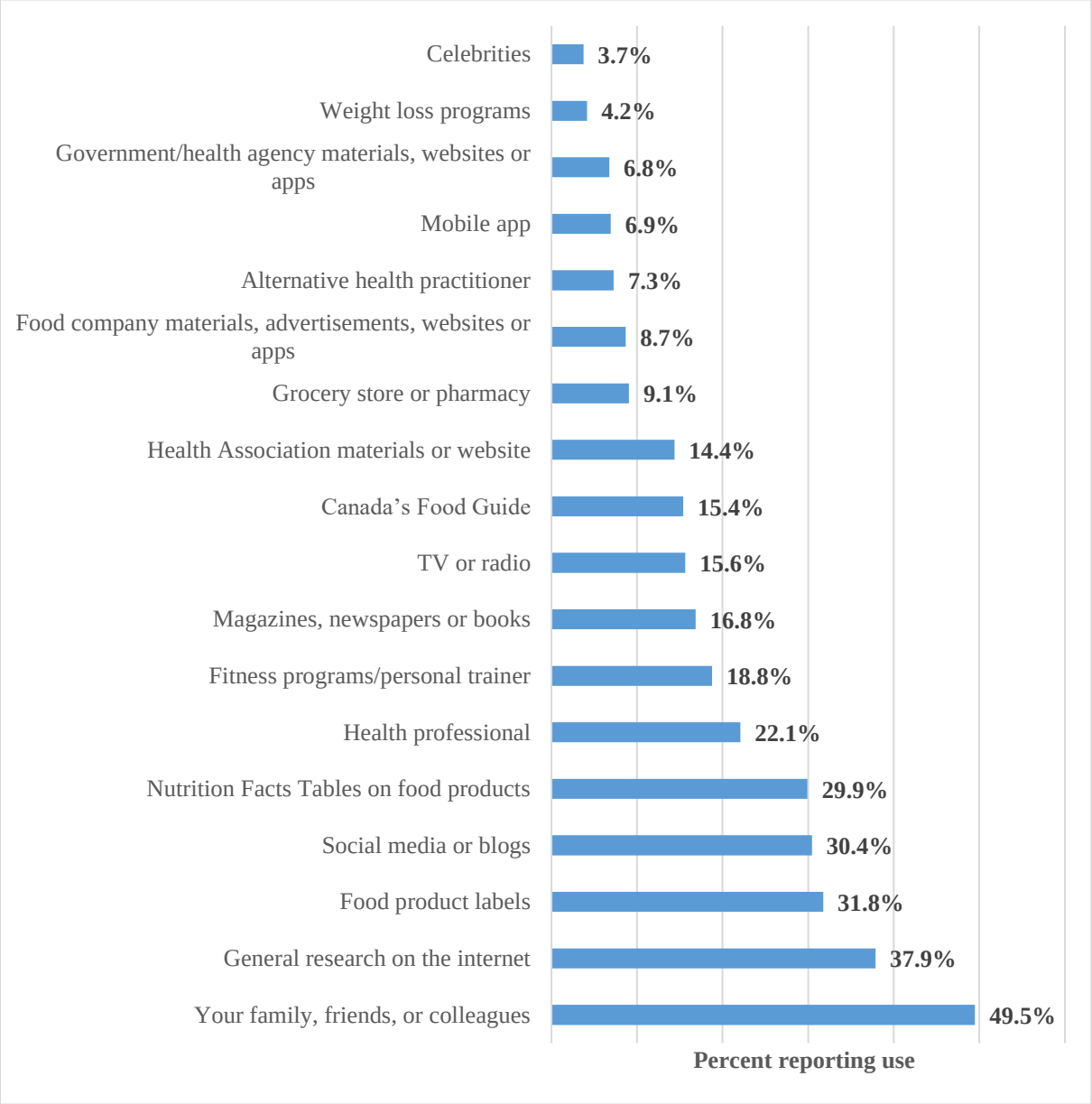
Figure 2. *Weight loss behaviours reported among weighted analytic sample (N= 1,452.15)*



The median number of sources used for nutrition information was 3 (mean, 3.29). Almost half of participants reported friends, family, and colleagues as a source of nutrition information (**Figure 3**). Over a third reported using general research on the internet, and three in 10 reported using each of social media or blogs, food product labels, and the Nutrition Facts

Table on food products. The least commonly-reported sources included “Celebrities”; “Weight loss programs”; “Government/health agency materials, websites or apps, and mobile apps”.

Figure 3. *Sources of nutrition information reported by weighted analytic sample (N= 1,452.15)*



Chapter 5- Clustering of Weight Loss Behaviours and Use of Nutrition Information Sources

This chapter presents methods and results of factor analyses used to identify patterns of weight loss behaviours and patterns of use of nutrition information sources. The identified patterns were used to inform the categorizations of weight loss behaviours and sources for nutrition information used in the regression models reported in Chapter 6.

5.1 Analytic Methods

Factor analysis was used to group weight loss behaviours and nutrition information sources consulted based on correlations, thereby identifying meaningful categorizations. This method is distinct from cluster analysis, which has been used in prior research to identify subgroups of individuals sharing similar characteristics within the population.

First, exploratory factor analysis was used to identify patterns, and this was followed by confirmatory factor analysis to verify the patterns/groupings identified. The variables used in the factor analysis were responses to the weight loss behaviours or nutrition information source questions outlined in Sections 4.3.1 and 4.3.2, which were dichotomous. The Weighted Least Squares Mean Variance (WLSMV), which is a robust weighted least squares estimator with a diagonal weight matrix, was used for these analyses because it is considered most appropriate for categorical data (103).

Factor analyses were conducted using MPlus, version 8.

5.1.1 Exploratory Factor Analysis

To understand whether and how weight loss behaviours co-occur, exploratory factor analysis, which is appropriate when theories about how data will cluster (such as the number of factors to be extracted and the pattern of factor loadings) are lacking, was used (104). The five steps in factor analysis, based on Williams, Onsman, and Brown (2010), are summarized in **Table 5**. The steps and methods for this particular analysis were developed in collaboration with the Statistical Consulting and Collaboration Unit (University of Waterloo).

The first step is determining if the data are suitable for factor analysis. Criteria used include meeting a minimum sample size (>100), and the ratio of participants to variables (10:1).

Table 5. *Summary of the 5-step Factor Analysis Protocol by Williams, Onsman & Brown (2010), detailing methods and steps used in this analysis*

Exploratory Factor Analysis Steps	Method(s) used
Are data suitable for factor analysis?	- Correlation matrix (factorability larger than 0.3) - Minimum sample size (>100) - Ratio of participants to variables (10:1)
How should data be extracted?	- Factor analysis
What criteria should be used in determining factor extraction?	- Recommend use of multiple methods - Kaiser's criteria (Eigenvalues >1) - Model fit indices (χ^2, RMSEA, CFI, TLI)
Which rotational method is appropriate?	- Oblique rotation
Interpretation and labelling	- Name identified factors based on variables within

Additionally, a matrix examining the correlation among the response variables of interest can be used to determine if factor analysis is appropriate; correlations larger than 0.3 are preferable as this is the minimum threshold necessary to indicate that a relationship exists among the variables, which is necessary for factor analysis (105).

The second step is extraction of the data; for this, the most common choices are principal component analysis (PCA) and factor analysis. For the purpose of this study, factor analysis was selected to identify latent structures underlining weight loss behaviours and sources of nutrition

information (105). This method is preferred over PCA because it accounts for shared variance and thus, identifies underlying structures that variables within each factor share, whereas component analysis is a data reduction method (106). Factor analysis also can distinguish between shared variance (the common variance among variables within a factor) and unique variance (variance belonging only to the variable and random error variance) (103). Factor analysis is useful for dealing with many variables and allows them to be placed into meaningful categories (104). This technique works best with large samples and can be performed using dichotomous variables (105).

The third step is to determine which criteria will assist in determining factor extraction. Kaiser's criteria (eigenvalues > 1.0) is a commonly-used criterion (105). If the eigenvalue is smaller than 1.0, then the variance explained by this factor is smaller than the variance that would be explained by a single variable (103). Additionally, fit indices (χ^2, RMSEA, CFI, TLI) for models with different number of factors are examined to determine the ideal number of factors to retain (model fit indices are explained in section 5.1.2).

The fourth step is selecting the rotation method, the rotation maximizes the high item loadings and minimizes the lower loading items to yield more easily interpretable factors. For this analysis, the oblique rotational method was used as it allows for correlation among factors and is recommended for use in research of human behaviours (104,105,106). The oblique rotation method is also preferred because even if the factors are not correlated, this method will produce factors that are practically identical to those produced by an orthogonal method (103). The specific type of oblique rotation method used was the Geomin rotation method, as this is the

default rotation method specified by MPlus software and is recommended by MPlus when variables have considerable loadings on more than one factor (107).

The final step is the interpretation of the factors identified. This involves naming each factor to best encapsulate the variables within it (105).

5.1.2 Confirmatory Factor Analysis

Confirmatory factor analysis was used to verify the model created by exploratory factor analysis. As opposed to exploratory factor analysis in which all the variables load freely onto all factors and then are rotated to maximize factor loadings and minimize cross-loadings, confirmatory factor analysis includes fewer variables and does not require rotation as cross-loadings among variables are set to zero (103).

Confirmatory factor analysis requires a model, which indicates the number of factors to be created and the variables that will load on each factor, to be specified. To identify the most appropriate model, measures of model fit were used. Chi-square is a commonly-reported measure of model fit, with significant results ($p< 0.05$) indicating that the model does not fit the data well (supporting the alternate hypothesis); however, it is seldom used as the only indicator of model fit in applied research because it is sensitive to sample size, such that the value can be inflated when the sample size is large (108). As such, the Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Tucker-Lewis index (TLI) were also used (108). The RMSEA is a measure of how well the model fits in the population. It is not sensitive to sample size because it is a population-based index. A RMSEA value below 0.05

suggest good model fit (103); thus, the threshold used for this study was an RMSEA level of <.05. The CFI and TLI evaluate how well the model fits compared to a more restricted nested baseline model, the values of which should be above 0.90 and close to 0.95 to indicate good model fit (103). The threshold used in this study was >0.90. Interpretation of CFI and TLI are similar; however, the CFI is normed (restricted to 0-1) while the TLI is not (103). If the stated threshold at least three of these four indicators were met, the model was considered adequate; if not, then modification indices were considered to examine how the model could be improved (109). Modification indices are estimates of the decrease in chi-square if the given parameter is estimated freely (103), and therefore suggest how to improve model fit.

5.2. Results- Weight Loss Behaviours

5.2.1 Exploratory Factor Analysis

The steps followed to perform exploratory factor analysis are presented in Section 5.1.1. As per Williams, Onsman & Brown (2010), the first step of factor analysis is to determine the suitability of the data for this method. The suitability of the data for factor analyses was confirmed. First, 16 of 17 response categories considered for exploratory factor analysis had correlations of at least 0.3 with at least one other response category, suggesting adequate factorability (See Appendix A, **Table 16**). Second, the expected ratio of participants to variables of 10:1 (105) for factor analysis is exceeded as the present analysis uses data for 1538 participants and 17 variables.

Exploratory factor analysis was conducted with all 17 weight loss response variables included. As discussed above (Section 5.1.1), the factor analysis extraction method (step 2), and the oblique rotation method (step 4) were used. For step 3 of the EFA, Kaisers criteria, χ^2, CFI, TFI, and RMSEA were used to determine the number of factors to be extracted. Kaisers criteria (eigenvalue>1) indicated that five factors should be retained. However, one variable, "Took weight loss pills prescribed by a doctor", did not load onto any of the factors at the 0.3 factorability threshold and was therefore removed from the analyses. The procedure was repeated with the remaining 16 variables. The response, "Got help from a health professional", did not load significantly on any factor following removal of taking weight loss pills prescribed by a doctor and was removed accordingly.

The exploratory factor analysis was repeated with the 15 remaining response categories and Kaisers criteria indicated that four factors was appropriate. However, measures of model fit were similar for a model with four factors ($\chi^2(51) = 79.457$, p= 0.0066; CFI= 0.984; TFI= 0.968; RMSEA= 0.019 90% confidence interval [0.010, 0.027]) and a model with 3 factors ($\chi^2(63) =$ 111.088.94, p= 0.0002; CFI= 0.974; TFI= 0.956; RMSEA= 0.022 90% confidence interval [0.015, 0.029]). Therefore, the models were compared to select the best model for the data through the confirmatory factor analysis.

5.2.2 Confirmatory Factor Analysis

Confirmatory factor analysis was conducted to compare the three-factor and four-factor models. The model fit indices of the CFA model differ from the EFA model because the

variables are not freely loading onto all factors in the CFA model as they do in the EFA model. After comparing fit indices (described in Section 5.1.2) and factor loading patterns for both the four-factor model ($\chi^2(69) = 148.857$, p= 0.0000; CFI= 0.956; TLI= 0.942; RMSEA= 0.027 90% confidence interval [0.021, 0.033]) and the three-factor model ($\chi^2(71) = 167.547$, p= 0.0000; CFI= 0.947; TLI= 0.932; RMSEA= 0.030 90% confidence interval [0.024, 0.036]), the 4-factor model was chosen because (a) there were seven variables loading into the 1st factor of the three-factor model, which suggested that an additional factor may be necessary and (b) because model fit indices were better for the four-factor model.

Table 6 shows the factor loadings for the final model with four factors labelled Dietary Changes (factor 1), Purging and Restrictive behaviours (factor 2), Non-Prescribed Supplements or Formulas (factor 3), and Health-Promoting behaviours (factor 4). The factor loadings represent the correlation between the factor and each response category. Confirmatory factor analysis indicated that some response categories were not loading at 0.3 on their respective factors and these were therefore removed consecutively. As a result, the responses “Did a cleanse or detox diet” and “Took other pills, medicines, herbs, or supplements not needing a prescription” were removed from factor 2; “Ate less food (amount)” and “Followed a special diet or weight loss program” were removed from factor 3 and “Used a liquid diet formula" was removed from factor 4. Modification indices were not reviewed since three out of four of the model fit indices were adequate (see Section 5.1.2) (109).

Table 6. *Factor loadings for four-factor confirmatory factor model for weight loss behaviours*

Factor and item	Estimate (S.E)
Dietary Changes	
11.Ate less fat	0.616 (0.036)
12.Ate less candy, sugar, and sweets	0.774 (0.030)
13.Ate fewer carbohydrates	0.636 (0.034)
14.Ate more fruits, vegetables, and salads	0.702 (0.032)
15.Switched to low calorie foods	0.616 (0.037)
20.Drank a lot of water	0.331 (0.075)
Purging and Restrictive Behaviours	
9.Skipped meals or fasted	0.797 (0.063)
10.Ate less food (amount)	0.593 (0.044)
24. Used laxatives or vomited	0.808 (0.062)
25. Started to smoke or began to smoke again	0.489 (0.081)
Non- Prescribed Supplements and Formulas	
17.Used a liquid diet formula such as Slimfast or Optifast	0.392 (0.097)
18. Did a cleanse or detox diet	0.727 (0.079)
23. Took other pills, medicines, herbs, or supplements not needing a prescription	0.686 (0.081)
Health-Promoting Behaviours	
9.Skipped meals or fasted	-0.334 (0.081)
19.Exercised	0.771 (0.098)
20. Drank a lot of water	0.390 (0.088)

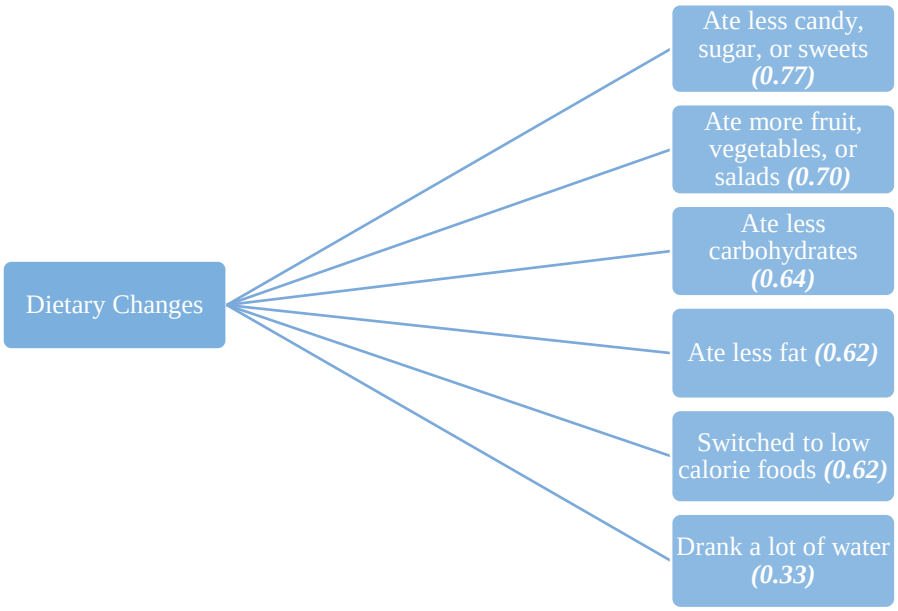
5.4.3 Overview of Factors for Weight Loss Behaviours

Dietary Changes

The response categories within the first factor involve altering dietary intake (e.g., ate less fat, ate less candy, sugar or sweets) (**Figure 4**); thus, this factor was labelled "Dietary Changes". The response that is most highly correlated with the latent factor Dietary Changes is

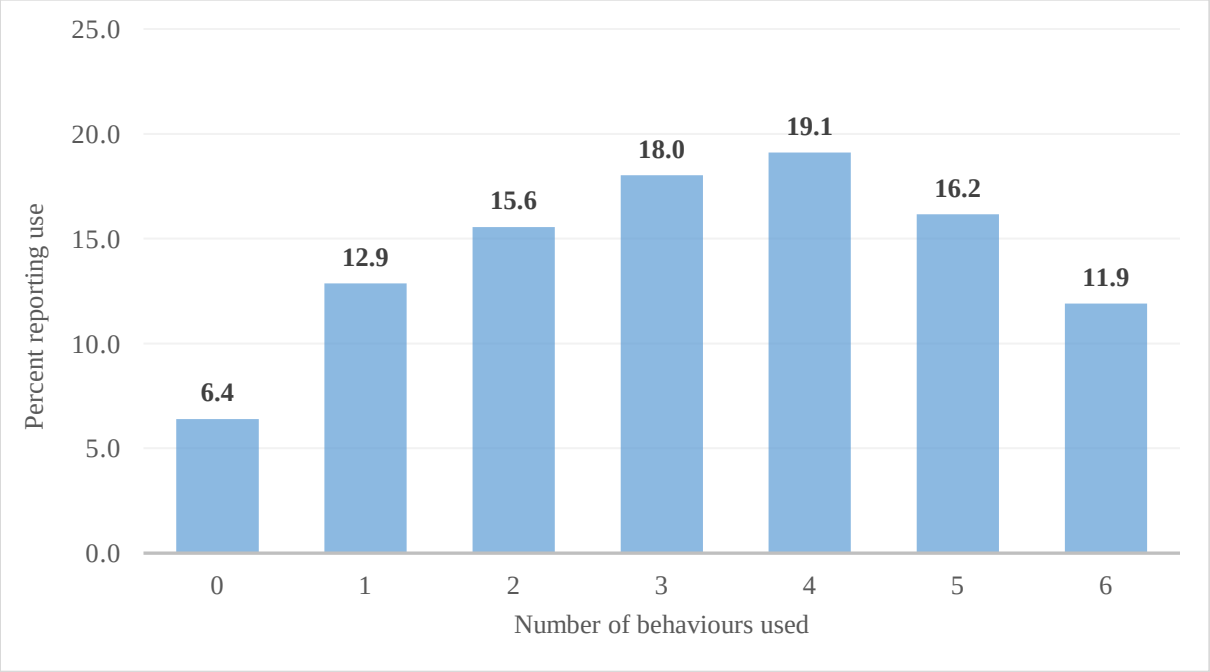
"Ate less candy, sugar, or sweets", followed by "Ate more fruit, vegetables, or salads", and the weakest association is between the factor and "Drank a lot of water".

Figure 4. *Structural diagram and factor loadings for Dietary Changes*



Two-thirds (65.4%) of individuals engaged in at least three of the behaviours belonging to this category (**Figure 5**), and 93.6% of individuals engaged in at least one of these behaviours.

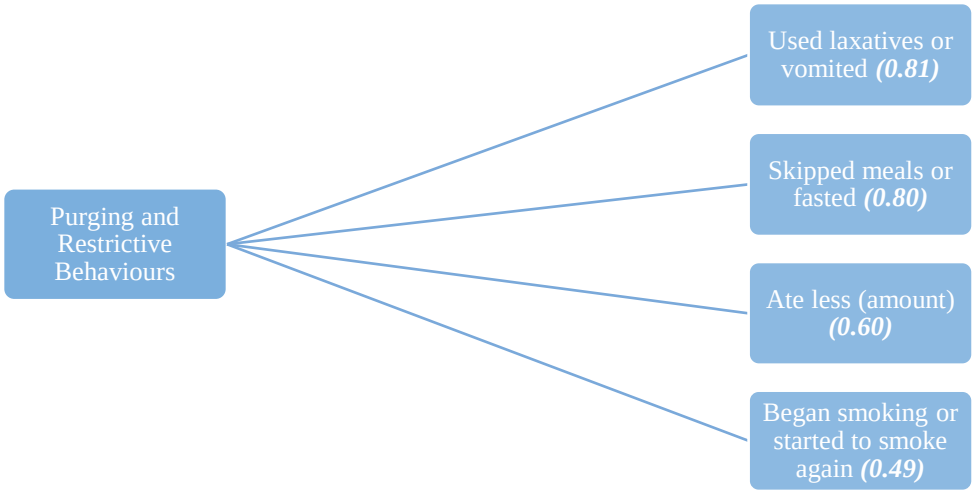
Figure 5. *Number of weight loss behaviours within the factor Dietary Changes reported among young adults, Canada Food Study (N=1,452.15)*



Purging and Restrictive Behaviours

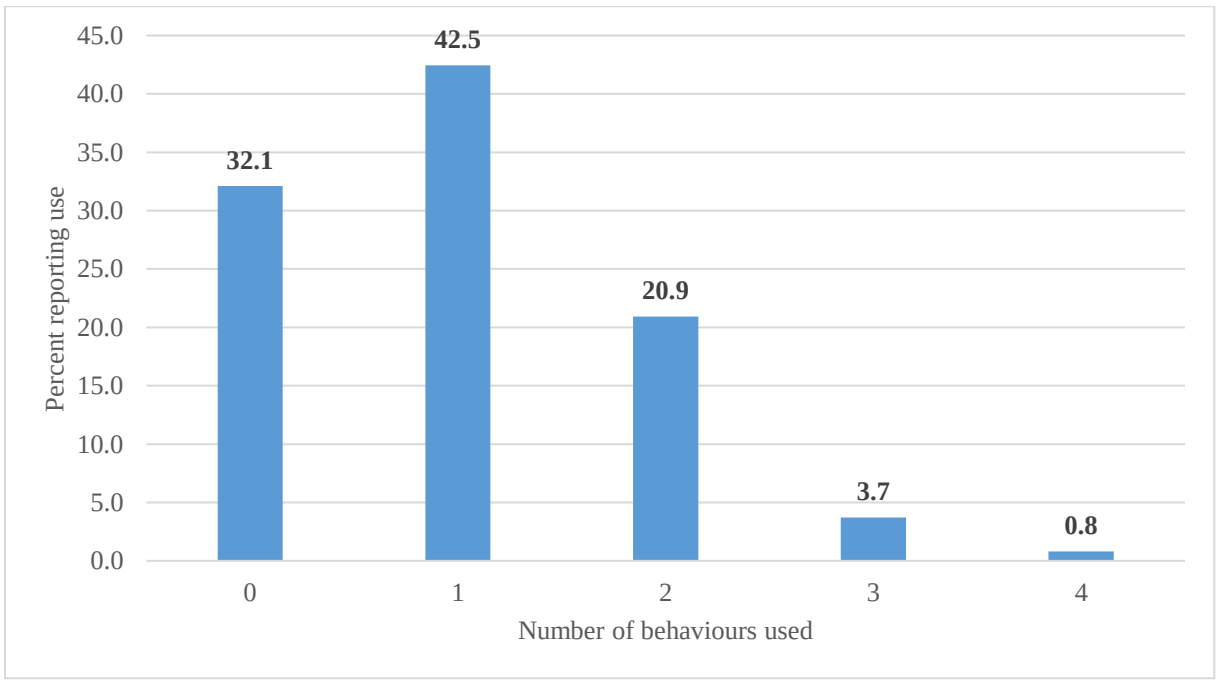
The second factor included four weight loss behaviours: “Skipped meals or fasted”, “Ate less food (amount)”, “Used laxatives or vomited”, and “Started to smoke or began to smoke again”. These were labelled as Purging and Restrictive Behaviours (**Figure 6**). The highest loading behaviour on this factor is “Used laxatives or vomited”, followed by “Skipped meals or fasted” and the lowest loading item was “Started to smoke or began to smoke again”.

Figure 6. *Structural diagram and factor loadings for Purging and Restrictive Behaviours*



Almost half of all individuals (42.5%) engaged in one of these Purging and Restrictive Behaviours, and 67.9% engaged in one or more of these behaviours (**Figure 7**).

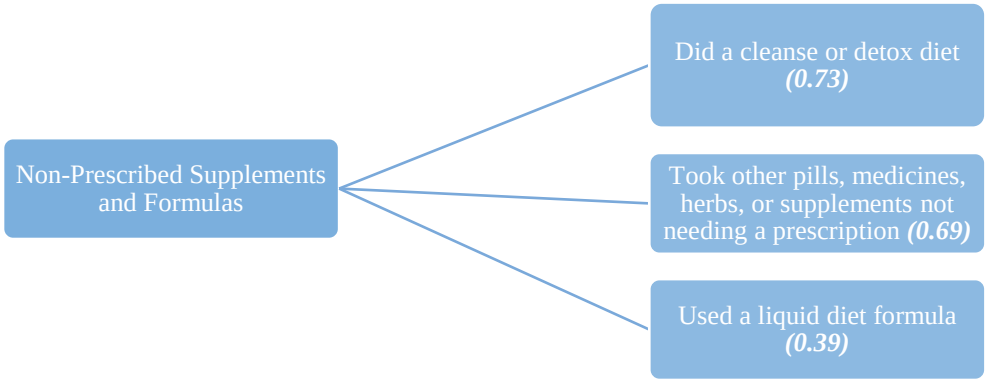
Figure 7. *Number of weight loss behaviours within the factor Purging and Restrictive Behaviours reported among young adults, Canada Food Study (N=1,452.15)*



Non-Prescribed Supplements and Formulas

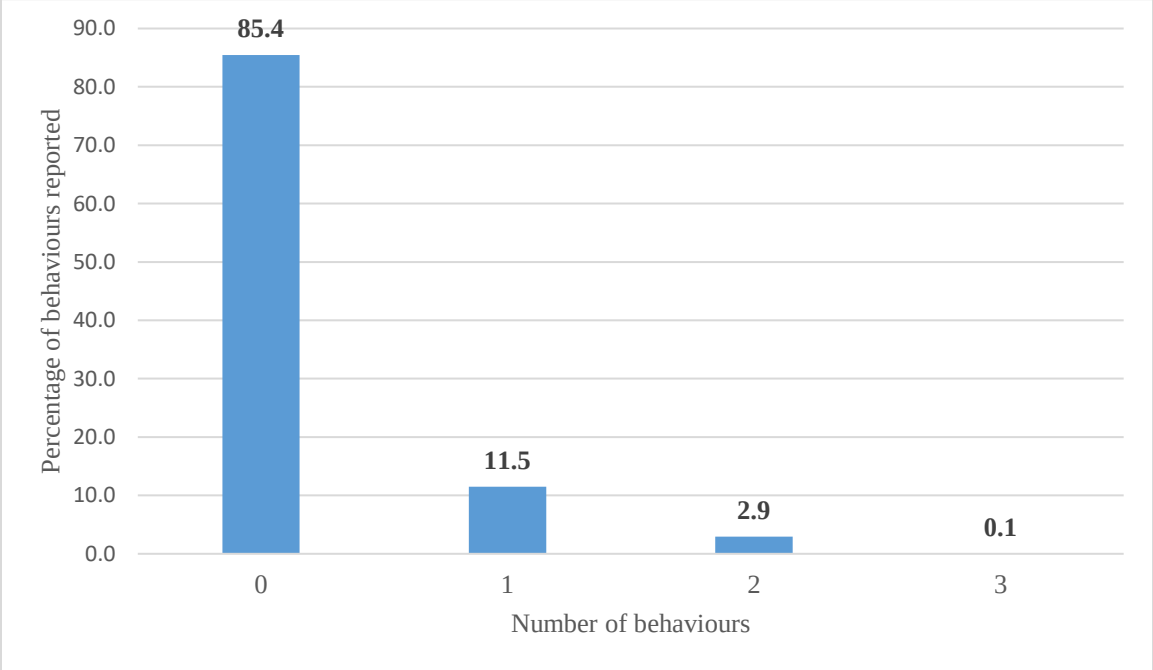
The third factor consists of the behaviours "Used a liquid diet formula such as Slimfast or Optifast", "Did a cleanse or detox diet", and "Took other pills, medicines, herbs, or supplements not needing a prescription". These behaviours involve ingestion of a non-prescribed supplement or formula, or engagement in a cleanse or detox that requires consumption of a concoction for the purposes of cleansing the body of toxins. As such, this behaviour pattern was labelled as Non-Prescribed Supplements or Formulas (**Figure 8**). The behaviour that was most highly correlated with the factor Non-Prescribed Supplements and Formulas was "Did a cleanse or detox diet" followed by "Took other pills, medicines, herbs or supplements not needing a prescription", and the lowest loading item is "Used a liquid diet formula such as Slimfast or Optifast".

Figure 8. *Structural diagram and factor loadings for Non-Prescribed Supplements and Formulas*



The majority (85.4%) of participants did not participate in use of any Non-Prescribed Supplements and Formulas (**Figure 9**).

Figure 9. *Number of behaviours within the factor Non-Prescribed Supplements and Formulas reported by young adults, Canada Food Study, (N=1,452.15)*

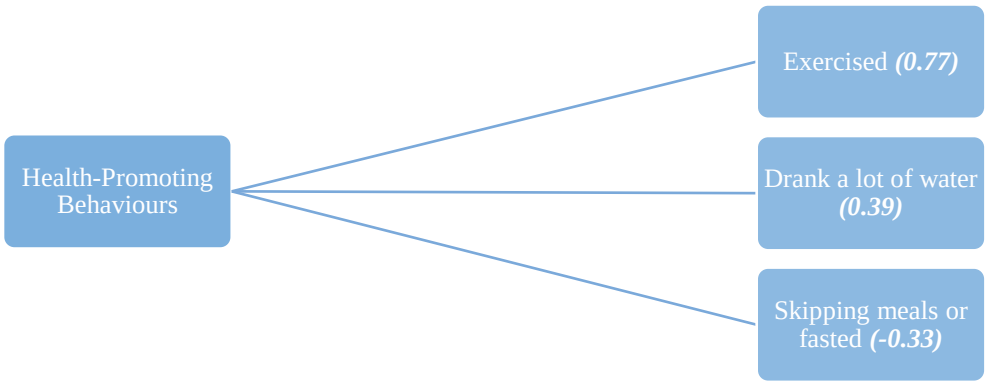


Health-Promoting Behaviours

The final factor was labelled Health-Promoting Behaviours and included the responses "Drank a lot of water", "Exercised", and "Skipped meals or fasted" (**Figure 10**). The last behaviour, "Skipped meals or fasted", negatively loaded on the factor, indicating that the behaviour is negatively associated with the factor Health-Promoting Behaviours. The response

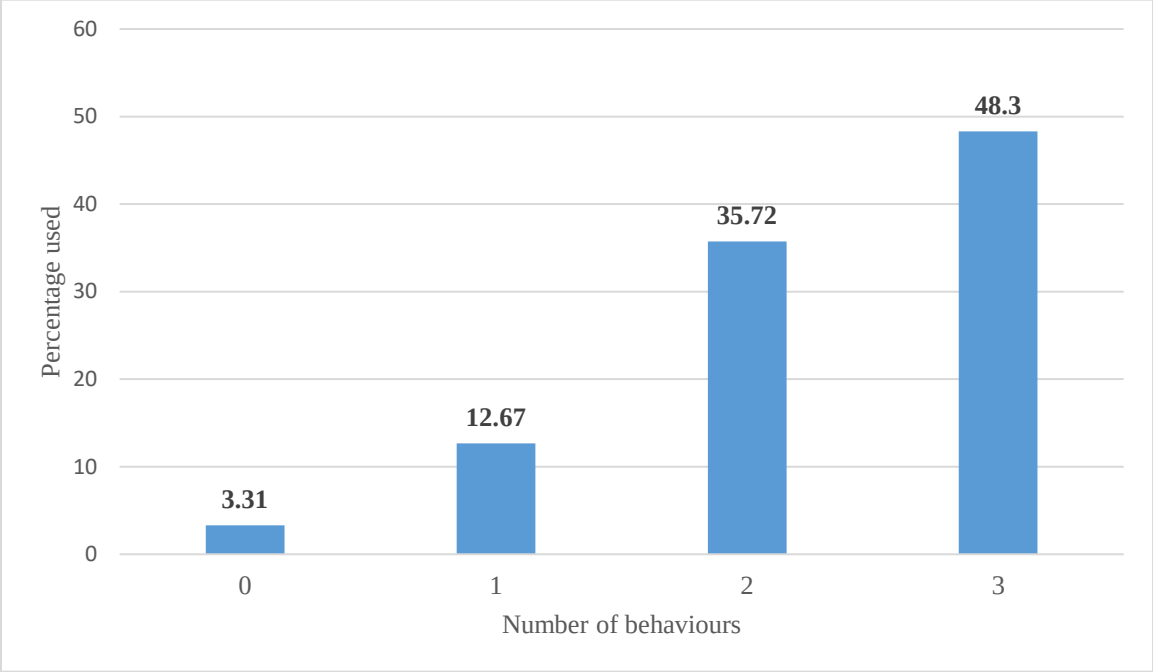
"Exercised" is most highly correlated with the latent factor, followed by "Drank a lot of water", the lowest loading item is "Skipped meals or fasted".

Figure 10. *Structural diagram and factor loadings for Health-Promoting Behaviours*



The majority of individuals (48.3%) engaged in all of these behaviour, and 96.7% of people engaged in at least one of these behaviours (**Figure 11**).

Figure 11. *Number of behaviours within the Factor Health-Promoting Behaviours reported among young adults, Canada Food Study (N=1,452.15)*

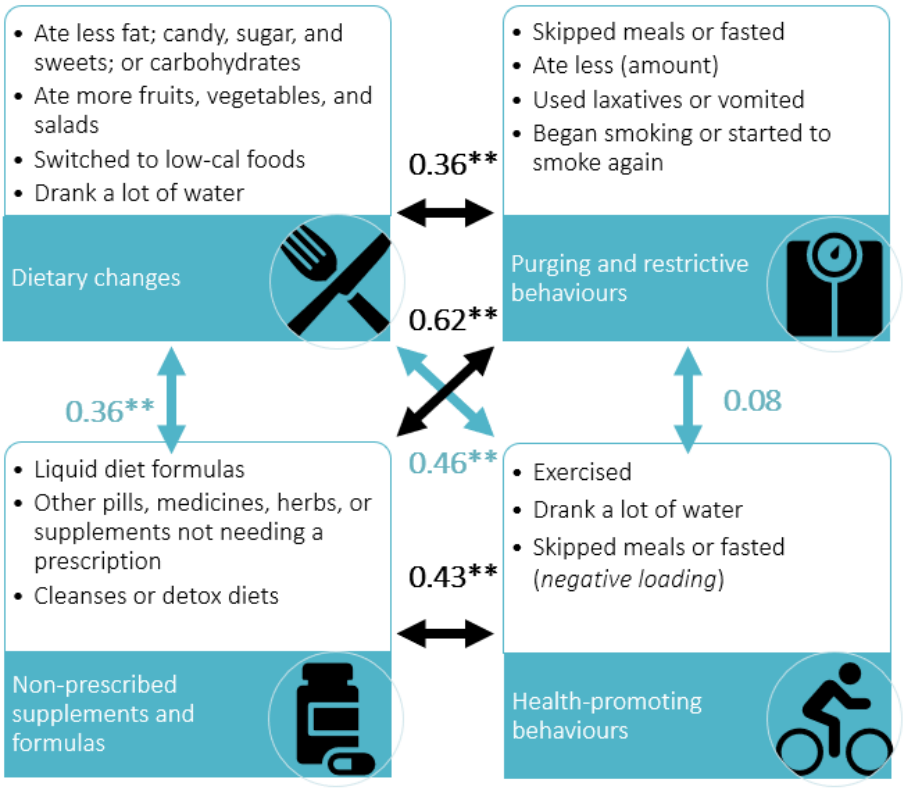


5.4.4 Structural Model of Weight Loss Behaviours

A simplified structural model identifying the relationships among the weight loss behaviour patterns (factors) can be seen in **Figure 12** (see Appendix A**, Figure 22** for full structural model). The model identified positive and significant correlations among all factors (weight loss behaviour patterns) except for between Purging and Restrictive Behaviours and Health-Promoting Behaviours, which were not correlated significantly with one another. The relationship between the factors (weight loss behaviour patterns) indicate that engagement in one pattern is associated with engagement in another (i.e., engagement in a given pattern of behaviours is not mutually exclusive). The strongest association was found between Purging and Restrictive Behaviours and Non-Prescribed Supplements or Formulas (r=0.62); the factor

Dietary Changes is moderately correlated with Purging and Restrictive Behaviours (r=0.36), Non-Prescribed Supplements or Formulas (r=0.36), and Health-Promoting Behaviours (r=0.46).

Figure 12. *Simplified structural diagram of associations among weight loss behaviour patterns*[1]



[1] *Diagram shows correlations among factors, with *p-value of <0.05 and **p-value of <0.001*

5.3 Results- Sources of Nutrition Information

5.3.1 Exploratory Factor Analysis

The steps followed to perform exploratory factor analysis are presented in Section 5.1.1. As per Williams, Onsman & Brown (2010), the first step of factor analysis is to determine the suitability of the data for this method. First, all 18 response categories considered for exploratory factor analysis correlated at 0.3 with at least one other response category, suggesting adequate factorability (See Appendix A, **Table 17**) (105). Secondly, the ratio of participants to variables of 10:1 was met as the present analysis uses 1538 participants and 18 variables (response categories).

All 18 response categories were included in the exploratory factor analysis. As discussed in Section 5.1.1, the factor analysis extraction method (step 2) and the oblique rotation method (step 4) were used. For step 3 of the EFA, Kaisers criteria, χ^2, CFI, TFI, and RMSEA were used to determine the number of factors to be extracted. Kaisers criteria indicated that a five-factor model was appropriate. The source "Your friends, family, or colleagues" did not load onto any factors with a correlation of 0.3 and was removed. After rerunning the model with 17 information sources, Kaisers criteria indicated that a four-factor model was appropriate; however, fit indices for a four-factor model ($\chi^2(74) = 130.94$, p= 0.0001; CFI= 0.974; TFI= 0.952; RMSEA= 0.022 90% confidence interval [0.016, 0.029]) were similar to those of a three-factor model ($\chi^2(88) = 194.104$, p=0.0000; CFI=0.951; TFI= 0.924; RMSEA= 0.028 90% confidence interval [0.023, 0.033]), and thus, both models were considered for confirmatory factor analysis to select a final model.

5.3.2 Confirmatory Factor Analysis

Confirmatory factor analysis was used to compare and verify the three-factor and four-factor models identified. After examining model fit indices and final factor structures for the four-factor model ($\chi^2(111) = 204.718$, p= 0.0000; CFI= 0.957; TFI= 0.947; RMSEA= 0.023 90% confidence interval [0.018, 0.028]) and the three-factor model ($\chi^2(112) = 234.176$, p= 0.0000; CFI= 0.944; TFI= 0.932; RMSEA= 0.027 90% confidence interval [0.022, 0.031]), the four-factor model was selected as the finalized model. A four-factor model was selected because (a) the three-factor model had eight information sources loading on factor 1 which suggested that an additional factor would be appropriate, and (b) model fit indices for the four-factor model were slightly better.

When verifying the four-factor model in confirmatory factor analysis, “Nutritional facts table on food products” and “Food product labels” did not load onto factor 1 and were removed step-wise from this factor. As model fit was adequate, modification indices were not consulted. The factor loadings for the final four-factor model for sources of nutrition information is shown in **Table 7.**

Table 7. *Factor loadings for four-factor confirmatory factor model for sources of nutrition information*

Factor and item	Estimate (S.E.)
Government and health association sponsored resources	
2.Health association materials or website (e.g., Heart & Stroke, Cancer Society, Dietitians of Canada)	0.463 (0.076)
3.Canada's Food Guide	0.638 (0.043)
4.Government/health agency materials, websites, etc.	0.780 (0.054)
11.Food company materials, advertisements, websites, etc.	0.455 (0.075)
Health and weight-loss specialists	
1.Health professional (e.g., family doctor, nurse, or dietician)	0.709 (0.050)
2.Health association materials or website (e.g., Heart & Stroke, Cancer Society, Dietitians of Canada)	0.359 (0.084)
7. Alternative health practitioner (e.g., chiropractor, naturopath, homeopath, holistic nutritionist)	0.703 (0.072)
8. Fitness programs/personal trainer	0.538 (0.053)
9. Weight loss program (such as Weight Watchers)	0.596 (0.097)
Commercial sources	
11.Food company materials, advertisements, websites, etc.	0.359 (0.079)
12.Grocery store or pharmacy	0.687 (0.048)
13. Magazines, newspapers or books	0.789 (0.034)
14. TV or radio	0.643 (0.041)
16. Social media or blogs (e.g., Facebook, Twitter)	0.703 (0.037)
17. Celebrities (e.g., Gwyneth Paltrow, Food Babe)	0.661 (0.070)
Easily accessible sources	
5.Nutrition facts tables on food products	0.859 (0.030)
6.Food product labels	0.772 (0.033)
15. General research on the internet	0.656 (0.036)
18. Mobile app	0.375 (0.062)

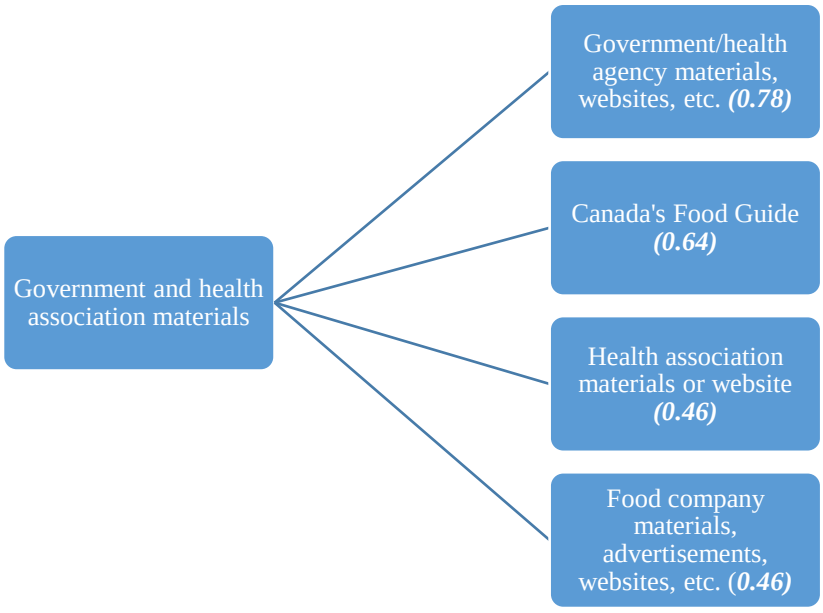
5.3.3 Results of Factor Analysis for Sources of Nutrition Information

Government and Health Association Materials

The first factor of information sources used for nutrition information among individuals trying to lose weight consists of “Health association materials or website”, “Government/health agency materials, websites, etc.”, “Food company materials, advertisements, websites, etc.” and “Canada’s Food Guide”. Together, these sources are similar in that they are all health or food agencies and therefore were labelled Government and Health Association Materials.

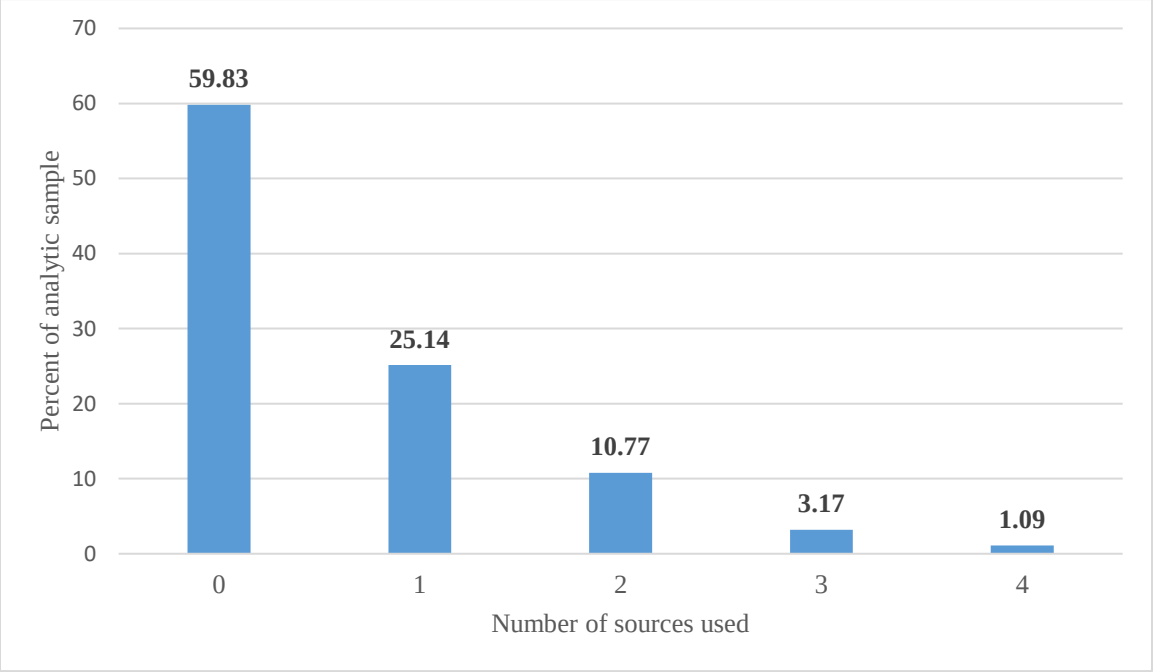
The factor loadings represent the correlation between the factor and the variable (response category) and can be found in **Figure 13** below. The information source most strongly associated with the factor Government and Health Association Materials is “Government/health agency materials, websites, etc.”, followed by “Canada’s Food Guide”, and the lowest association is with “Food company materials, advertisements, websites, etc.”.

Figure 13. *Structural diagram and factor loadings for Government and Health Association Materials*



The majority (59.83%) of people used none of these sources, and 40.17% of people used at least one of these sources.

Figure 14. *Number of Government and Health Association Materials used for nutrition information by analytic sample (N=1,452.15)*

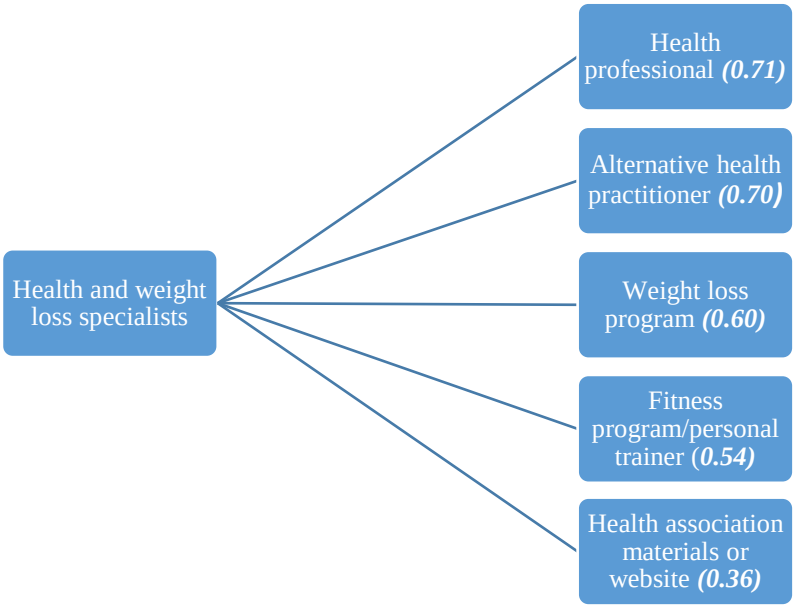


Health and Weight Loss Specialists

The second factor is comprised of health professionals, health association materials or websites, alternative health practitioners, fitness program/personal trainer and weight loss programs. These sources are all deemed specialists in their respective fields, and therefore this factor was labelled as Health and Weight Loss Specialists. “Health professional” was most

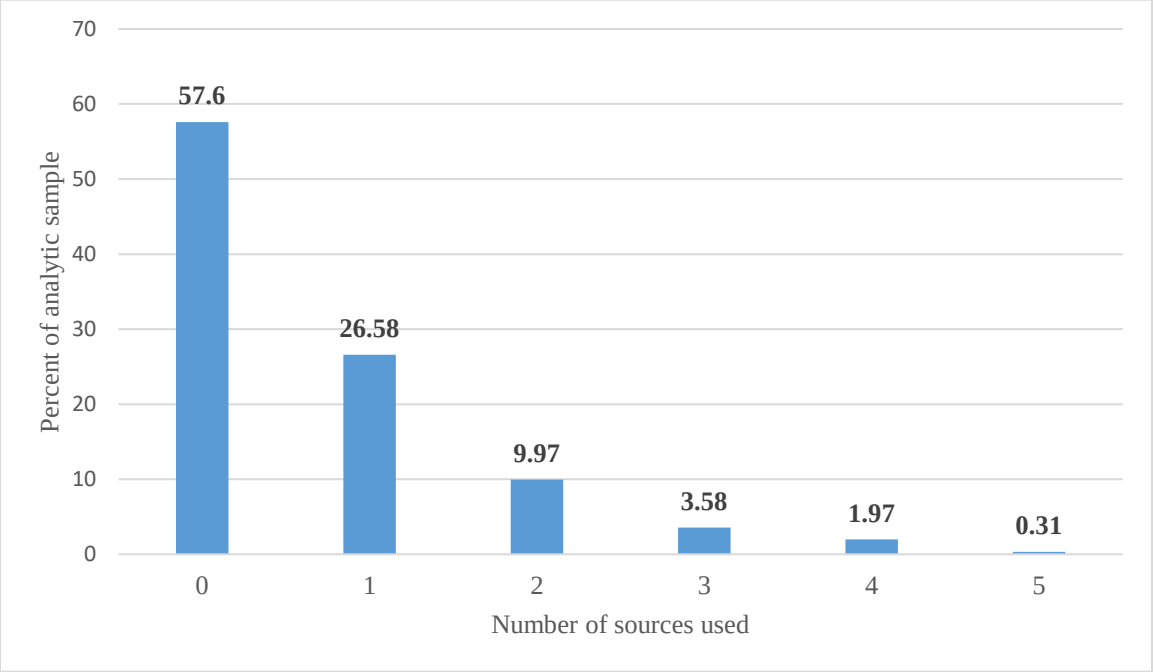
highly correlated with the factor followed by “Alternative health practitioner”. The weakest correlation was with “Health association materials or websites”.

Figure 15. *Structural diagram and factor loadings for Health and Weight Loss Specialists*



Most individuals (57.6%) did not use any of these sources for nutrition information, and 42.4% of people used at least one of these sources.

Figure 16. *Number of Health and Weight Loss Specialists used for nutrition information by analytic sample (N=1,452.15)*

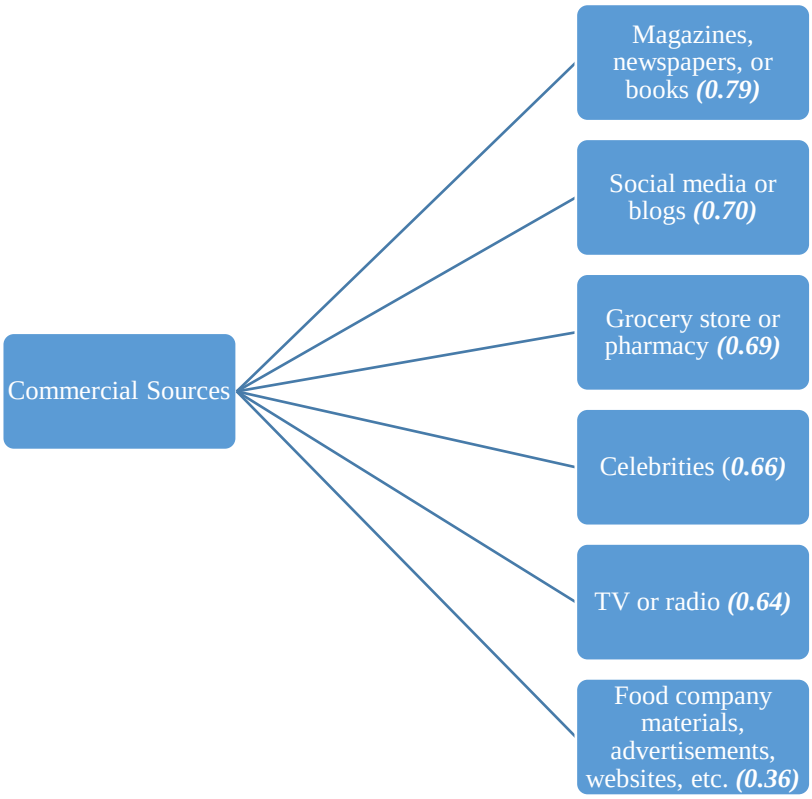


Commercial Sources

The third factor consists of "Food company materials, advertisements, websites, etc.", "Grocery store or pharmacy", "Magazines, newspapers or books", "TV or radio", "Social media or blogs", and "Celebrities". These sources gain a profit from selling a product or brand, and thus were labelled Commercial Sources.

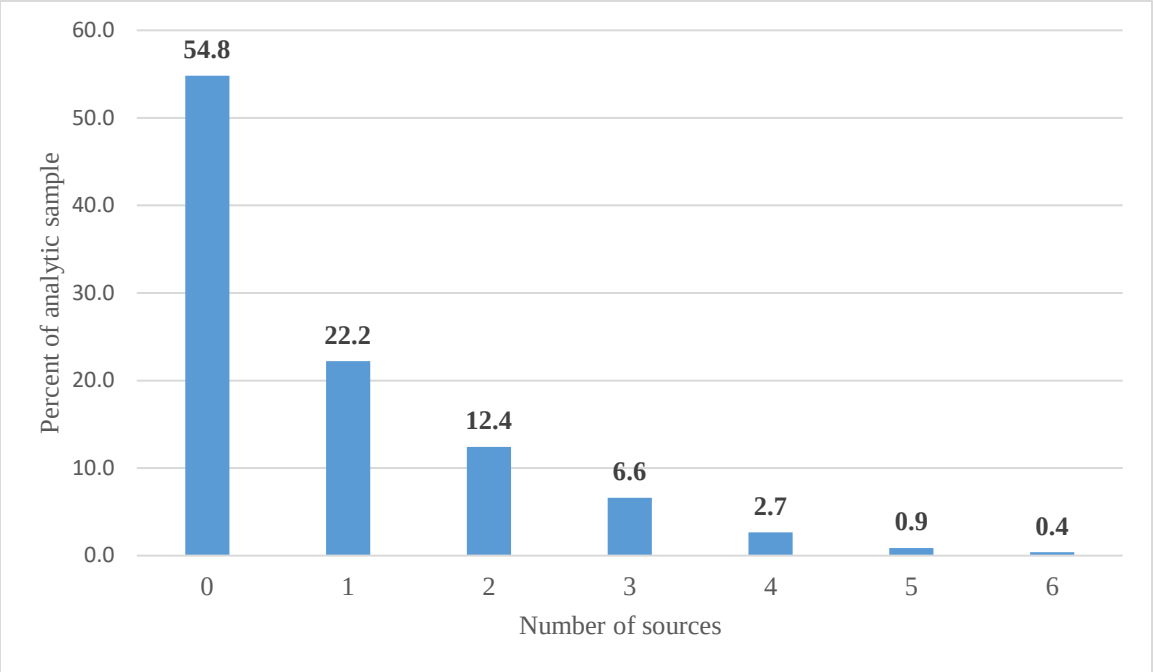
The information source that is most highly correlated with the factor Commercial sources is "Magazines, newspapers, or books", followed by "Social media or blogs", and the least correlated is "Food company materials, advertisements, websites, etc.".

Figure 17. *Structural diagram and factor loadings for Commercial Sources*



The majority of respondents (54.8%) did not use any of these sources, and 45.2% of people used one or more of these sources.

Figure 18. *Number of Commercial Sources used for nutrition information by analytic sample (N=1,452.15)*

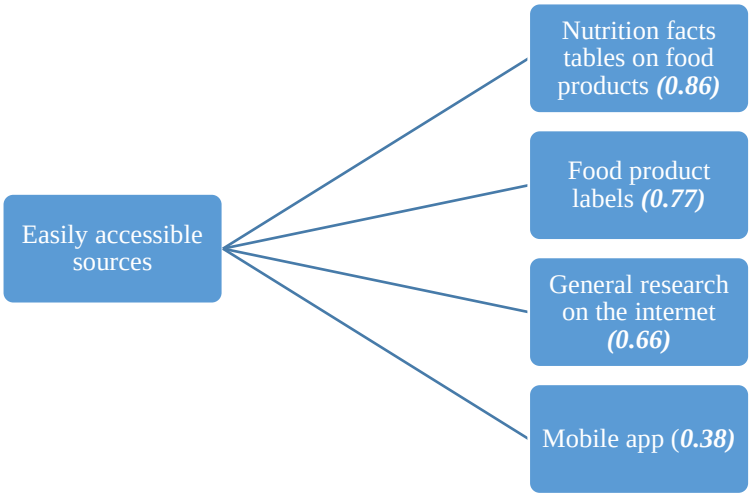


Easily Accessible Sources

The fourth factor consists of “Nutrition facts tables on food products”, “Food product labels”, “General research on the internet” and “Mobile apps”. The shared characteristic among these sources is that they are easily accessible; food labels and nutrition facts tables have nutrition information printed on the item, and mobile applications and internet research can quickly generate a response to any nutrition or food queries.

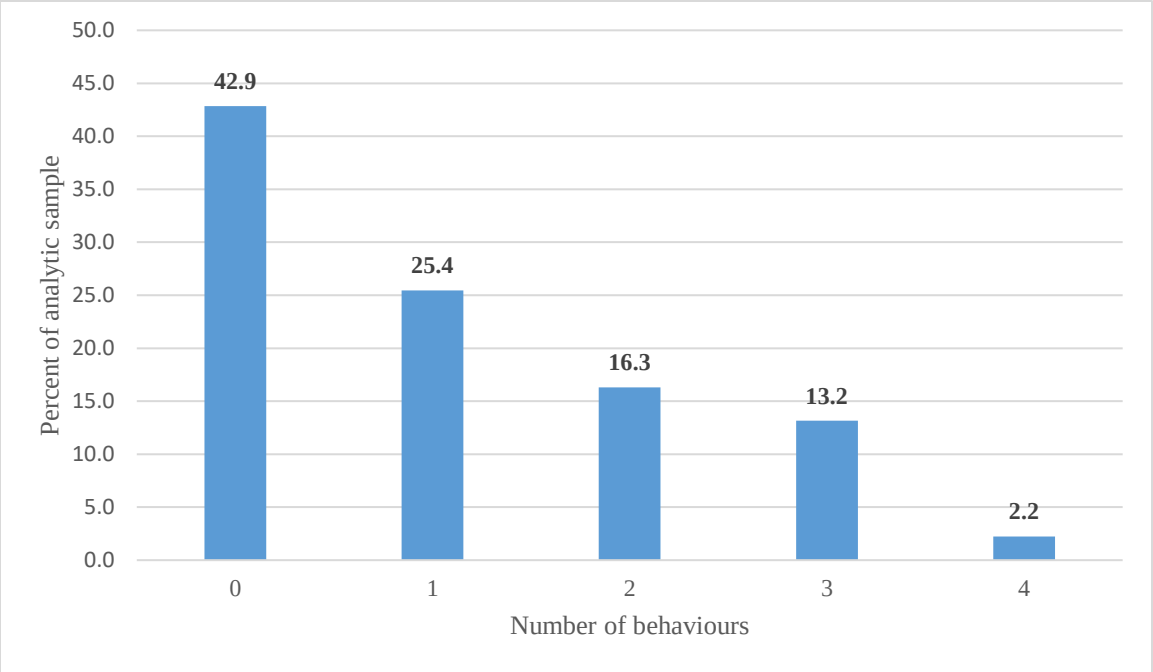
The information source that correlates highest with the factor is “Nutrition facts tables on food products”, followed by “Food product labels”, and the least correlated is “Mobile app”.

Figure 19. *Structural diagram and factor loadings for Easily Accessible Sources*



Most people (42.9%) did not use any of these sources, however, 57.1% used one or more of these sources.

Figure 20. *Number of Easily Accessible Sources used for nutrition information by analytic sample (N=1,452.15)*



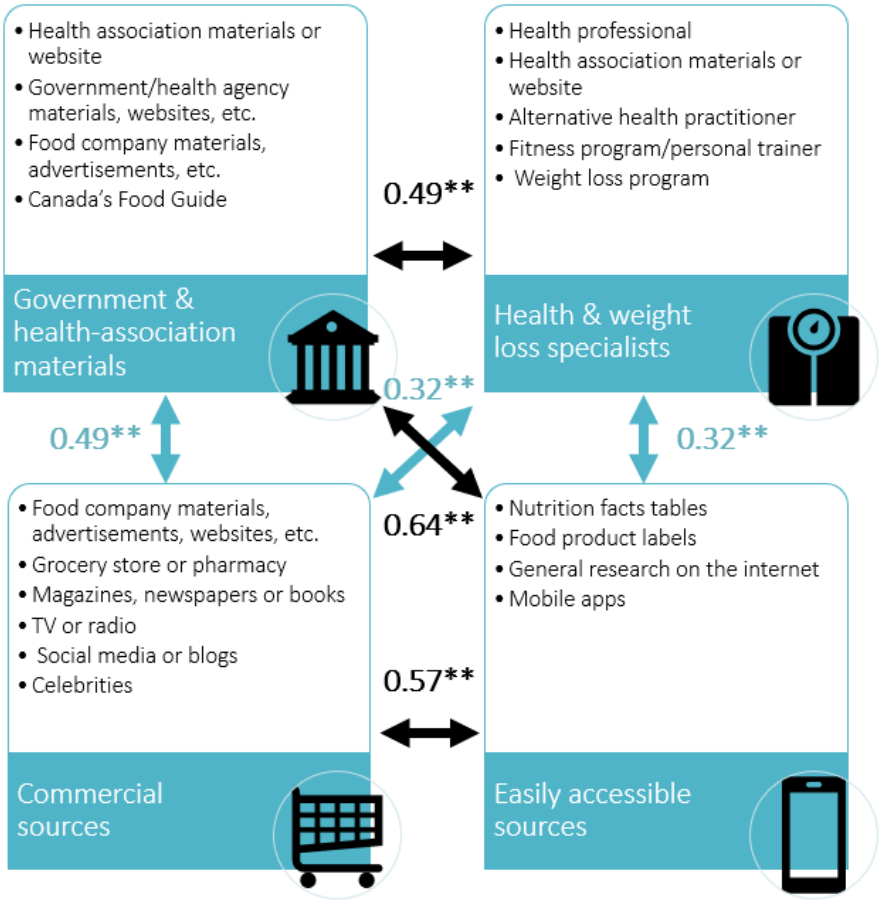
5.3.4 Structural Model for Nutrition Information Sources

Figure 21 shows a simplified structural model identifying the relationships among the sources for nutrition information (factors) (see Appendix A, **Figure 23** for full structural model). The factor analysis model for weight loss behaviours identified positive and significant correlations among all factors (source of nutrition information), indicating that engagement in any pattern of sources is not mutually exclusive, such that engagement in one pattern is associated with engagement in another.

The strongest association is between Government and Health Association Materials and Easily Accessible Sources (r=0.64), and there is also a strong relationship between use of Easily Accessible Sources and Commercial Sources (r=0.57). Use of Government and Health

Association Materials is moderately associated with use of Commercial Sources (r=0.49) and Health and Weight Loss Specialists (r=0.49). Use of Health and Weight Loss Specialists is moderately correlated with use of Commercial Sources (r=0.32) and Easily Accessible sources (r=0.31). The associations between the factor patterns demonstrate the co-occurrence of sources considered more credible (e.g., Government and Health Association Materials) with those considered less credible (e.g., Commercial Sources), which is further explored in Chapter 7, section 7.2.

Figure 21. *Simplified structural diagram of associations among sources of nutrition information*[1]



[1] *Diagram shows correlations among factors, with *p-value of <0.05 and **p-value of <0.001*

Chapter 6- Associations Between Information Sources Used and Weight Loss Behaviours

6.1 Analytic Methods

Multiple logistic regression was used to assess associations between sources of nutrition information used and reported weight loss behaviours, drawing upon the results of the factor analyses to inform the operationalization of variables. To inform how to include the factors in the models, past literature was consulted. A study by Löffler et al., 2015 (110) conducted EFA and CFA on the three-factor eating questionnaire (TFEQ) and then analyzed the association between the identified factors for eating behaviours (3 factors) with BMI. TFEQ factors were input into the model as scores that represented the sum of scores for that item. Based on this study method, it was determined that the factors would be characterised by scores representing the total number of behaviours within the factor that were reported.

Weight loss behaviours were included as dependent variables in four separate regression models using count variables that indicated the number of strategies in the category reported by participants: Dietary Changes (scores ranging from 0-6), Purging and Restrictive Behaviours (scores ranging from 0-4), Non-Prescribed Supplements and Formulas (scores ranging from 0-3), and Health-Promoting Behaviours (scores ranging from 0-3). Four separate independent variables were created for the sources of nutrition information identified by the factor analyses: Government and Health Association Materials (scores ranging from 0-4), Health and Weight Loss Specialists (scores ranging from 0-5), Commercial Sources (scores ranging from 0-6), and

Easily Accessible Sources (scores ranging from 0-4). Since the number of sources in each variable differed, they were represented as proportions (# of sources used from grouping/total # of sources within the grouping). Therefore, scores for each source (factor) ranged from 0-1. The regression coefficients therefore represent the change in the number of dietary weight loss behaviours reported when all of the sources belonging to that information source are used (as a 1-unit change represents using all of the sources (4/4)).

Regression analyses were conducted using SAS, version 9.4 (Cary, NC). Poisson models were used since the dependent variables were expressed as counts. A multinomial regression model was also considered but was not appropriate due to the assumption of independence of the dependent variable levels (111). Models were repeated with covariates identified *a priori* to examine if any observed association were independent of factors such as health literacy. Therefore, a total of eight models were run.

A basic requirement for a Poisson model is that the count data follows a Poisson distribution in which the mean and variance of the count data are equal (111). Over-dispersion is common in discrete data and occurs when there is more variability in the count data than is expected by the model (111). Goodness of fit statistics (Chi-square) were used to assess whether the Poisson model adequately fit the count data; if the Chi-square is significant, this suggests that the count data has more variability that can be accounted for by the model, which usually occurs because of over-dispersion of data (112,113). Since the Goodness of fit statistic was non-significant for all models, accounting for covariates, the Poisson distribution was deemed to adequately fit the count data and models to account for over-dispersion or any model assumption violations were not explored.

Models of weight loss behaviour patterns (Purging and Restrictive Behaviours, and Non-Prescribed Supplements and Formulas) for which there was a large number of zeros in the count data were modelled using a zero-inflated Poisson regression for comparison to the standard model (114). The zero-inflated model for these two dependent variables (Purging and Restrictive Behaviours, and Non-Prescribed Supplements and Formulas) did not differ meaningfully from results from the standard model (Appendix A, **Table 18-21**) and thus results from the standard model are presented.

6.1 Associations between Dietary Weight Loss Methods and Nutrition Information Sources

In the unadjusted model, the use of Easily Accessible Sources of nutrition information (e.g., "Nutrition facts tables on food products", "Food product labels", "General research on the internet" and "Mobile apps") was significantly associated with a higher number of reported behaviours within the category Dietary Changes (**Table 8**). The use of one source in this category is associated with an 7.9% increase in predicted number of Dietary Changes for weight loss, and use of all four sources is associated with a 35.7% increase in predicted number Dietary Changes. No other associations between nutrition information sources and the number of Dietary Changes reported were observed.

Table 8. *Poisson multiple regression investigating relationship between sources used for nutrition information (proportion) and number of Dietary Changes made to lose weight in the past year (N=1452.15)*

Parameter	Regression coefficient (95% CI)	P-value
Government and health association materials	0.0369 (-0.1402, 0.2140)	0.6830
Health and weight loss specialists	0.2608 (0.0719, 0.4497)	0.0068
Commercial sources	0.1153 (-0.0291, 0.2596)	0.1176
Easily accessible sources	**0.3050 (0.2071, 0.4028) ****	<0.0001

**p-value of <0.05, **p-value of <0.001*

When controlling for the covariates, greater use of Easily Accessible Sources (e.g., "Nutrition facts tables on food products", "Food product labels", "General research on the internet" and "Mobile apps") and Health and Weight Loss Specialists (e.g., "Health professional", "Health association materials or website", "Alternative health practitioner", "Fitness program/personal trainer" and "Weight loss program") for nutrition information were associated with a greater number of Dietary Changes used for weight loss. Use of one of the Easily Accessible Sources increased the expected number of Dietary Changes used by 5.8%, while use of all 4 of these sources increases the number of predicted Dietary Changes by 25.3%.

Although not significant without covariates in the model, when covariates are considered the use of Health and Weight Loss Specialists for nutrition information is significant. This may have occurred because the covariates are explaining some of the residual variability in the dependent variable, which subsequently increases the power of the statistical test of the significance of Health and Weight Loss Specialists on the dependent variable of interest. When considering the covariates, the use of one source within the Health and Weight Loss Specialist category for nutrition information is associated with a 4.4% increase in the expected number of

Dietary Changes used for weight loss, and use of all five sources is associated with a 23.9% increase in the number of expected Dietary Changes used for weight loss.

The regression analysis shows that individuals who find it very easy to make ends meet, who have overweight or obesity, or who feel slightly satisfied, slightly dissatisfied or mostly dissatisfied with their body size and shape report greater use of Dietary Changes for weight loss. On the other hand, having a high likelihood of limited health literacy, identifying as male, being of South Asian descent and responding, “Don’t know/Refuse to answer” to the body image question were associated with reporting fewer Dietary Changes for weight loss.

Table 9. *Poisson multiple regression investigating variables associated with the number of Dietary Changes made to lose weight in the past year (N=1452.15)*

Parameter		Poisson regression coefficient (95% CI)	P-value
Government and health association materials		0.0432 (-0.1326, 0.2189)	0.6302
Health and weight loss specialists		**0.2143 (0.0252, 0.4034) ***	0.0263
Commercial sources		0.1034 (-0.0409,0.2476)	0.1601
Accessible sources		**0.2258 (0.1235, 0.3281) ****	<.0001
Body image	Don't know/ Refuse to answer	**-0.9329(-1.7606, -0.1052) ***	0.0272
	Mostly dissatisfied	**0.1798 (0.0164, 0.3433) ***	0.0311
	Slightly dissatisfied	**0.1788(0.0269-0.3308) ***	0.0211
	Neither dissatisfied nor satisfied	0.00	
	Slightly satisfied	**0.1897(0.0386, 0.3407) ***	0.0139
	Mostly satisfied	0.0337(-0.1240, 0.1915)	0.675
Income adequacy	Difficult	0.0545(-0.0212, 0.1302)	0.1586
	Don't know/ Refuse to answer	0.0216(-0.0828, 0.1260)	0.6853
	Easy	-0.0466(-0.1233, 0.0302)	0.2346
	Very Difficult	0.0598(-0.0491, 0.1686)	0.2818
	Very Easy	**0.1152(0.0250, 0.2055) ***	0.0123
	Neither easy nor difficult	0.00	.
Age		**-0.0065(-0.0130, 0.0000) ***	0.0509
Gender	Don't know/ Refuse to answer	0.0653(-0.3846, 0.5151)	0.776
	Man	**-0.1752 (-0.2332, -0.1171) ****	<.0001
	Other	-0.0622(-0.3159, 0.1916)	0.6312
	Woman	0.00	.
Race	Aboriginal inclusive (includes mixed)	-0.0520(-0.1920, 0.0881)	0.4669
	Black only	0.0827(-0.0400, 0.2053)	0.1866
	Chinese only	0.0253(-0.0778, 0.1284)	0.6311
	Mixed/Other/Not Stated/Missing (excludes Aboriginal)	0.0208(-0.0453, 0.0869)	0.5379
	South Asian only	**-0.1244(-0.2382, -0.0107) ***	0.032

	White only	0.00	.
BMI class	Missing	0.0087(-0.0839, 0.1012)	0.854
	Obese	**0.1442(0.0591, 0.2294) ****	0.0009
	Overweight	**0.0712(0.0041, 0.1383) ***	0.0375
	Underweight	-0.1368(-0.3311, 0.0575)	0.1676
	Normal Range	0.00	.
Health literacy	Don't know/ Refuse to answer	-0.1514(-0.3170, 0.0143)	0.0733
	High likelihood of limited health literacy	**-0.1813(-0.2752, -0.0874) ****	0.0002
	Possibility of limited health literacy	-0.0184(-0.0902,0.0533)	0.6145
	Adequate health literacy	0.00	.

**p-value of <0.05, **p-value of <0.001*

6.2 Purging and Restrictive Weight Loss Methods and Nutrition Information Sources Used

In the unadjusted model, a greater number of Commercial Sources (e.g., “Food company materials, advertisements, websites, etc.”, “Grocery store or pharmacy”, “Magazines, newspapers or books”, “TV or radio”, “Social media or blogs”, and “Celebrities”) used for nutrition information was associated with greater use of Purging and Restrictive Behaviours for weight loss. Use of just one of these Commercial Sources is associated with a 5.7% increase in predicted number of Purging and Restrictive Behaviours, and a 39.5% increase in expected number of Purging and Restrictive Behaviours when all Commercial Sources are used.

Table 10. *Poisson multiple regression investigating relationship between sources used for nutrition information (proportion) and number of Purging and Restrictive Behaviours used to lose weight in the past year (N=1452.15)*

Parameter	Regression coefficient (95% CI)	P-value
Government and health association materials	0.0335 (-0.3151, 0.3821)	0.8506
Health and weight loss specialist	0.1210 (-0.2534, 0.4954)	0.5263
Commercial sources	**0.3326 (0.0539, 0.6113) ***	0.0193
Easily accessible	0.1780 (-0.0156, 0.3715)	0.0715

**p-value of <0.05, **p-value of <0.001*

When considering covariates, none of the sources for nutrition information were associated with the number of Purging and Restrictive Behaviours used. This may be because the covariates account for the same or overlapping variability with that of the Commercial Sources variable.

In terms of the covariates, a greater number of Purging and Restrictive Behaviours are expected by individuals classifying as underweight, those who found it very difficult to make ends meet, and those who were mostly dissatisfied with their body size and shape. Being of South Asian descent was a protective factor against the use of Purging and Restrictive Behaviours.

Table 11. *Poisson multiple regression investigating variables associated with the number of Purging and Restrictive Behaviours used to lose weight in the past year (N=1452.15)*

Parameter	Response	Regression coefficient (95% CI)	P-value
Government and health association materials		0.0727(-0.2809, 0.4264)	0.6868
Health and weight loss specialists		0.0546(-0.3301, 0.4393)	0.7808
Commercial sources		0.2675 (-0.017, 0.552)	0.0653
Accessible sources		0.1803 (-0.0265, 0.387)	0.0874
Body Image	Don't know/ Refuse to answer	0.2382(-0.6857, 1.1621)	0.6134
	Mostly dissatisfied	**0.3773 (0.0702, 0.6845) ***	0.0161
	Slightly dissatisfied	0.1514(-0.1381, 0.4408)	0.3054
	Neither dissatisfied nor satisfied(Ref)	0	.
	Slightly satisfied	0.0338 (-0.2553, 0.3229)	0.8187
	Mostly satisfied	-0.2327 (-0.5395, 0.074)	0.137
Income Adequacy	Don't know/ Refuse to answer	0.1562 (-0.0402, 0.3526)	0.119
	Very Difficult	**0.234 (0.0306, 0.4374) ***	0.0241
	Difficult	0.115 (-0.037, 0.2669)	0.1381
	Neither easy nor difficult(Ref)	0	.
	Easy	0.0221 (-0.1318, 0.1759)	0.7786
	Very Easy	0.0669 (-0.122, 0.2558)	0.4873
Age		**-0.0146 (-0.0274, -0.0017) ***	0.0264
Gender	Don't know/ Refuse to answer	-0.6219 (-1.8551, 0.6113)	0.3229
	Man	-0.0984 (-0.2138, 0.0171)	0.095
	Other	0.2150 (-0.2007, 0.6306)	0.3107
	Woman(Ref)	0	.
Race	Aboriginal inclusive (includes mixed)	-0.0378 (-0.3044,0.2289)	0.7813
	Black only	-0.0622 (-0.3094,0.1851)	0.6222
	Chinese only	-0.0101 (-0.2133, 0.1932)	0.9227
	Mixed/Other/Not Stated/Missing (excludes Aboriginal)	-0.0858 (-0.2186, 0.0469)	0.2052
	South Asian only	**-0.3025 (-0.5363, -0.0688) ***	0.0112
	White only(Ref)	0	.

BMI/ weight status	Missing	0.023 (-0.1564, 0.2024)	0.8018
	Obese	-0.0569 (-0.232, 0.1181)	0.5238
	Overweight	0.0706 (-0.0629, 0.204)	0.3001
	Underweight	**0.3384 (0.0273, 0.6495)***	0.033
	Normal Range(Ref)	0	.
Health Literacy	Don't know/ Refuse to answer	-0.1894 (-0.5308, 0.1519)	0.2768
	High likelihood of limited health literacy	0.084 (-0.0897, 0.2578)	0.3432
	Possibility of limited health literacy	0.1059 (-0.0345, 0.2464)	0.1393
	Adequate health literacy (Ref)	0	.

**p-value of <0.05, **p-value of <0.001*

6.3 Non-Prescribed Supplements and Formulas and Sources of Nutrition Information

In the unadjusted model, the number of both Commercial Sources (e.g., "Food company materials, advertisements, websites, etc.", "Grocery store or pharmacy", "Magazines, newspapers or books", "TV or radio", "Social media or blogs", and "Celebrities") and Health and Weight Loss Specialists (e.g., "Health professional", "Health association materials or website", "Alternative health practitioner", "Fitness program/personal trainer" and "Weight loss program") consulted was related to the number of Non-Prescribed Supplements and Formulas used. The results show that use of one Commercial Source for nutrition information was associated with a 21.0% increase in the predicted number of Non-Prescribed Supplements and Formulas used for weight loss, and use of all six sources was associated with a 214.1% increase in the expected number of Non-Prescribed Supplements or Formulas used. Use of one Health and Weight Loss Specialist for nutrition information was associated with a 46.0% increase in the predicted number of Non-Prescribed Supplements or Formulas used for weight loss, while use of

all five sources is related to a 563.7% increase in number of expected Non-Prescribed Supplements or Formulas used.

Table 12. *Poisson multiple regression investigating relationship between sources used for nutrition information (proportion) and number of Non-Prescribed Supplement and Formulas used to lose weight in the past year (N=1452.15)*

Parameter	Regression coefficients (95% CI)	P-value
Government and Health Association Materials	-0.7406 (-1.5262, 0.0449)	0.0646
Health and Weight Loss Specialists	**1.8927 (1.1394, 2.6461) ****	<0.0001
Commercial Sources	**1.1444 (0.5490, 1.7399) ****	0.0002
Easily Accessible Sources	-0.1562 (-0.6268, 0.3143)	0.5152

**p-value of <0.05, **p-value of <0.001*

When considering covariates, use of Government and Health Association Materials (e.g., "Health association materials or website", "Government/health agency materials, websites, etc.", "Food company materials, advertisements, websites, etc." and "Canada's Food Guide"), Commercial sources (e.g., "Food company materials, advertisements, websites, etc.", "Grocery store or pharmacy", "Magazines, newspapers or books", "TV or radio", "Social media or blogs", and "Celebrities") and Health and Weight Loss specialists (e.g., "Health professional", "Health association materials or website", "Alternative health practitioner", "Fitness program/personal trainer" and "Weight loss program") are significantly related to the number of Non-Prescribed Supplements and Formulas used to lose weight.

Use of one Government and Health Association Material for nutrition information was associated with 18.8% decrease in the expected number of Non-Prescribed Supplements and Formulas to lose weight, and use of all four sources decreases the number by 56.5%.

Government and Health Association Materials was not significantly associated with these weight loss behaviours without considering covariates which suggests that this variable contributes uniquely to the variability in the dependent variable, beyond what is contributed by the covariates.

The use of just one Health and Weight Loss Specialist is associated with 47.9% increase in the predicted number of Non-Prescribed Supplements and Formulas used, and use of all six of these sources is associated with a 608.5% increase. Lastly, the use of one Commercial Source is associated with a 17.9% increase in the expected number of Non-Prescribed Supplements and Formulas, and use of all six sources 168.6% increase.

Greater use of Non-Prescribed Supplements and Formulas was associated with identifying as “Other/Non-binary”, and being of Black descent. Responding “Don’t know/Refuse to answer” or “Easy” to make ends meet, identifying as male, and being of South Asian descent were protective factors against use of Non-Prescribed Supplements and Formulas.

Table 13. *Poisson multiple regression investigating variables associated with the number of Non-Prescribed Supplements and Formulas used to lose weight in the past year (N=1452.15)*

Parameter		Regression coefficient (95% CI)	P-value
Government and Health Association Materials		**-0.833 (-1.633, -0.034) ***	0.041
Health and Weight Loss Specialists		**1.958 (1.180, 2.736) ****	<.0001
Commercial Sources		**0.988 (0.371, 1.605) ***	0.002
Easily Accessible Sources		-0.065 (-0.564, 0.433)	0.797
Body Image	Don't know/ Refuse to answer	-0.323 (-2.949, 2.304)	0.810
	Mostly dissatisfied	0.048 (-0.661, 0.758)	0.894
	Slightly dissatisfied	0.006 (-0.657, 0.670)	0.985
	Neither dissatisfied nor satisfied(Ref)	0.000	.
	Slightly satisfied	-0.060 (-0.718, 0.599)	0.859
	Mostly satisfied	-0.131 (-0.822, 0.560)	0.710
Income Adequacy	Don't know/ Refuse to answer	**-0.625 (-1.148, -0.103) ***	0.019
	Very Difficult	0.133 (-0.307, 0.573)	0.554
	Difficult	-0.284 (-0.649, 0.081)	0.127
	Neither easy nor difficult(Ref)	0.000	.
	Easy	**-0.420 (-0.809, -0.032) ***	0.034
	Very Easy	-0.111 (-0.560, 0.338)	0.627
Age		**-0.030 (-0.060, 0.000) ***	0.053
Gender	Don't know/ Refuse to answer	0.645 (-1.089, 2.379)	0.466
	Man	**-0.541 (-0.836, -0.245) ****	0.000
	Other	0.778 (0.030, 1.526)	0.041
	Woman(Ref)	0.000	.
Race	Aboriginal inclusive (includes mixed)	0.260 (-0.313, 0.834)	0.374
	Black only	**0.599 (0.124, 1.074) ***	0.013
	Chinese only	-0.042 (-0.564, 0.480)	0.874
	Mixed/Other/Not Stated/Missing (excludes Aboriginal)	0.260 (-0.044, 0.563)	0.093
	South Asian only	**-0.881 (-1.663, -0.099) ***	0.027
	White only(Ref)	0.000	.

BMI/ weight status	Missing	0.175 (-0.242, 0.591)	0.411
	Obese	0.177 (-0.222, 0.576)	0.383
	Overweight	0.117 (-0.211, 0.445)	0.485
	Underweight	0.390 (-0.315, 1.095)	0.279
	Normal Range(Ref)	0.000	.
Health Literacy	Don't know/ Refuse to answer	0.113 (-0.638, 0.863)	0.768
	High likelihood of limited health literacy	0.088 (-0.315, 0.491)	0.668
	Possibility of limited health literacy	0.238 (-0.081, 0.557)	0.144
	Adequate health literacy (Ref)	0.000	.

**p-value of <0.05, **p-value of <0.001*

6.4 Health-Promoting Weight Loss Behaviours and Sources of Nutrition Information

In the unadjusted model, use of Easily Accessible Sources (e.g., “Nutrition facts tables on food products”, “Food product labels”, “General research on the internet” and “Mobile apps”) was associated with a greater number of Health-Promoting Behaviours for weight loss. Use of one of these sources was associated with a 4.8% increase in the predicted number of Health-Promoting Behaviours used, and use of all four was associated with a 20.5% increase.

Table 14. *Poisson multiple regression investigating relationship between sources used for nutrition information (proportion) and number of Health-Promoting Behaviours used to lose weight in the past year (N=1452.15)*

Parameter	Regression coefficient (95% CI)	P-value
Government and Health Association Materials	-0.0276 (-0.2622, 0.2070)	0.8175
Health and Weight Loss Specialists	0.1063 (-0.1449, 0.3576)	0.4068
Commercial Sources	-0.1041 (-0.2975, 0.0893)	0.2914
Easily Accessible Sources	**0.1867 (0.0595- 0.3140) ***	0.0040

**p-value of <0.05, **p-value of <0.001*

When controlling for the covariates, none of the information sources were associated with the number of Health-Promoting Behaviours for weight loss. No variables studied were associated with an increase in number of Health-Promoting Behaviours, the only variables associated with decreased number is having a high likelihood of limited health literacy.

Table 15. *Poisson multiple regression investigating variables associated with the number of Health-Promoting Behaviours used to lose weight in the past year (N=1452.15)*

Parameter		Regression coefficient (95% CI)	P-value
Government and Health Association Materials		-0.0325 (-0.27, 0.205)	0.7885
Health and Weight Loss Specialist		0.1029 (-0.1525, 0.3584)	0.4296
Commercial Sources		-0.0791 (-0.2761, 0.1178)	0.431
Easily Accessible Sources		0.1078 (-0.0278, 0.2433)	0.1191
Body Image	Don't know/ Refuse to answer	-0.5225 (-1.3215, 0.2764)	0.1999
	Mostly dissatisfied	-0.0464 (-0.2537, 0.1609)	0.6608
	Slightly dissatisfied	0.0389 (-0.1487, 0.2266)	0.6842
	Neither dissatisfied nor satisfied(Ref)	0	.
	Slightly satisfied	0.0993 (-0.0865, 0.2851)	0.295
	Mostly satisfied	0.0686 (-0.1243, 0.2616)	0.4856
Income Adequacy	Don't know/ Refuse to answer	-0.0522 (-0.1893, 0.0848)	0.4551
	Very Difficult	-0.1152 (-0.2672, 0.0368)	0.1374
	Difficult	-0.0387 (-0.1394, 0.062)	0.4512
	Neither easy nor difficult(Ref)	0	.
	Easy	-0.0184 (-0.1167, 0.08)	0.7141
	Very Easy	0.0494 (-0.068, 0.1669)	0.4095
Age		-0.0003 (-0.0088, 0.0082)	0.9453
Gender	Don't know/ Refuse to answer	0.0356 (-0.5413, 0.6125)	0.9037
	Man	-0.0523 (-0.1272, 0.0226)	0.1708
	Other	-0.0563 (-0.4037, 0.291)	0.7505
	Woman(Ref)	0	.
Race	Aboriginal inclusive (includes mixed)	0.051 (-0.1242, 0.2262)	0.5682
	Black only	0.0026 (-0.163, 0.1681)	0.9757
	Chinese only	-0.0484 (-0.1854, 0.0885)	0.4881
	Mixed/Other/Not Stated/Missing (excludes Aboriginal)	0.0025 (-0.0848, 0.0899)	0.9547
	South Asian only	0.0037 (-0.1364, 0.1437)	0.9591

	White only(Ref)	0	.
BMI/ weight status	Missing	-0.0036 (-0.1235, 0.1163)	0.9536
	Obese	0.0845 (-0.0295, 0.1984)	0.1462
	Overweight	0.0122 (-0.0755, 0.0999)	0.7852
	Underweight	-0.1377 (-0.3947, 0.1192)	0.2935
	Normal Range(Ref)	0	.
Health Literacy	Don't know/ Refuse to answer	-0.0726 (-0.276, 0.1308)	0.4842
	High likelihood of limited health literacy	**-0.1773 (-0.298, -0.0566) ***	0.004
	Possibility of limited health literacy	-0.0851 (-0.1804, 0.0102)	0.0802
	Adequate health literacy (Ref)	0	.

**p-value of <0.05, **p-value of <0.001*

Chapter 7- Discussion

7.1 Co-Occurrence of Health-Compromising and -Promoting Weight Loss Behaviours

Weight loss behaviours are extremely prevalent among Canadian youth. Despite evidence that health behaviours co-occur, studies examining weight loss behaviours continue to consider weight loss behaviours individually. These behaviours are often categorized dichotomously, as either healthy or unhealthy, with little regard for the use of both healthy and unhealthy behaviours. The present study used factor analysis and found that weight loss behaviours co-occur and that weight loss behaviour patterns can be identified. The patterns identified in this analysis were Dietary Changes, Purging and Restrictive Behaviours, Non-Prescribed Supplements and Formulas, and Health-Promoting Behaviours.

This study highlights the complexity of weight loss behaviours, and suggests that categorizing these behaviours in a dichotomous manner is over simplistic. It was hypothesised that behaviours conceptualized as health-compromising would occur alongside those conceptualized as health-promoting and therefore challenge the way that weight loss behaviours are categorized. This was found for two distinct weight loss behaviours, "Using a liquid diet formula" and "Ate less food (amount)". The use of a liquid diet formulas has been categorized as both 'healthy' and 'unhealthy' by different authors (6,29). However, the co-occurrence of this behaviour alongside detoxing (115), and taking other pills, medicines, herbs or supplements not needing a prescription suggest that this behaviour is not a healthful behaviour among this sample. The same is true for eating less (amount), which has been categorized as a "healthy"

behaviour in previous literature (36); however, the co-occurrence of this behaviour along with use of laxatives, smoking, and skipping meals or fasting suggests that this behaviour may be being used in a restrictive manner that should not be considered a healthful behaviour. Inclusion of this behaviour as a healthful behaviour may distort results of studies examining weight loss behaviours and predictors of these behaviours.

The structural model of weight loss behaviours (factors) demonstrated that they are interconnected, such that engagement in one behaviour pattern is associated with engagement in another. These associations among weight loss behaviours (factors) may provide support for the health-promoting or -compromising potential of the behaviour. The strongest association was found between Purging and Restrictive Behaviours and Non-Prescribed Supplements and Formulas (r=0.62). This strong positive relationship between these two factors indicates that engagement in one of these patterns is strongly associated with engagement in the other. This may be due to the similarity in these behaviours, as both of these categories comprise of behaviours that literature has categorize as health-compromising/ "unhealthy".

Dietary Changes was moderately correlated with Purging and Restrictive Behaviours (r=0.36), Non-Prescribed Supplements and Formulas (r=0.36), and Health-Promoting behaviours (r=0.46). The fact that Dietary Changes is correlated with behaviours conceptualized as being more healthful (i.e., Health-Promoting Behaviours) as well as those considered to be more health-compromising (i.e., Purging and Restrictive Behaviours) indicates that perhaps these Dietary Changes are used in different ways (more restrictive or more flexible), which might dictate the health promoting or compromising potential of the behaviours. This idea that different types of dieting (defined as dietary restraint) exist and impact the healthfulness of a behaviour

was evidenced in a cross-sectional study of American women aged 18-65 years. The study found that engagement in rigid dieting (very strict/ all or nothing dieting) was associated with eating disorder symptoms, mood disturbances, and body image concerns, whereas flexible dieting (more relaxed) was not as strongly correlated with these variables (116). Therefore, whether weight loss behaviours should be considered health compromising or health promoting seems to depend on the degree of the weight controlling behaviour, which might be why Dietary Changes is associated with both Purging and Restrictive Behaviours and Health-Promoting Behaviours.

Although evidence for the occurrence of health-compromising behaviours along with health-promoting behaviours were found in this sample, to my knowledge, there has been no other research that has demonstrated the simultaneous use of weight loss behaviours considered health-compromising and health-promoting.

7.2 Co-Occurrence of Credible and Less-Credible Sources for Nutrition Information

Evidence suggests that the type of weight loss behaviour used is influenced by the source of such information (5,7,37,38,39). Sources for health information vary in credibility, and even sources that are conceptually credible (i.e., medical professionals) may promote pseudoscientific beliefs with regards to weight loss (e.g., Dr. Mehmet Oz). There is also evidence that individuals prefer to use multiple sources for health information (40), and little is known as to whether credible and less credible sources for health information are used simultaneously.

Therefore, factor analysis was used to identify patterns of nutrition information sources that are used among individuals who were trying to lose weight. Four patterns were identified: Government and Health Association Materials, Health and Weight Loss Specialists, Commercial Sources, and Easily Accessible Sources. It was hypothesised that patterns of sources used for nutrition information would emerge and that sources that are typically considered to be credible (e.g., health professionals, government and health associations) would occur alongside sources that are considered less credible (e.g., celebrities, TV and magazines).

There is evidence for the use of a combination of sources that can be conceptualized as credible and those considered less credible. Three out of four of the nutrition information source patterns (factors) contained sources that are considered to be credible along with sources considered less credible. Firstly, the source Government and Health Association Materials is made up of primary credible sources for nutrition information: "Health association materials or website", "Government/health agency materials, websites, etc.", and "Canada's Food Guide"; however, this pattern also contains "Food company materials, advertisements, websites, etc.", which may not be a credible source for nutrition information because of the profit incurred by these companies and therefore the motivation to promote their food products.

Second, for Health and Weight Loss Specialists, sources considered to be credible sources for nutrition information such as "Health professional" occur alongside "Fitness program/personal trainers", whom, according to the literature summarized in Chapter 2, may be less credible sources for nutrition information due to the gap between the knowledge they attained in their education and the knowledge needed to effectively advise their clients (80).

Lastly, for Easily Accessible Sources, there is also evidence for the co-occurrence of use of credible and less credible sources for nutrition information. For example, “Nutrition facts tables on food products” and “Food product labels” are considered credible sources as they are regulated by the Canadian Government (117); however, general research on the internet and mobile applications are also included as a source in this category, the credibility of which are debateable. Credible internet sources such as government and health agency materials are mixed among less credible materials that a general search on the internet related to nutrition or dieting will produce (68). The literature suggests that the quality of information shared via the internet varies greatly, and since health information is not monitored, there may be a large amount of misinformation shared related to weight loss (42,68).

Finally, the behaviour cluster Commercial Sources is made up almost entirely of sources that are potentially less-credible due to the profit incurred by these sources (e.g., “Magazines, newspapers or books”, “TV or radio”, “Social media or blogs”, and “Celebrities”).

The associations between nutrition information sources (factors) evidenced by the structural model of the factors further demonstrates that sources considered more credible (e.g., Government and Health Association Materials) are used alongside less credible sources (e.g., Commercial Sources). In fact, these two sources (factors) are moderately association ($r=0.49$), indicating that use of one of these sources is associated with use of the other. This is interesting because Government and Health Association Materials is made up of almost entirely “credible sources”, while Commercial Sources are almost entirely “less credible”. However, this is in line with past literature demonstrating that most often, people do not consider the credibility of the

source that they are accessing (42) and that individuals prefer to use multiple sources for health information (40).

Overall, this part of the analysis provides insight into where individuals attempting weight loss access their nutrition information, and demonstrates the simultaneous use of sources that the literature considers credible along with less credible. The implications of relying on the various sources identified through factor analysis for the weight loss behaviours will now be discussed.

7.3 Association Between Sources of Nutrition Information and Weight Loss Behaviours

Weight loss attempts are common among Canadian youth, and such attempts are associated with poor body image, risks of developing eating pathologies, and poor mental health (3). Previous research has identified numerous predictors of engagement in weight loss behaviours, such as BMI (10,15), gender (10,11,24), age (2,19,20), race/ethnicity (21,22,25), socioeconomic status (23), body image (15), and health literacy (27). However, most of these variables focus on individual characteristics, and little research has focused on other possible environmental variables through which weight loss attempts, and in particular health-compromising behaviours may be discouraged.

Thus, there is need to identify and understand environmental variables that may impact engagement in weight loss behaviours, as well as the nature of such relationships. It has been

evidenced that sources for nutrition, fitness, or weight loss information may impact engagement in weight loss behaviours (5,7,37,38,39).

The current study found that sources for nutrition information are associated with weight loss behaviours when controlling for potential covariates. In particular, a greater number of Health and Weight Loss Specialists ("Health professional", "Health association materials or website", "Alternative health practitioner)", "Fitness program/personal trainer" and "Weight loss program") and Easily Accessible Sources (e.g., "Nutrition facts tables on food products", "Food product labels", "General research on the internet" and "Mobile apps") are associated with an increase in number of Dietary Changes used to lose weight ("Ate less candy, sugar, or sweets"; "Ate more fruit, vegetables, or salads", "Ate fewer carbohydrates", "Ate less fat", "Switched to low calorie foods", "Drank a lot of water").

These findings are in line with past literature; although the categorizations used in the present study have not previously been used, research has considered these sources individually. Food label (part of Easily Accessible Sources) use has been shown to be associated with dietary weight loss behaviours such as switching to lower-calorie foods, consuming more fruits, vegetables or salads, and eating less sugar, candy and sweets (48). Use of the nutrition facts tables (from Easily Accessible Sources) has been associated with higher fruit and vegetable consumption and lower fat intakes (118); consultation with doctors (from Health and Weight Loss specialists) for weight loss is associated with increased dietary changes (e.g., choosing lower calorie foods, smaller portion sizes) (55,56,57) and use of weight loss programs (from Health and Weight Loss Specialists) such as Weight Watchers promotes the use of dietary programs such as low-carbohydrate diets, low-fat diets, and low-calorie diets (75). However, the internet (from Easily Accessible Sources) has been found to be associated with use of diuretics

and diet pills when used for weight loss information by 16-24-year-old American women (7). The internet is also associated with exercising among this sample; however, the healthfulness of this exercising is unknown (7).

A greater number of Health and Weight Loss Specialists consulted is also associated with more Non-Prescribed Supplements and Formulas ("Did a cleanse or detox diet", "Took other pills, medicines, herbs or supplements not needing a prescription", and "Used a liquid diet formula such as Slimfast or Optifast") used for weight loss. This finding is in line with past literature that found that consultation with alternative health practitioners (Health and Weight Loss Specialists) is associated with use of complimentary or alternative medical treatments (aromatherapy, thigh creams and acupuncture (60), nutritional supplements, and herbal supplements) (59). However, most research has found that the use of such professionals is associated with dietary changes (55,56,57,75), as was discussed above. However, the fact that this source (from Health and Weight Loss Specialists) is associated with a weight loss behaviour pattern that is considered by the literature as more health -promoting (e.g. Dietary Changes) as well as less healthful (e.g. Non-Prescribed Supplements and Formulas) suggests that the healthfulness of these behaviours may be dose dependent, Dietary Changes may be being used restrictively which may be less healthful. Past literature has identified that there are different types of dieting (defined as dietary restraint) that can impact the health implications of the behaviours. As mentioned in Section 7.1, engagement in rigid dieting was found to be associated with eating disorder symptoms, while more flexible dieting was not as strongly associated (116). Therefore, it is possible that Dietary Changes may be being used restrictively, which may be less healthful. It is also possible that some of the sources within this factor may be relied on more heavily than others. For example, since alternative health practitioners promote use of theses

supplements or formulas, this source may be more heavily relied on compared to others within this grouping, among those who are using Non-Prescribed Supplements and Formulas.

Another source which was associated with Non-Prescribed Supplements and Formulas are Commercial Sources (e.g., "Food company materials, advertisements, websites, etc.", "Grocery store or pharmacy", "Magazines, newspapers or books", "TV or radio", "Social media or blogs", and "Celebrities"). This finding demonstrates the implications of relying on commercial sources such as magazines, celebrities or social media for advice on weight loss, nutrition, or fitness. The study demonstrates that reliance on such sources is associated with the use of Non-Prescribed supplements or Formulas (many of which are unregulated and can potentially be dangerous). As outlined in Chapter 2.2.2, one way that these commercial sources may be influencing the types of weight loss behaviours used is through advertisements via social media, magazines, blogs, television, and celebrities (70,71,87,88). These advertisements promote the use of fad diets (87), and non-prescribed supplements or formulas such as weight loss pills, fat burners, hunger reduction strategies, and fat blockers (81).

Given current controversies regarding targeted advertising from social media platforms such as Facebook (87), this finding suggests that these advertisements can have serious implications for the types of health behaviours used by Canadians. Additionally, since such online sources are a source of misinformation (44), this study also suggests that there are repercussions of this misinformation and that perhaps there is need to intervene into the types of information being shared by these commercial sources as this information can have implications for the health and wellness of young Canadians.

A greater number of Government and Health Association Materials ("Health association materials or website", "Government/health agency materials, websites, etc.", "Food company materials, advertisements, websites, etc." and "Canada's Food Guide") was a protective factor against the use of Non-Prescribed Supplements and Formulas as it was related to use of fewer of these behaviours. To the authors knowledge, the use of such sources and associations with health behaviours has not previously been studied, and this finding suggests that the use of these more credible sources is associated with fewer less healthful behaviours.

Overall, the present study found that use of Health and Weight Loss Specialists ("Health professional", "Health association materials or website", "Alternative health practitioner"), and Commercial Sources ("Food company materials, advertisements, websites, etc.", "Grocery store or pharmacy", "Magazines, newspapers or books", "TV or radio", "Social media or blogs", and "Celebrities"), are associated with the use of Non-Prescribed Supplements and Formulas for weight loss. Government and Health Association Materials ("Health association materials or website", "Government/health agency materials, websites, etc.", "Food company materials, advertisements, websites, etc." and "Canada's Food Guide") was associated with fewer Non-Prescribed Supplements and Formulas. Health and Weight Loss Specialists and Easily Accessible Sources (e.g., "Nutrition facts tables on food products", "Food product labels", "General research on the internet" and "Mobile apps") are associated with greater use of Dietary Changes for weight loss.

7.4 Limitations

The present study is not without limitations. Firstly, the participants were recruited from five major Canadian cities (Montreal, Toronto, Edmonton, Vancouver, and Halifax) and thus, the results may not be representative of youth from those living in smaller cities and in rural areas. As well, the present sample reports higher education levels and had more current students than national estimates from the 2014 Canadian Community Health Survey and the 2013 Canadian Tobacco, Alcohol, and Drugs Survey, which may skew results towards more highly educated persons (93). Secondly, both questions of interest (sources for nutrition information and weight loss behaviours) were presented with a list of response options; individuals indicated all responses that applied to them. It is possible that the ordering of such questions led to individuals selecting more of these options than they would have if they had to freely recall (119). As well, there may have been sources for nutrition information or weight loss behaviurs that we did not consider. The participants may have been subject to survey fatigue due to the long length of the CFS, including the long lists of possible weight loss behaviours and sources for nutrition information (119). Also, the question used to evaluate where information was gathered did not ask about weight loss information in particular and it is possible that different sources are used for nutrition information and weight loss behaviours.

A limitation with regards to the factor analysis includes the naming of factors, since these names were given by the author; these may not reflect the underlying commonalities among variables in each factor (120). Since the study is cross-sectional in nature, a causal relationship cannot be inferred and thus the present research identifies an association among the variables of interest. Since separate multiple logistic regression models were used to identify associations

between multiple independent variables and the dependent variable of interest, the models cannot be compared.

7.5 Implications for Future Research

The present study has several implications for future research. First of all, the current research demonstrates the complexity of weight loss behaviours and suggests that categorizing such behaviours in a dichotomous way (healthy vs. unhealthy) is overly simplistic. Future research should consider weight loss behaviours holistically as this may affect results of studies examining weight loss behaviours and potential covariates. Future research could replicate factor analysis of weight loss behaviours in another sample to examine if these patterns are consistent among other samples. To further investigate the co-occurrence of healthful and less healthful behaviors, future research could examine the doses of these behaviours to identify if different levels of dosing affects how the behaviours cluster. For example, past research has found that exercising can be health-compromising if used compulsively and is associated with disordered eating behaviours (31). Therefore, identifying whether higher doses are associated with more disordered behaviours vs lower doses could provide further insight into the complexity of these behaviours.

As well, this is the first time to the author's knowledge that empirical analyses have been used to identify patterns of sources used for nutrition information. The findings demonstrate that multiple sources are consulted and that sources that are typically considered credible are used along with sources considered to be less credible. Future research can replicate factor analysis to verify for consistency among use of sources in other samples.

The present study demonstrates that sources for nutrition information are associated with weight loss behaviours. Future research can employ a longitudinal methodology to examine

whether there is a temporal link between sources of information used and engagement in different health behaviours.

7.6 Implications for Public Health Policy and Practice

The socio-ecological framework can be used to understand the complexity of intervening in public health issues, and states that an individual's behaviour is reciprocally influenced by multiple factors: intrapersonal (e.g., education), interpersonal (e.g., peer and family relations), community (e.g., social and physical environment), and societal levels (e.g., public health policies) (121,122).

There are numerous variables that may influence an individual's chosen weight loss approach (health literacy, gender, age, socioeconomic status, body image, etc.), and much of weight loss literature has focused on these individual level variables (intrapersonal level) in order to prevent engagement in weight loss behaviours or eating disorders. Such interventions may target self-esteem, body image, or unrealistic body ideals (123). However, there are other levels through which dieting behaviours and especially health-compromising behaviours can be prevented.

Lessons drawn from smoking prevention programs have shown that societal level changes, such as taxation of tobacco products and sanctions on advertising of such products, can impact individual behaviour change (124). The present study has identified another level (societal) through which public health can prevent the development of eating disorders and use of potentially health-compromising weight loss behaviours (e.g., Non-prescribed Supplements and Formulas) among Canadian youth. Preventive measures targeted at the societal level can take the form of government sanctions on commercial health information and advertising, or improved monitoring of health information. Given the evidence of effective multi-level

interventions for smoking prevention (122,124), the present study proposes that another area of prevention is at the societal level.

Chapter 8- Conclusion

Weight loss attempts are common, the present study found that over half of young Canadians aged 16-30 years had attempted weight loss in the previous year. Weight loss attempts are associated with poor mental health and development of eating disorders, and there is need to identify environmental factors which may influence engagement in such behaviours. Currently, weight loss methods are considered healthy or unhealthy, with no consideration of the use of multiple of these behaviours, as the health-promoting or -compromising potential of these behaviours may be dose dependent. The current study used factor analysis to propose an alternative way of conceptualizing such behaviour which goes beyond the healthy vs. unhealthy dichotomy. Four patterns of weight loss behaviours were identified: Dietary Changes, Non-Prescribed Supplements or Formulas, Purging and Restrictive Behaviours, and Health-Promoting Behaviours. Research has suggested that information sources may be an environmental variable that impact the weight loss methods used. Such sources were categorized based on factor analysis and found four sources: Government and Health Association Materials, Health and Weight Loss Specialists, Commercial Sources, and Easily Accessible Sources. Poisson regression analyses found that weight loss behaviours were associated with sources for nutrition information, independent of potential confounders. The present findings suggest that weight loss behaviours need to be considered holistically, and that information sources may be an environmental factor which public health can target to prevent engagement in health-compromising weight loss behaviours.

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Appendices

Appendix A- Supplementary tables and figures

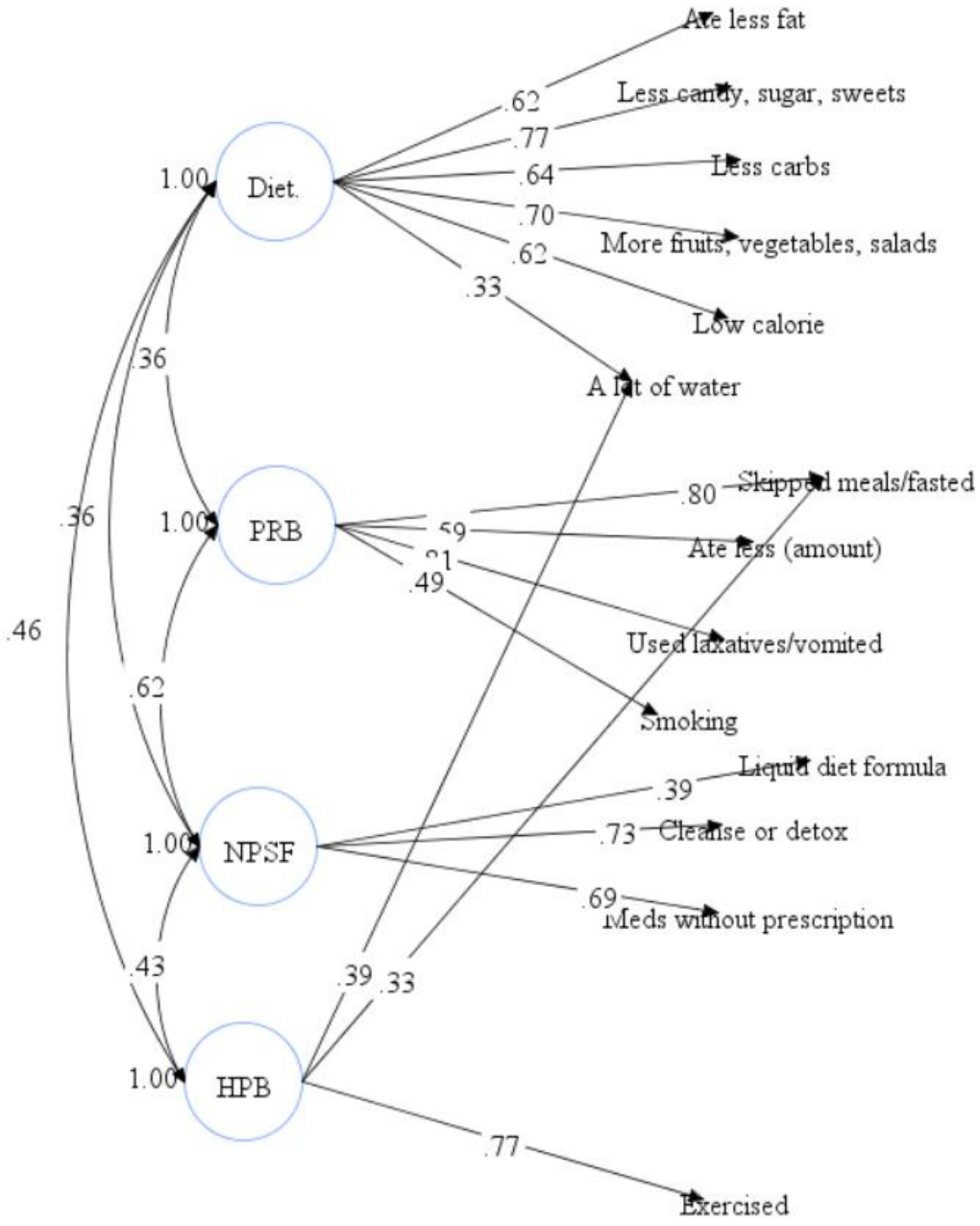
Table 16. *Factorability table of weight loss behaviour responses demonstrating correlations among response categories*

	Sk	Am	ft	cdy	crb	frt	low	di	liq	det	ex	wa	pr	rx	op	lax
Am	***0.48***															
ft	0.111	0.12														
cdy	0.02	0.23	***0.51***													
crb	0.09	0.19	***0.44***	***0.54***												
frt	0.03	0.17	***0.40***	***0.55***	***0.41***											
low	0.18	***0.30***	***0.44***	***0.38***	***0.37***	***0.40***										
di	0.12	-.08	0.00	0.10	0.29	0.18	0.09									
liq	0.28	0.12	-0.01	0.07	0.07	0.02	0.20	0.19								
det	0.26	0.06	0.17	0.13	0.14	0.29	0.22	0.17	***0.33***							
ex	-0.22	-0.04	0.08	0.25	0.20	***0.35***	0.28	0.12	-0.02	***0.32***						
wa	-0.03	0.14	0.21	***0.42***	0.26	***0.42***	***0.31***	0.01	0.02	0.26	***0.42***					
pr	0.02	0.14	0.27	0.13	0.24	***0.34***	***0.34***	0.15	0.21	0.35	0.15	0.26				
rx	***0.33***	0.04	-0.05	0.08	0.24	-0.11	0.01	0.27	0.14	0.06	0.19	0.09	0.11			
op	0.20	0.16	0.08	0.20	0.11	0.18	0.18	0.26	***0.36***	***0.47***	0.13	0.27	0.19	0.09		
lax	***0.59***	***0.46***	0.06	0.09	0.11	0.14	0.17	-0.05	-0.04	***0.43***	0.06	0.12	***0.30***	***0.45***	***0.52***	
smk	***0.37***	0.10	0.11	-0.01	0.06	0.01	0.03	-0.22	0.21	***0.31***	0.13	0.08	0.10	0.08	***0.32***	***0.56***

Table 17. *Factorability table of sources of nutrition information responses demonstrating correlations among response categories*

	HPr	As	CFG	Gov	NFT	Lab	APr	Fit	Prog	Soc	Com	Str	Mag	TV	Net	Smed	Cel
As	***0.49***																
CFG	0.29	***0.45***															
Gov	0.26	***0.42***	***0.55***														
NFT	0.17	***0.36***	***0.44***	***0.52***													
Lab	0.14	0.29	0.28	0.25	***0.68***												
APr	***0.49***	***0.41***	0.15	0.08	0.24	0.25											
Fit	***0.39***	0.22	0.16	0.22	0.17	0.08	***0.34***										
Prog	***0.34***	0.26	0.29	***0.30***	0.08	0.08	***0.38***	***0.47***									
Soc	0.22	***0.30***	0.22	0.26	***0.32***	***0.30***	0.27	0.20	0.10								
Com	0.16	***0.40***	***0.33***	***0.50***	***0.47***	***0.43***	0.27	0.20	0.29	0.27							
Str	0.12	0.21	***0.33***	***0.35***	***0.33***	***0.43***	0.20	0.17	0.16	***0.32***	***0.43***						
Mag	0.17	0.27	0.23	***0.38***	***0.31***	***0.32***	0.20	0.05	0.18	0.25	***0.41***	***0.51***					
TV	0.13	0.25	0.16	0.15	0.18	0.29	0.06	-0.01	0.08	***0.32***	***0.32***	***0.51***	***0.61***				
Net	0.15	***0.33***	0.11	0.28	***0.53***	***0.49***	***0.30***	0.13	-0.09	0.29	***0.35***	0.27	***0.40***	0.18			
Smed	0.10	0.28	0.11	***0.34***	***0.34***	0.27	0.18	0.17	0.16	***0.42***	***0.46***	***0.34***	***0.49***	***0.45***	***0.39***		
Cel	0.23	0.11	0.25	0.26	0.22	0.23	***0.31***	0.17	***0.36***	0.21	0.28	***0.31***	***0.54***	***0.40***	0.15	***0.60***	
App	0.13	0.14	0.04	0.10	0.27	***0.38***	0.09	0.08	0.13	0.08	0.14	0.19	0.19	0.06	0.27	0.17	0.18

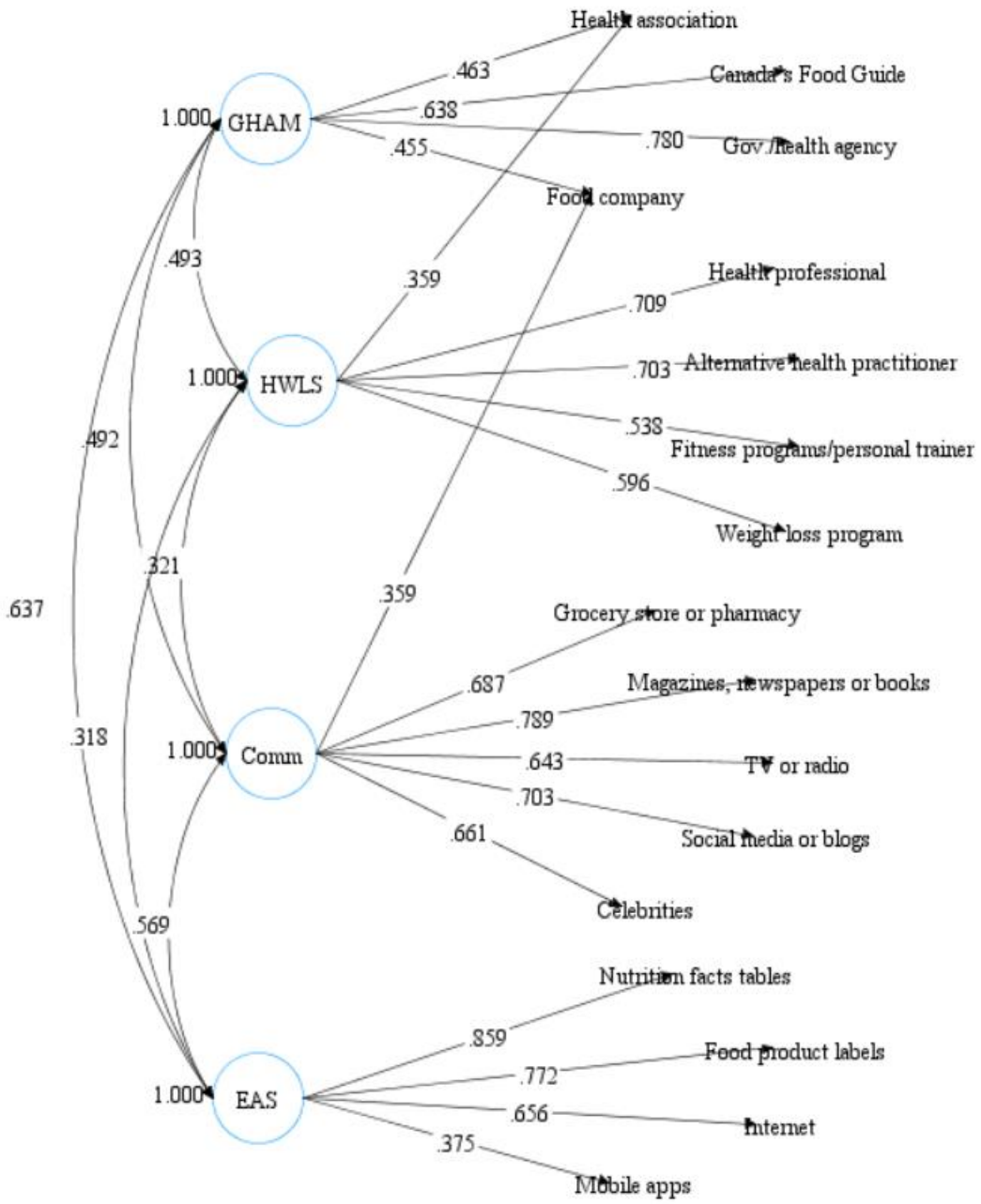
Figure 22. *Structural model of weight loss behaviour factors*



**Purging and Restrictive Behaviours (PRB); Dietary Changes (Diet.); Non-Prescribed Supplements or Formulas (NPSF); Health-Promoting Behaviours (HPB)*

***All displayed associations significant at <0.001 level*

Figure 23. *Structural model of sources of information factors*



**Government and Health Association Materials (GHAM); Health and Weight Loss Specialists (HWLS); Commercial Sources (Comm.); Easily Accessible Sources (EAS)*

***All displayed ssociations significant at <0.001 level*

Table 18. *Zero-inflated Poisson regression for Purging and Restrictive Behaviours*

Parameter	Regression coefficient (95% CI)	P-value
Government and Health Association Materials	0.0335 (-0.3151, 0.3821)	0.8506
Health and weight loss specialists	0.1210 (-0.2534, 0.4954)	0.5263
Commercial sources	**0.3326 (0.0539, 0.6113) ***	0.0193
Accessible sources	0.1780 (-0.0156, 0.3715)	0.0715

**p-value of <0.05, **p-value of <0.001*

Table 19. *Zero-inflated Poisson regression for Purging and Restrictive Behaviours with covariates*

Parameter		Regression coefficient (95% CI)	P-value
Government and Health Association Materials		0.0727 (-0.2809, 0.4264)	0.6868
Health and weight loss specialists		0.0546 (-0.3301, 0.4393)	0.7808
Commercial sources		0.2675 (-0.017, 0.552)	0.0653
Accessible sources		0.1803 (-0.0265, 0.387)	0.0874
Body Image	Don't know/ Refuse to answer	0.2382 (-0.6857, 1.1621)	0.6134
	Mostly dissatisfied	**0.3773 (0.0702, 0.6845) ***	0.0161
	Slightly dissatisfied	0.1514 (-0.1381, 0.4408)	0.3054
	Neither dissatisfied nor satisfied(Ref)	0	.
	Slightly satisfied	0.0338 (-0.2553, 0.3229)	0.8187
	Mostly satisfied	-0.2327 (-0.5395, 0.074)	0.137
Income Adequacy	Don't know/ Refuse to answer	0.1562 (-0.0402, 0.3526)	0.119
	Very Difficult	**0.234 (0.0306, 0.4374) ***	0.0241

	Difficult	0.115 (-0.037, 0.2669)	0.1381
	Neither easy nor difficult(Ref)	0	.
	Easy	0.0221 (-0.1318, 0.1759)	0.7786
	Very Easy	0.0669 (-0.122, 0.2558)	0.4873
Age		**-0.0146 (-0.0274, -0.0017) ***	0.0264
Gender	Don't know/ Refuse to answer	-0.6219 (-1.8551, 0.6113)	0.3229
	Man	-0.0984 (-0.2138, 0.0171)	0.095
	Other	0.215 (-0.2007, 0.6306)	0.3107
	Woman(Ref)	0	.
Race	Aboriginal inclusive (includes mixed)	-0.0378 (-0.3044, 0.2289)	0.7813
	Black only	-0.0622 (-0.3094, 0.1851)	0.6222
	Chinese only	-0.0101 (-0.2133, 0.1932)	0.9227
	Mixed/Other/Not Stated/Missing (excludes Aboriginal)	-0.0858 (-0.2186, 0.0469)	0.2052
	South Asian only	**-0.3025 (-0.5363, -0.0688) ***	0.0112
	White only(Ref)	0	.
BMI/ weight status	Missing	0.023 (-0.1564, 0.2024)	0.8018
	Obese	-0.0569 (-0.232, 0.1181)	0.5238
	Overweight	0.0706 (-0.0629, 0.204)	0.3001
	Underweight	**0.3384 (0.0273, 0.6495) ***	0.033
	Normal Range(Ref)	0	.
Health Literacy	Don't know/ Refuse to answer	-0.1894 (-0.5308, 0.1519)	0.2768

	High likelihood of limited health literacy	0.084 (-0.0897, 0.2578)	0.3432
	Possibility of limited health literacy	0.1059 (-0.0345, 0.2464)	0.1393
	Adequate health literacy(Ref)	0	.

**p-value of <0.05, **p-value of <0.001*

Table 20. *Zero-inflated Poisson regression for Non-Prescribed Supplements or Formulas*

Parameter	Regression coefficient (95% CI)	P-value
Government and Health Association Materials	-0.7167 (-1.5604, 0.1270)	0.0959
Health and weight loss specialists	**1.7523 (0.9290, 2.5756) ****	<.0001
Commercial sources	**1.0291 (0.3888, 1.6694) ***	0.0016
Accessible sources	-0.1435 (-0.6510, 0.3641)	0.5796

**p-value of <0.05, **p-value of <0.001*

Table 21. *Zero-inflated Poisson regression for Non-Prescribed Supplements or Formulas with covariates*

Parameter		Regression coefficients (95% CI)	P-value
Government and Health Association Materials		**-0.9119 (-1.7719, -0.0519) ***	0.0377
Health and weight loss specialists		**1.9779 (1.1381, 2.8178) ****	<.0001
Commercial sources		**0.9668 (0.3161, 1.6175) ***	0.0036
Accessible sources		-0.0543 (-0.5828, 0.4742)	0.8405
Body Image	Don't know/ Refuse to answer	-0.3383 (-3.025, 2.3484)	0.8051
	Mostly dissatisfied	0.0616 (-0.6833, 0.8065)	0.8713
	Slightly dissatisfied	0.0128 (-0.6848, 0.7105)	0.9712

	Neither dissatisfied nor satisfied(Ref)	0	.
	Slightly satisfied	-0.0853 (-0.7777, 0.6071)	0.8093
	Mostly satisfied	-0.0982 (-0.8244, 0.628)	0.791
Income Adequacy	Don't know/ Refuse to answer	**-0.6417 (-1.1814, -0.102) ***	0.0198
	Very Difficult	0.1013 (-0.3702, 0.5729)	0.6736
	Difficult	-0.3114 (-0.6945, 0.0717)	0.1111
	Neither easy nor difficult(Ref)	0	.
	Easy	**-0.4453 (-0.8506, -0.0399) ***	0.0313
	Very Easy	-0.141 (-0.6109, 0.329)	0.5566
Age		**-0.034 (-0.0666, -0.0014)***	0.0409
Gender	Don't know/ Refuse to answer	0.6691 (-1.167, 2.5052)	0.4751
	Man	**-0.5384 (-0.847, -0.2298) ***	0.0006
	Other	0.7037 (-0.1183, 1.5257)	0.0934
	Woman(Ref)	0	.
Race	Aboriginal inclusive (includes mixed)	0.2528 (-0.3625, 0.8681)	0.4207
	Black only	**0.5605 (0.0558, 1.0651) ***	0.0295
	Chinese only	0.0022 (-0.5482, 0.5526)	0.9938
	Mixed/Other/Not Stated/Missing (excludes Aboriginal)	0.2776 (-0.0417, 0.5968)	0.0883
	South Asian only	**-0.8674 (-1.6667, -0.0681) ***	0.0334
	White only(Ref)	0	.
BMI/ weight status	Missing	0.1212 (-0.314, 0.5564)	0.5852
	Obese	0.2555 (-0.1702, 0.6812)	0.2394
	Overweight	0.1191 (-0.2226, 0.4609)	0.4944
	Underweight	0.3341 (-0.4151, 1.0833)	0.3821

	Normal Range(Ref)	0	.
Health Literacy	Don't know/ Refuse to answer	0.1363 (-0.6525, 0.9251)	0.7349
	High likelihood of limited health literacy	0.0885 (-0.3431, 0.5201)	0.6877
	Possibility of limited health literacy	0.2272 (-0.1124, 0.5668)	0.1897
	Adequate health literacy (Ref)	0	.

**p-value of <0.05, **p-value of <0.001*

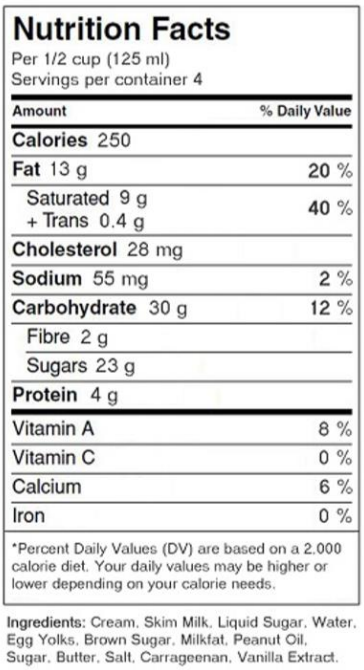
Appendix B- Relevant questions from wave 1 CFS

Weight loss	**During <u>the past 12 months</u>, have you tried to lose weight?** Yes No Don't know Refuse to answer

Weight loss methods	**How did you try to lose weight in the past 12 months?** (Select all that apply) Skipped meals or fasted Ate less food (amount) Ate less fat Ate less candy, sugar or sweets Ate fewer carbohydrates Ate more fruits, vegetables or salads Switched to foods with lower calories Followed a special diet or weight loss program (e.g., Atkins, Weight Watchers.) → Please specify: [open-ended] Used a liquid diet formula such as Slimfast or Optifast Did a cleanse or detox diet Exercised Drank a lot of water Got help from a health professional Took diet pills prescribed by a doctor Took other pills, medicines, herbs, or supplements not needing a prescription

	Took laxatives or vomited Started to smoke or began to smoke again Other → Please specify: [open-ended] None of the above Don't know Refuse to answer
Sources of nutrition information	**In the past 12 months, did you get information on food or nutrition from any of the following sources?** (Select all that apply) Health professional (e.g., family doctor, nurse, or dietician) Alternative health practitioner (e.g., chiropractor, naturopath, homeopath, holistic nutritionist) Health association materials or website (e.g., Heart & Stroke, Cancer Society, Dietitians of Canada) Fitness programs / personal trainer Weight loss programs (such as Weight Watchers) Your family, friends, or colleagues Canada's Food Guide Government / health agency materials, websites or apps Food company materials, advertisements, websites or apps Nutrition Facts Tables on food products Food product labels Grocery store or pharmacy Magazines, newspapers or books TV or radio General research on the internet Social media or blogs (e.g., Facebook, Twitter)

	Celebrities (e.g., Gwyneth Paltrow, Food Babe) Mobile app →Which app? [open-ended] Other → Please specify: [open-ended] None of the above Don't know Refuse to answer
Body image	**Right now I feel . . .** **Extremely satisfied** with my body size and shape **Mostly satisfied** with my body size and shape **Moderately satisfied** with my body size and shape **Slightly satisfied** with my body size and shape **Neither dissatisfied nor satisfied** with my body size and shape **Slightly dissatisfied** with my body size and shape **Moderately dissatisfied** with my body size and shape **Mostly dissatisfied** with my body size and shape **Extremely dissatisfied** with my body size and shape Don't know Refuse to answer
Health Literacy Newest Vital Sign	This information is on the back of a container of a pint of ice cream.



Nutrition Facts

Per 1/2 cup (125 ml)
Servings per container 4

Amount	% Daily Value
Calories 250	
Fat 13 g	20 %
Saturated 9 g + Trans 0.4 g	40 %
Cholesterol 28 mg	
Sodium 55 mg	2 %
Carbohydrate 30 g	12 %
Fibre 2 g	
Sugars 23 g	
Protein 4 g	
Vitamin A	8 %
Vitamin C	0 %
Calcium	6 %
Iron	0 %

*Percent Daily Values (DV) are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Ingredients: Cream, Skim Milk, Liquid Sugar, Water, Egg Yolks, Brown Sugar, Milkfat, Peanut Oil, Sugar, Butter, Salt, Carrageenan, Vanilla Extract.

1. **If you eat the entire container, how many calories will you eat?**

   Enter number of calories: [open-ended]

   Don't know

   Refuse to answer

2. **If you are allowed to eat 60 grams of carbohydrates as a snack, how much ice cream could you have?**

   Enter number of cup(s): [open-ended]

   Don't know

   Refuse to answer

3. **Your doctor advises you to reduce the amount of saturated fat in your diet. You usually have 42 g of saturated fat each day, which includes one serving of ice cream. If you stop eating ice cream, how many grams of saturated fat would you be consuming each day?**

   Enter number of grams: [open-ended]

   Don't know

	Refuse to answer **4. If you usually eat 2,500 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving?** Enter percentage: [numeric percentage, 0 to 100%] Don't know Refuse to answer **5. Pretend that you are allergic to the following substances: penicillin, peanuts, la tex gloves, and bee stings. Is it safe for you to eat this ice cream?** Yes No Don't know Refuse to answer [If "no", ask:] **Why not?** Enter reason: [open-ended] Don't know Refuse to answer
Self reported height	It is helpful to know the height and weight of survey participants. **How tall are you without shoes?** Would you rather answer in: Feet and inches Centimetres Don't know Refuse to answer [PROGRAMMER: show based on response to above] Enter number: _____ feet [numeric, 3-7] AND Enter number: _____ inches [numeric, 0-12]

	OR Enter number: _____ cm [numeric, 100-250]
Self reported weight	How much do you weigh without clothes or shoes? Would you rather answer in: Pounds (lb) Kilograms (kg) Don't know Refuse to answer Enter number: _____ [kg/lb] [PROGRAMMER: show based on response to above]
Perceived income adequacy	**Thinking about your total monthly income, how difficult or easy is it for you to make e nds meet?** Very difficult Difficult Neither easy nor difficult Easy Very easy Don't know Refuse to answer
Ethnicity	**People living in Canada come from many different cultural and racial backgrounds. A re you… (Select all that apply)** White Chinese South Asian (e.g., East Indian, Pakistani, Sri Lankan) Black Filipino Latin American Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese)

	Arab West Asian (e.g., Afghan, Iranian) Japanese Korean Other → Please specify: [open-ended] Don't know Refuse to answer
Age	**How old are you?** [numeric]
Gender	**What is your current gender identity?** Man Woman Trans male/trans man Trans female/trans woman Gender queer/gender non-conforming Different identity → Please specify: [open-ended] Don't know Refuse to answer