

Mount Saint Vincent University
Department of Applied Human Nutrition

University Students' Eating Behaviours: Implications for the Social Cognitive Theory

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Applied Human Nutrition

2016

Halifax, Nova Scotia

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Abstract

University students have long been known to have poor dietary habits, consuming a diet low in vegetables and fruit, but high in high fat and snack foods. Theoretically based dietary interventions can be effective in altering these behaviours, however theories such as the Social Cognitive Theory (SCT) are often deemed as too broad to be applied to a specific population, requiring testing and refinement. As such, this thesis used a conceptual model of the SCT to assess the effectiveness of social-cognitive constructs in explaining the dietary outcomes of a sample of university students. This quantitative research utilized secondary data from the Student Meal Study, in which 188 university students were surveyed on their eating habits, out of which social cognitive constructs were developed, and their dietary intake, as per Canada's food guide. Eight hypotheses were tested by inserting the social-cognitive constructs into a conceptual model of the SCT, and analyzing the model using Partial Least Squares regression per each food group of interest. The following relationships, pertaining to social-cognitive constructs leading to a dietary outcome of interest, were found to be statistically significant at the 0.05 level of significance: i) Self-Efficacy leading to an increased intake of Fruits and Vegetables; Grains; Meat and Alternatives; Milk and Alternatives; and Foods to Limit; ii) Situation leading to an increased intake of Fruits and Vegetables; Grains; Meat and Alternatives; Milk and Alternatives; and Foods to Limit and; iii) Behavioural Strategies leading to an increased intake of Fruits and Vegetables and; Grains. Regarding constructs that do not lead to dietary outcomes, the following relationships were found to be statistically significant: i) Self-Efficacy leading to increased Behavioural Strategies; ii) Self-Efficacy as leading to Outcome Expectancies and; iii) Situation as leading to increased Self-Efficacy. The thesis resulted in a refined conceptual model of the SCT specific to the target population, and supports the appropriateness of using the SCT as a

framework for developing dietary interventions for university students. Practical implications focus on the development of nutrition interventions as guided by the SCT that simultaneously focus on enhancing students' self-efficacy for healthy eating as pertaining to all food groups, while increasing their access to healthy food and decreasing availability of foods to limit, and enhancing their behavioral skills for preparing certain foods, specifically vegetables and fruits and grain products.

Acknowledgements

I firstly wish to thank my Thesis Co-Supervisors, Linda Mann and Dr. Karen Blotnicky, for bringing me on board with their research. Linda, thank you for always being calm and collected, helping me wade my way through the theory (and so much more) of my research! Karen, thank you for making a fledgling statistician out of me! Thank you both for always being so encouraging; it was an honour and a pleasure to work with you.

Another thanks to my committee member, Dr. Misty Rossiter. Thank you for agreeing to work with me, and for all of your helpful comments, ideas, and encouragements along the way! I hope one day we will have the pleasure of meeting in person.

I would like to thank my fellow graduate student, Kathleen, for listening to me ramble and rant throughout this process; we're in this together!

A huge thank you to my family; Mum, Dad, Gran & Jase, thanks for always supporting me, in more ways than one! It means everything knowing that you all believe in me, motivating me to be the best version of myself. A special shout-out to my Mum for listening to my (long) defense presentation on repeat!

Lastly, thank you to my boyfriend, Jason, for always being there for me. You have been so encouraging and reassuring throughout this entire process, always offering to proof-read papers and listen to practice presentations.

You are all highly appreciated and valued – thank you!

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Chapter 1: Introduction

Numerous studies have reported on the unhealthy lifestyle behaviours of university students (Brunt & Rhee, 2008; Ha & Caine-Bish, 2009; Morse & Driskell, 2009). Unhealthy dietary behaviours in this population include low intakes of vegetables and fruit and excessive intakes of high-fat foods. Such behaviours have potentially negative short-term consequences, such as weight gain, reduced immunity, and long-term consequences, such as an increased risk of chronic disease. These consequences indicate the need for effective lifestyle interventions tailored to university students. In order to design such interventions, an inclusive understanding of the mechanisms of behaviour and thus behaviour change among university students is required (Dewar, Lubans, Plotnikoff & Morgan, 2012).

Health behaviour theories aid in systematically explaining the relationships/mechanisms between variables influencing behaviour. Furthermore, it has been reported that theory-based interventions are “more effective in altering risk factors than are atheoretical applications” (Langlois & Hallam, 2010). The Social Cognitive Theory (SCT) is a health behaviour theory that has been used to offer insight into a variety of health-related issues, including dietary behaviours (Glanz, Rimer & Viswanath, 2008). In an overview of theoretical frameworks, the National Cancer Institute (2010) highlighted that the SCT posits a dynamic and reciprocal process in which personal, environmental and behavioural factors exert influence upon each other, and explains behavior. As stated in the overview of theoretical frameworks, the SCT is a very broad theory, and because of this, its validity has not been tested as comprehensively as have other theories (National Cancer Institute, 2012). Thus, different concepts and principles of the SCT should be measured and manipulated over diverse populations, contributing to the refinement and subsequent usefulness of the theory in guiding interventions. As such, the purpose of the current study is to assess the effectiveness

of social cognitive measures in explaining the dietary behaviours of a sample of university students.

Chapter 2: Literature Review

Consequences of Poor Eating Habits

Short term effects. Research into all aspects of the health behaviours of university students is vital, due to the plethora of negative consequences that arise from the unhealthy eating of this population. Practicing optimal dietary behaviours is a major contributor to good overall health, as dietary factors are associated with five of the ten leading causes of death in the USA (Brunt & Rhee, 2008). Despite this, it has been repeatedly reported that college students “typically consume a diet lacking in fruits, vegetables, and dairy products, and high in fat, sodium and sugar” (Brunt, Rhee & Zong, 2008). In terms of the negative short term consequences of such behaviour, few studies exist on the topic of nutrition and academic performance amongst university students. However, many studies have been conducted on nutrition and dietary behaviours and the academic performance of young children (Trochel, Barnes & Egget, 2000). Taras (2005) conducted a review on this topic, specifically focusing on performance in school and on tests of cognitive functioning of school-aged children. The author reported that academic performance might be improved following breakfast consumption versus fasting. Furthermore, within undernourished populations, consumption of a healthy breakfast effectively improved children’s academic performance and cognitive functioning (Taras, 2005). While the majority of the studies within the review included children no older than age 12, a positive correlation was found between proper nutrition and student’s ability to learn was supported.

As previously stated, very few studies focus on academic performance of university students and dietary behaviours. One such study was conducted in 1992 by Benton and Sargent, and found that breakfast consumption by university students resulted in improved immediate recall and spatial memory. While this study was conducted many years ago, its evidence when combined with the findings from studies focusing on younger children further

supports the benefit of proper nutrition in relation to academic performance. Thus, it can be stated that a negative short-term effect of poor dietary habits of university students is the subsequent increase in likelihood of poor academic outcomes. This is neither in the best interest of the students nor the university, and may be viewed as an inefficient use of resources and tuition money. Furthermore, poor nutrition may also contribute to poor academic outcomes through increasing the likelihood of illness within the student population. The link between poor nutritional intake, decreased immunity and increased risk for non-communicable disease is well established, (Gibney, Lanham-New, Cassidy & Vorster, 2009; Edelstein & Sharlin, 2009). For example, a diet deficient in Vitamin A may increase risk for illness/disease as Vitamin A plays a vital role in cell mediated immunity, and a deficiency in this vitamin impairs immunity by hindering the regeneration of damaged epithelial barriers (Wintergerst, Maggini & Hornig, 2007). Therefore, it can be postulated that poor dietary intake contributes to micronutrient deficiencies, increasing students' chance of illness, which in turn may lead to a decrease in academic productivity. Overall, it can be seen that as a consequence of poor dietary behaviours university students may not be making the most of their post-secondary education opportunities.

Long term effects. Poor nutrition habits of university students also have the ability to result in long-term negative health consequences, namely chronic disease. Chronic diseases, including cardiovascular disease, type 2 diabetes, metabolic syndrome, and cancer, are the leading causes of death in the Western world (Roberts & Barnard, 2005). A “rich diet” has been reported as a main cause of obesity and cardiovascular disease, and includes a greater proportion of high calorie foods to essential nutrients, referring to high fat animal products, dairy products, processed meat, junk food and foods with a high proportion of refined sugars (Mirolla, 2004). If such “rich” or unhealthy diets are consumed by university students during their time at university, which for many is a critical time in the formation of life long health

behaviours (Brunt & Rhee, 2008), chronic disease prevalence will likely only increase. Not only will this mean a continuation of chronic disease as a leading cause of death within North America, but it may also mean a continuation of the economic burden of chronic disease. Chronic disease puts a huge drain on the budget of Canada's national health insurance program, and is responsible for 67% of total direct costs and 60% of total indirect costs of the healthcare system (Public Health Agency of Canada, 2005). It is estimated that chronic disease costs the healthcare system over \$90 billion per year in treatment and lost productivity (Mirolla, 2004.).

It can thus be seen that poor diet is a major contributor to chronic disease, specifically obesity, which in turn is a significant risk factor for heart disease, hypertension, and a wide range of other chronic diseases (Mirolla, 2004). Targeting university students in attempts to understand and explain their dietary habits, and subsequently intervene on them, is of particular importance for tackling the chronic disease epidemic in North America. This is largely due to the unique life stage being experienced by the majority of university students, known as emerging adulthood. This life stage typically includes individuals aged 18-25 years, and can be defined as "a unique developmental period when young people's independence and autonomy are increasing" (Laska, Pasch, Lust, Store & Ehlinger, 2009). Within Canada, as of 2007, approximately 70% of all university students and 69% of all college students fell within this life stage (Statistics Canada, 2010). Particularly of significance is that during this time period is when most individuals undergo the psychological process of developing a stable and viable self-identity (Schwartz, Cote & Arnett, 2005). The authors of previous studies have indicated that identity, which includes the incorporation of healthy lifestyle characteristics, is predictive of long lasting health behaviour change (Nelson, Story, Larson, Neumark-Sztainer & Lytle, 2008). Thus, emerging adulthood may be a particularly important

time for intervening on dietary behaviours, working towards the development of healthy dietary habits, which continue throughout individuals' lives.

Eating Behaviours of University Students

The previous sections of this literature review focused on the negative health consequences which may arise from eating unhealthily as a university student. This section will review what those eating habits have reportedly included. Born et al. (2003) assessed the intakes of servings of fruits and vegetables for 736 university students, and reported that 69.4% of the sample consumed less than five servings of vegetables and fruit daily. More recently, the American College Health Association (2009) reported the results from the National College Health Assessment, which were that only 8.5% of students ate five or more servings of fruits and vegetables daily. Similarly, Ha and Caine-Bish (2009) conducted a study including 80 college students, and found that 72% of participants consumed one cup or less of total vegetables daily. Furthermore, when asked specifically about fresh vegetables 90% of students reported consuming less than one cup per day. In further indication of the low fruit and vegetable intake of university students are the results from McLean-Mevinsse, Harris, Taylor and Gager's (2013) study. The study involved 305 college students and the findings were that 50% of participants consumed no fruits and vegetables daily and only 8% consumed fresh fruits and vegetables at least three times daily (McLean-Meyinsse et al., 2013). The results from these studies consistently demonstrate that university students' fruit and vegetable intakes are well below national nutritional recommendations (Health Canada, 2007).

Another dietary behaviour of university students which may be health damaging is that of high fat food and fast food consumption. While not all items sold at fast food restaurants are high in energy, fast-food consumption has been associated with obesity and high-fat foods (Morse & Driskell, 2009). Deusinger, Deusinger, Highstein, Racette and

Strube (2005) studied the changes seen in exercise and dietary habits of first year university students through to their second year of study. The authors stated that more than 50% of participants reported consuming “high-fat fried or fast foods at least three times during the previous week”. Furthermore, a study conducted by Morse and Driskell (2009) found that majority of the 259 university students surveyed reported “typically eating at fast-food restaurants one to three times weekly”.

Another contributor to the poor dietary habits of university students may be the excessive snacking on energy dense but nutrient poor foods (Silliman et al., 2004). Brunt, Rhee and Zhong (2008) examined the dietary and lifestyle practices of 557 college students. The authors found that 95% of the students consumed high-fat sugary and salty snacks, referred to as “discretionary calories”. In another study, conducted by Brunt and Rhee (2008), 95% of the 585 included college students reported consuming two or more “discretionary sweet/fat choices” during the previous three days. Silliman, Rodas-Fortier & Neyman (2004) examined the dietary habits of 471 college students, and found that 63% of students reported snacking one to two times daily. While the majority of the students reported eating chips, crackers or nuts, the results indicated that women snacked specifically on fast foods, ice-cream, candy and cookies more frequently than men did. These studies indicate that university students frequently snacked on calorically dense but nutrient poor foods, contributing to an overall poor diet.

This section of the literature review indicated that university students represent a population whose dietary intake is a cause for concern. Overall, the general consensus in extant literature is that the majority of university and college students do not meet nutritional guidelines. Of specific concern are reports that students tended to under-consume fruits and vegetables, while far exceeding sugar and fat recommendations (Vella-Zarb and Elgar, 2010).

Influences on Eating Behaviours

The authors of previous research have reported that many factors influence the dietary behaviours of university students such as “time limitations, convenience, cost, taste, health, physical and social environments and weight control” (Driskell, Schake & Detter, 2008). The issue of time constraints has been reported on repeatedly in extant literature (Blissmer et al., 2009; Dauner, Krambeer, 2011; Kocos, Lytle, Nelson & Perry, 2009), with the implication being that the student lifestyle inhibited healthy eating. Specifically, Dauner et al. (2011) reported that the “lack of perceived time due to the busy nature of college life” acted as a barrier to a student’s ability to cook healthy meals. This perceived lack of time relates to the previous section of this review discussing the consumption of fast food. More than half of the student participants in Morse and Driskell’s study (2009) reported choosing to eat fast-food due to limited time.

University students’ social environments have also been reported as a significant influence upon dietary intake. Generally, the influence of peers appeared to be negative, with students in Blissmer et al.’s (2009) study reporting that social situations were “associated with overeating and eating unhealthful food”. Furthermore, some participants in Kocos et al.’s (2009) study reported feeling as though there was little alternative to going out and eating fast-food with friends if they wished to be social. This creates cause for concern, as university/college marks a very social time in students’ lives (Born et al., 2003). However, Dauner et al. (2011) stated that some female participants found their peers to be positive influences on their diets. It should be noted that this was only the case when those peers were engaging in healthy eating behaviours themselves (Dauner et al., 2011).

Another major influence on university students’ dietary intakes is that of the physical environment. The physical environment in this context refers to the availability of opportunities for healthy and unhealthy food choices, particularly those on university

campuses. A school or university campus can be classified as a micro-environment, where there is typically “room for direct mutual influence between individuals and the environment” (Brug, 2008). The overarching role of the environment in dietary intake was expressed by Brug (2008) as “environments may make healthier choices easier choices or may even reduce the number of options or possibilities for unhealthy choices”. Regarding the opinions of university students, participants in both Blissmer et al.’s (2009) and Kocos et al.’s (2009) studies reported that healthy eating was difficult due to how easily unhealthy food could be accessed on campus. Similarly, Dauner et al. (2011) reported that a lack of healthy food offerings on campus was identified as a challenge to healthy eating by study participants. Furthermore, participants in these studies stated that the presence of all-you-can-eat cafeterias made healthy eating a challenge. Specifically, Blissmer et al.’s (2009) study participants reported that unlimited meal plans at school contributed to overeating and difficulty in controlling consumption of unhealthy foods. Consistently, participants in the study by Kocos et al. (2009) stated that the all-you-can-eat cafeterias “influenced poor dietary habits and encouraged frequent overconsumption”. These studies thus indicated that unhealthy, easily accessible food on-campus significantly impacts university students’ dietary intakes.

Theory in Nutrition Related Health Promotion

A theory can be defined as presenting “a systematic way of understanding events or situations. It is a set of concepts, definitions and propositions that explain or predict these events or situations by illustrating the relationships between variables” (National Cancer Institute, 2012). In the context of health promotion, and more specifically, nutrition interventions, theories can aid in understanding how the various influences on dietary behaviour relate to each other and to the behaviour itself. Several prominent theories are used to guide the development of nutrition education programs/interventions, helping planners to identify the most appropriate means for fostering change within the target audience (National

Cancer Institute, 2012). The incorporation of a health behaviour theory into nutrition interventions is highly valuable, as Langlois and Hallam (2010) reported that theory-based interventions are “more effective in altering risk factors than are atheoretical applications”. Essentially, understanding why university students eat and behave as they do is critical to changing their behaviours, and theories provide a road map for doing so, as they aid in explaining the relationships between variables influencing behaviour (Langlois & Hallam, 2010). While the focus of this thesis will be on the Social Cognitive Theory, other prominent health behaviour theories should also be examined.

The Health Belief Model. The Health Belief Model (HBM) has been a widely used conceptual framework since the 1950s, utilized by health behaviour researchers to explain change and maintenance of health-related behaviours (Glanz et al., 2008). The HBM posits seven concepts that predict why individuals take action to prevent or control health conditions, and these include:

- 1) Perceived susceptibility: refers to beliefs about one’s likelihood of contracting a disease or health condition.
- 2) Perceived severity: refers to the perceived seriousness of contracting a disease or of leaving it untreated and includes medical and social consequences. Together, perceived severity and perceived susceptibility is referred to as one’s perceived threat.
- 3) Perceived benefits: refers to one’s perception of the possible benefits of taking action to reduce their perceived threat of a disease.
- 4) Perceived barriers: refers to one’s perception of the possible negative aspects of taking action to reduce the threat of a disease, and can be compared to a cost-benefit analysis.

- 5) Self-efficacy: refers to “the conviction that one can successfully execute the behaviour required to produce the outcomes” (Bandura, 1997). This concept is the most recent addition to the constructs of the HBM.
- 6) Cues to action: refers to possible situations or occurrences that may trigger an individual to take action against the threat of a disease.
- 7) Other variables: refers to the demographic, socio-psychological and structural variables that may influence perceptions.

Figure 1 displays the interactions between the constructs of the HMB. It can be seen that the modifying factors, such as knowledge, may influence health perceptions. Individual beliefs consist of the majority of the previously described main constructs (susceptibility, severity, benefits, barriers and self-efficacy). Lastly are the actions, which refer to modifying factors such as cues to action (Glanz et al., 2008).

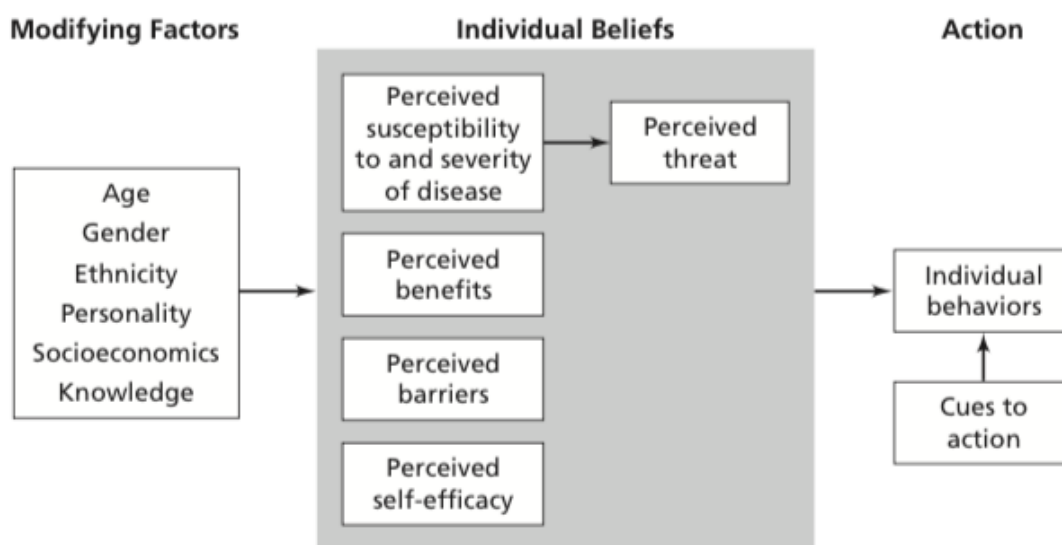


Figure 1. Linkages between the constructs of the Health Belief Model (Glanz et al., 2008).

The Theory of Reasoned Action and Planned Behaviour. The Theory of Reasoned Action (TRA) was developed to aid in the understanding of the relationships between attitude, intentions and behaviours (Glanz et al., 2008). The TRA posits that the most important influences upon behaviour are behavioural intentions. According to the TRA, the

determinants of one's behavioural intention are their "attitude toward performing the behaviour and their subjective norm associated with the behaviour" (Glanz et al., 2008). An individual's attitude is said to be determined by their beliefs about the outcomes of performing the behaviour, impacted by the evaluation of said outcomes. An individual's subjective norm in turn is said to be determined by "whether important referent individuals approve or disapprove of performing the behaviour" influenced by one's desire to comply with said referents.

The Theory of Planned Behaviour (TPB) emerged through the evolution of the TRA, with the main difference being the construct of perceived control over the behaviour in question (Glanz et al., 2008). This construct was included because Ajzen, the developer of the TRA, believed that behavioural performance is determined by both motivation/intention and ability or behavioural control. As seen in Figure 2, the TPB asserts that there is a causal series linking behavioural beliefs, normative belief and control beliefs to behavioural intentions and behaviour, as modified by subjective norms and perceived control (Glanz et al., 2008).

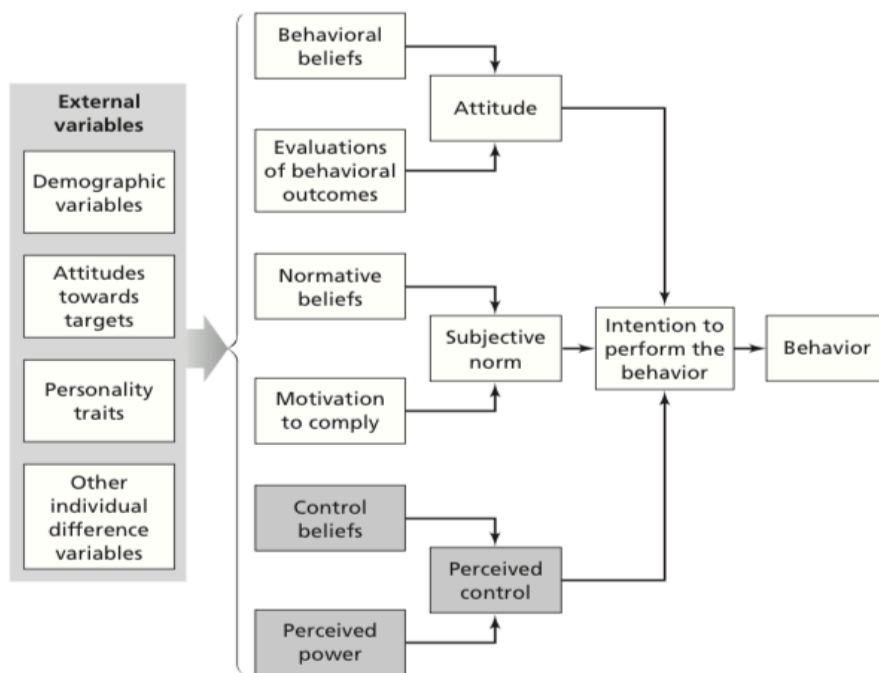


Figure 2. Linkages between the constructs of the Theory of Reasoned Action and Planned Behaviour (Glanz et al., 2008).

The Social Cognitive Theory. The SCT is the focus of this thesis, and postulates that behaviour is influenced by a dynamic interaction, known as reciprocal determinism, that occurs between the overall categories of behavioural, personal and environmental factors (Dewar et al., 2012). The key concept of reciprocal determinism asserts that there is a triadic reciprocal interaction between personal factors, behaviour and environmental influences, rather than “a dyadic conjoint or a dyadic bidirectional one” (Bandura, 1978). The following excerpt by Bandura (1978) illustrates reciprocal determinism in action:

It is largely through their actions that people produce the environmental conditions that affect their behaviour in a reciprocal fashion. The experiences generated by behaviour also partly determine what individuals think, expect and can do, which in turn, affect their subsequent behaviour (p. 345).

Beyond the overarching categories of environmental, cognitive and individual factors, there is no universally accepted list of “correct” social-cognitive constructs as found in extant literature. That being said, the most commonly occurring key constructs of the SCT, as resulting from an extensive literature review include environmental influences, behavioural capabilities, individual knowledge, expectations and expectancies, self-efficacy, observational learning (modeling), self-regulation and reinforcements (National Cancer Institute, 2012; Lytle & Perry, 2008; Bandura, 2004; Lubans et al., 2012).

Situation, or environmental influences, encompass perceptions of physical, social and cultural environments. As such, the environment plays a pivotal role in explaining behaviour, as demonstrated in the SCT. Despite the pivotal role of environment, particularly physical environment, its premise is simple; an individual’s choice of food will be contingent on the availability of food items available in his or her physical environment, including home, university and restaurants offerings (Lytle & Perry, 2001).

Behavioural capability refers to an individual's skills. For an individual to perform a behaviour, he/she must know how to do it (Glanz et al., 2008). Behavioural capabilities or skills relate to individuals' abilities to perform the requisite behaviour. That is, university students' ability to interpret food labels, or prepare healthy meals will affect the quality of their dietary intake (Lytle & Perry, 2001). Related to behavioural capability is knowledge, which in the context of the SCT tends to refer to knowledge of health risks and benefits as per a behaviour change. Knowledge is vital because if an individual does know the benefits of adopting new lifestyle habits he or she has essentially no reason for changing their behaviours (Bandura, 2004). Of course, as the basic premise of the SCT posits, behaviour change is not as simple as being aware of the benefits of changing. That is, along with knowing the benefits of making dietary changes, an individual must have the belief that he or she can indeed successfully change their lifestyle; thus, the construct of self-efficacy comes into play (Bandura, 2004).

Albert Bandura, the developer of the SCT, considered the construct of self-efficacy to be the most vital personal factor when considering behaviour change. Self-efficacy is included in the majority of prominent health behaviour theories, and was previously described within the section on the Health Belief Model. The SCT asserts strategies for increasing self-efficacy, which are: setting achievable/realistic personal goals, providing oneself with rewards for meeting goals and practicing self-monitoring or record keeping. Another related construct of the SCT is that of outcome expectations, which refers to the consequences of performing a specific behaviour as anticipated by an individual (Glanz et al., 2008). Essentially, health behaviour change can be affected by the outcomes individuals expect will occur as a result of their actions (Bandura, 2004).

An accompanying, but less commonly occurring construct is that of outcome expectancies, which refers to the value an individual places on the expected outcome of

behaviour change (Lubans et al., 2012). With regards to the concept of observational learning or modeling, it is posited that individuals may learn through witnessing the experience of others, rather than solely through their own experience (Glanz et al., 2008). The concept of reinforcements refers to consequences of behaviour that affect whether an individual will or will not repeat it. Positive reinforcements may be described as rewards, and increase one's likelihood of repeating a certain behaviour. However, negative reinforcement increases one's likelihood of repeating a certain behaviour via the removal of an aversive stimuli as a result of the behaviour (Glanz et al., 2008).

Lastly, is the concept of self-regulation, which works alongside other concepts, such as reinforcements, self-efficacy, and expectations, and asserts that individuals will endure short-term negative outcomes in anticipation of positive long-term outcomes. Essentially, the idea is that “we can influence our own behaviour in many of the same ways we would influence another person, that is through rewards and environmental changes that we plan and organize for ourselves” (Glanz et al., 2008).

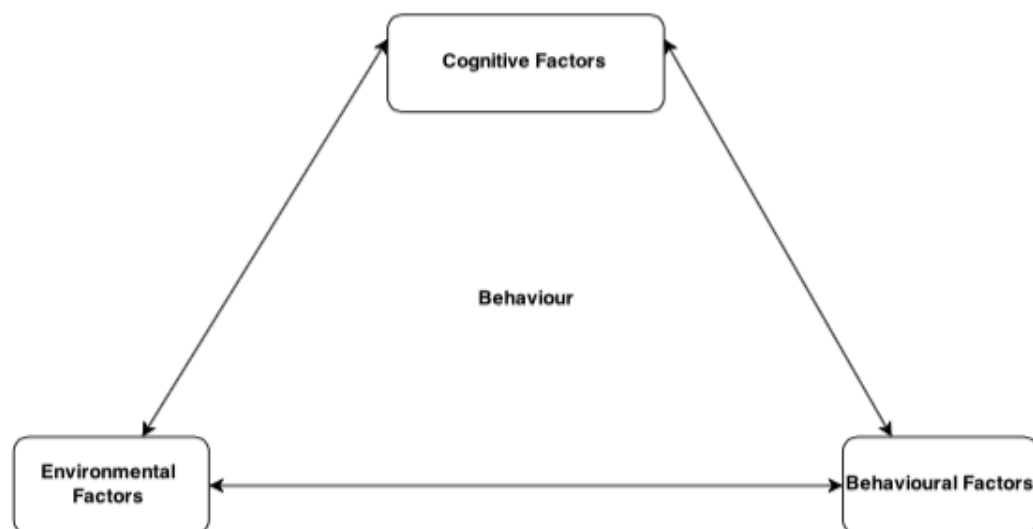


Figure 3. Linkages between the main constructs of the Social Cognitive Theory

Theoretical commonalities and differences. While each theory as a whole is unique, there are some overlapping concepts among the SCT, HBM and TPB. First, both the SCT and HBM include a strong focus on the concept of self-efficacy, which as previously stated relates to one's belief in one's self to carry out a behaviour. The concept of self-efficacy is also included in the TPB, however it is referred to as perceived behavioural control. Secondly, all three of the theoretical frameworks are similar with respect to beliefs about the personal benefits or power of carrying out a behaviour. In the HBM this would refer to the perceived benefits, whereas this concept is included in the attitude construct of the TPB, and the expectations construct of the SCT. However, each theory maintains unique characteristics despite the examples of similarities given and uniqueness should be considered when choosing a theory to work with.

While there is no one “correct” theory that explains all health behaviours, an appropriate theory should be carefully selected after assessing the target population to which the theory will be applied (National Cancer Institute, 2012). As the population included in this thesis is university students, the majority of whom are classified as emerging adults, the SCT was deemed by the author to be most appropriate. That is, the unique aspects of the SCT make it particularly appropriate in application to emerging adults because of the unique characteristics of this lifestyle. Therefore, the SCT is the focus of this thesis.

As previously stated, ‘emerging adulthood’ typically includes individuals aged 18-25 years and is “a unique developmental period when young people’s independence and autonomy are increasing” (Laska et al., 2009). Emerging adulthood is an extended period of development between adolescence and young adulthood, often marked by transitions such as leaving home for the first time and increasing autonomy in decision-making. Despite this increase in autonomy, “adult responsibilities such as financial independence and residential employment stability are still in flux” (Nelson et al., 2008). Another distinctive feature of

emerging adulthood is the psychological process of developing a stable and viable self-identity (Schwartz, Cote & Arnett, 2005), which usually involves exploration of various ideologies and behaviours (Nelson et al., 2008). A key contributor as to why the SCT was considered appropriate for the target population of this thesis was due to its focus on self-efficacy. Along with self-identity, self-efficacy has been reported as being one of the psychosocial attributes to become developed/established during emerging adulthood (Nelson et al., 2008). Observational learning and environmental influences are other constructs of the SCT deemed responsible for its appropriateness in relating to emerging adults. It is important that dietary interventions targeted to emerging adults at post-secondary institutions take these into consideration, as this population appears to be particularly susceptible to not only the food physically available on/near campuses, but also to their social environment/peer influence and modeling. For example, Blissmer et al. (2009) found that university students were influenced by what and when those around them were eating and that social situations such as going out for dinner were “associated with overeating unhealthful food”. Lastly, the concept of reciprocal determinism allows for consideration of how the many influences on behaviour as experienced by students, such as time constraints, cost, physical and social environments interact with each other and behaviours, and thus why this theory was deemed as appropriate for this population.

Dietary interventions guided by the SCT. Despite the identification of college/university as a time during which students may be developing life long eating habits, very limited literature exists regarding the efficacy of interventions aiming to improve dietary intake among this population (Kelly et al., 2013). Kelly et al. (2013) conducted a systematic review, the aim of which was to synthesize the literature evaluating nutrition/dietary interventions in college/university settings, and identify factors associated with healthful behaviour changes. Only 14 studies published between 2001 and 2011 met the authors’

inclusion criteria, and while a theoretical framework guided them all, most were informed by the SCT. Due to the variability in intervention content and duration, Kelly et al. were unable to provide specific conclusions in terms of the most effective dietary interventions implemented in colleges/universities. The authors did, however, identify that approaches involving self-regulation strategies, a component of the SCT, had the potential to facilitate dietary change among students.

One of the studies included in the systematic review by Kelly et al. developed a nutrition-oriented, SCT-driven, cooking show designed for off-campus college students. The authors, Clifford et al. (2009), aimed to determine if a series of four 15-minute episodes were able to influence students' knowledge, attitudes and behaviours regarding fruits and vegetables. One hundred and one students took part in the study, with 50 in the intervention group viewing the specially designed episodes and 51 in the control group. Students in the control group viewed four five-minute programs on sleep disorders. Clifford et al. (2009) reported incorporating aspects of the environmental, expectations, self-efficacy and modeling factors of the SCT into the development of the utilized episodes. Despite the theoretical guidance from the SCT, the only significant results reported were around improvements in knowledge in the intervention group as compared to the control group. That is, there were no significant changes in fruit and vegetable consumption, motivators, barriers and self-efficacy in the intervention vs. control group.

Contradictory to the relatively poor outcomes of the study by Clifford et al. (2009), however, are the results of another SCT guided intervention included in the systematic review. The study by Ha and Caine-Bish (2009) aimed to evaluate the effectiveness of participation in a 15-week basic nutrition class in increasing college students' intake of fruits and vegetables. The intervention combined conventional education materials with interactive and hands-on activities in promotion of fruit and vegetable intake. According to the authors,

many of the activities and lectures were guided by the SCT, and a table was provided which described various activities and their underlying SCT concept. For example, the activity “happy body log” required students to list up to three good things that they do for their body in a daily log. Ha and Caine-Bish (2009) stated that this activity was founded on the SCT constructs of self-control and expectations, which the authors defined as “personal regulation of goal-directed behaviour” and “model positive outcomes of a behaviour”, respectively. The results of the study were that the intervention led to statistically significant increases in total fruit and vegetable consumption as determined by pre- and post-test measures. Therefore, unlike Clifford et al. (2009), Ha and Caine-Bish (2009) reported that the implemented intervention was successful in improving fruit and vegetable intake of college students.

The difference in the success of the two reviewed studies, both reportedly guided by the SCT, indicates the need for detailed assessment and tailoring of theoretical frameworks. It is insufficient to design a dietary intervention for a specific population based on a theoretical framework as general and broad as the SCT. Different concepts and principles of the SCT may be more or less appropriate in guiding behaviour change interventions in the population of college/university students. It is thus necessary to assess the utility of SCT constructs as they work to explain dietary behaviour of university students so that future interventions may be guided by the theoretical constructs most applicable to them. This is currently a gap in the literature, as to the author’s knowledge, no studies exist that aim to evaluate the utility of the SCT in explaining the dietary behaviours of university students. However, a study conducted by Lubans et al. (2012) did aim to test the utility of the SCT in “explaining the dietary behaviours of a sample of adolescent girls from secondary schools in low-income communities”.

The results of Lubans et al.’s study further supports the notion that examining the application of theory to specific situations is valuable, as not all tested constructs of the SCT

were found to significantly predict participants' eating behaviours. The authors developed a final, refined theoretical model of the SCT, including only the concepts found to be statistically significant and thus relevant in explaining the eating behaviours of their population. The refined model retained the central concept of reciprocal determinism, as it included bidirectional and moderating pathways between the social-cognitive scales. The current study proposed to use Lubans et al.'s tested and adapted model of the SCT for application to its sample of university students. Taking the previously tested model of the SCT and applying it to a different sample will allow for further refinement of the theory, expanding existing knowledge on the appropriateness of the SCT in explaining and predicting the dietary habits of university students.

Conceptual Model of the Social Cognitive Theory

Figure 4 shows the conceptual model of the SCT that was originally intended for use as a guide for the analysis of students' dietary behaviors as per social-cognitive constructs. As previously stated, this model was developed by Lubans et al. in a research study that assessed the utility of the SCT in explaining dietary behaviours of a sample of adolescent girls.

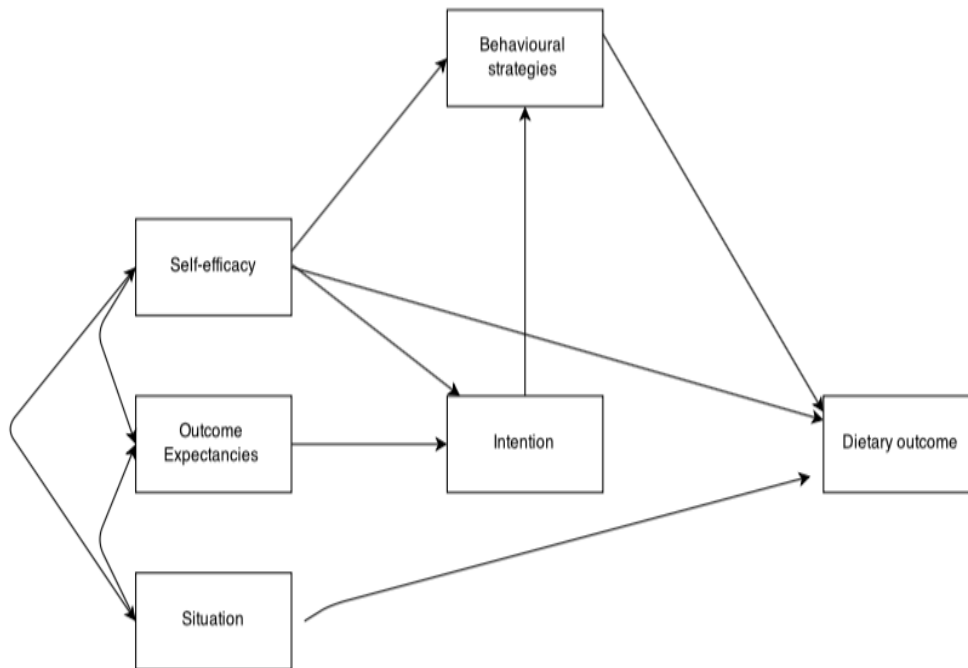


Figure 4. Initial conceptual model of the Social Cognitive Theory, indicating the linkages between the included constructs

The key social-cognitive constructs included in this model are as follows:

- *Self-efficacy*: falling under the “cognitive” aspect of the SCT, self-efficacy refers to students’ confidence in their ability to adopt, maintain and overcome barriers to healthy eating (Lubans et al., 2012).
- *Outcome expectancies*: falling under the “cognitive” aspect of the SCT, outcome expectancies refers to the value that students place on their perceived outcomes of healthy eating (Lubans et al., 2012).
- *Intentions*: falling under the “cognitive” aspect of the SCT, intentions refer to students’ intentions to eat healthily (Lubans et al., 2012).
- *Situation*: falling under the “environmental” aspect of the SCT, situation refers to students’ perception of their physical environment (Lubans et al., 2012).

- *Behavioural strategies*: falling under the “behavioural” aspect of the SCT, behavioural strategies refer to self-management techniques used by students to support healthy eating (Lubans et al., 2012).

As will be explained in the Results section of this thesis, the construct of Intention was removed from conceptual model of the SCT, based on the results of statistical analyses. As such, the figure below demonstrates the final model that was used as a guide for the analysis of students’ dietary behaviors as per social-cognitive constructs.

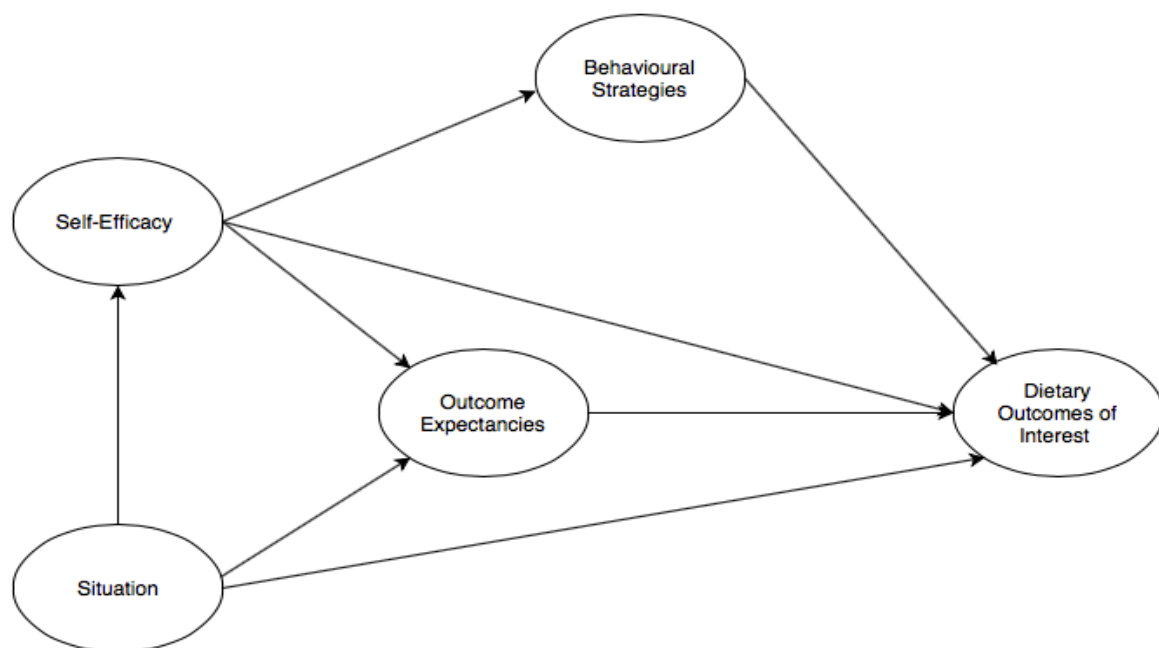


Figure 5. Final conceptual model of the Social Cognitive Theory, indicating the linkages between the included constructs

Summary

Overall, there is a wealth of data indicating that university students typically have poor eating habits, with reports of insufficient fruit and vegetables intake along with excessive high fat and fast food intake (Born et al., 2003; Deusinger et al., 2005). This may result both in negative short- and long-term health effects for university students namely putting them at increased risk of chronic disease later in life.

Existing research has indicated that many factors influence the eating behaviours of university students (Driskell, Schake & Detter, 2008). In order to systematically understand and subsequently change the behaviours of students, an appropriate health behaviour theory should be consulted. While several health behaviour theories have been utilized in research and practice, the SCT is the focus of this thesis.

The SCT was deemed as most appropriate for the population of university students mainly due to its focus on reciprocal determinism and self-efficacy. That being said, certain constructs of the SCT may be more or less appropriate in affecting the behaviour of the university student population. It is thus necessary to assess the utility of the SCT constructs as they work to explain the dietary behaviours of university students so that future dietary interventions may be guided by the theoretical constructs most relevant to that population. This assessment and subsequent refinement of the SCT is the purpose of this thesis.

Chapter 3: Research Questions and Hypotheses

Research Questions

The “dietary outcomes of interest” as per Canada’s Food Guide (CFG) (Health Canada, 2007) will be tested individually within the SCT model and are as follows: a) students’ consumption of vegetables and fruit; b) students’ consumption of grain products; c) students’ consumption of meat and alternatives; d) students’ consumption of milk and alternatives and; e) students’ consumption of “foods to limit”.

1. To what extent, if any, does self-efficacy relate to the dietary outcomes of interest?
2. To what extent, if any, does self-efficacy relate to students’ behavioural strategies for eating a healthy diet?
3. To what extent, if any, do students’ behavioural strategies for eating a healthy diet relate to the dietary outcomes of interest?
4. To what extent, if any, does students’ perception of their situation as conducive to eating a healthy diet relate to the dietary outcomes of interest?
5. To what extent, if any, does self-efficacy relate to students’ outcome expectancies for eating a healthy diet?
6. To what extent, if any, does students’ perception of their situation as conducive to eating a healthy diet relate to their self-efficacy?
7. To what extent, if any, does students’ perception of their situation as conducive to eating a healthy diet relate to their outcome expectancies?
8. To what extent, if any, does students’ outcome expectancies for eating a healthy diet relate to the dietary outcomes of interest?

Hypotheses

The hypotheses identified in Figure 6 can be defined as follows:

- H1₀: As self-efficacy increases, students' consumption of a) vegetables and fruit; b) meat and alternatives; c) grain products; d) milk and alternatives and; e) foods to limit, will not change.
- H1_A: As self-efficacy increases, students will consume a) more servings of vegetables and fruit; b) more servings of meat and alternatives; c) more servings of grain products; d) more servings of milk and alternatives; e) less servings of "foods to limit"
- H2₀: As self-efficacy increases, students' behavioural strategies for eating a healthy diet will not change.
- H2_A: As self-efficacy increases, students' behavioural strategies for eating a healthy diet will increase
- H3₀: As students' behavioural strategies for eating a healthy diet increase, students' consumption of a) vegetables and fruit; b) meat and alternatives; c) grain products; d) milk and alternatives; e) "foods to limit", will not change.
- H3_A: As students' behavioural strategies for eating a healthy diet increase, students will consume a) more servings of vegetables and fruit; b) more servings of meat and alternatives; c) more servings of grain products; d) more servings of milk and alternatives; e) less servings of "foods to limit"
- H4₀: As students perceive their situation to be more conducive to eating a healthy diet, students' consumption of a) vegetables and fruit; b) meat and alternatives; c) grain products; d) milk and alternatives; e) "foods to limit", will not change.
- H4_A: As students perceive their situation to be more conducive to eating a healthy diet, students will consume a) more servings of vegetables and fruit; b) more

servings of meat and alternatives; c) more servings of grain products; d) more servings of milk and alternatives; e) less servings of “foods to limit”

- H5₀: As self-efficacy increases, students’ outcome expectancies for eating a healthy diet will not change.
- H5_A: As self-efficacy increases, students’ outcome expectancies for eating a healthy diet will increase.
- H6₀: As students perceive their situation to be more conducive to eating a healthy diet, their self-efficacy for eating a healthy diet will not change.
- H6_A: As students perceive their situation to be more conducive to eating a healthy diet, their self-efficacy for eating a healthy diet will increase.
- H7₀: As students perceive their situation to be more conducive to eating a healthy diet, their outcome expectancies for eating a healthy diet will not change.
- H7_A: As students perceive their situation to be more conducive to eating a healthy diet, their outcome expectancies for eating a healthy diet will increase.
- H8₀: As students’ outcomes expectancies for eating a healthy diet increase, students’ consumption of a) vegetables and fruit; b) meat and alternatives; c) grain products; d) milk and alternatives; e) “foods to limit”, will not change
- H8_A: As students’ outcomes expectancies for eating a healthy diet increase, students will consume a) more servings of vegetables and fruit; b) more servings of meat and alternatives; c) more servings of grain products; d) more servings of milk and alternatives; e) less servings of “foods to limit”

The following conceptual model, Figure 5, provides a pictorial representation of the hypotheses that were tested.

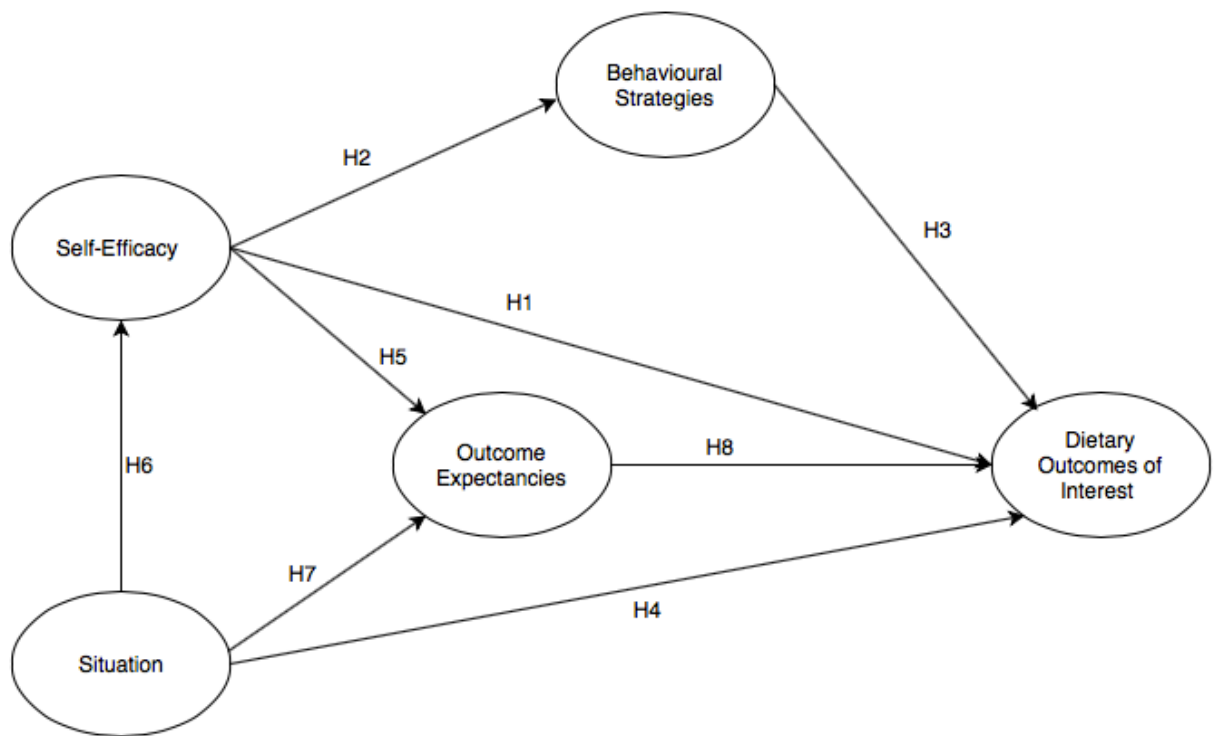


Figure 6. Conceptual model of the Social Cognitive Theory indicating the linkages between the social-cognitive construct and the corresponding hypotheses

Chapter 4: Methods

Use of Secondary Data: The Student Meal Study

This thesis aimed to explain the dietary behaviours of university students using the SCT and as such, data on social-cognitive constructs and the dietary intake of students was required. These requirements were met through the analysis of the data previously collected during the Student Meal Study, as reported in *The Impact of Influencers on the Eating Behaviours of University Students* (Mann & Blotnick, 2015) and *An Assessment of University Students' Healthy Eating Behaviours with the Expectancy Theory* (Blotnick, Mann & Joy, 2015).

The purpose of the Student Meal Study was to determine the influences on the eating behaviours of university students attending two Halifax universities. The authors designed and tested a validated questionnaire, which was approved by the University Research Ethics Boards of Mount Saint Vincent University and Saint Mary's University. The Determinants of Healthy Eating (Raine, 2005) was the theoretical framework utilized in designing the questionnaire. The main premise of this framework is that the determinants of healthy eating are organized as follows: 1) individual determinants of personal food choices, including food preferences, perceptions of healthy eating etc. and; 2) collective determinants, including a) environmental determinants, such as the physical and economic environment, and b) public policies as a means of creating supportive environments for healthy eating (Raine, 2005). Upon examination of the Determinants of Healthy Eating framework, it became apparent that many of its concepts overlap with those of the SCT, and that the framework is essentially derived from constructs of the SCT. As such, the use of data obtained from the questionnaire designed as per the Determinants of Healthy Eating can be deemed as appropriate for use in this study, which focused on the SCT.

Questionnaire administrations were done online (FluidSurveys.com), and were completed by students invited by their professors who were randomly selected and contacted by the researchers. The outcome included a sample of 188 students who completed the questionnaire during the 2012-2013 academic year. The main component of the data collection tool was a food frequency questionnaire (FFQ), with the aim of subsequently determining students' adherence to CFG (Health Canada, 2007). The basis of the FFQ was based on the research of Rockett, Wolf and Colditz (1995) and Thompson, Midthune, Subar, Kahle, Schatzkin and Kipnis (2004). Students were provided with images of food servings as per the food guide as an effort to increase reporting accuracy of number of servings consumed. This FFQ component thus satisfies the requirements of the proposed study with reference to the dietary intake of university students. The questionnaire also included questions addressing the determinants of healthy eating, several constructs of which overlap with those of the SCT. Thus, the reliably and recently collected data from the Student Meal Study provides an exemplary source of data that can be analyzed for the purpose of this thesis.

Data Analysis

Analysis of dietary intake. The results of the three-day food frequency questionnaire items were first converted to daily measures, and subsequently analyzed using descriptive statistical analysis via SPSS software, including overall percentages, means, medians, confidence intervals and standard deviations. The data were weighted on student population at each institution for descriptive statistics.

Dietary outcomes of interest were guided by CFG; reported intake of daily servings of each food group as per CFG (Vegetables and Fruit; Meat and Alternatives; Grain Products; Milk and Alternatives), along with “foods to limit”, were examined. This thesis examined the SCT in relation to each food group, and “foods to limit”, rather than overall categories of

“healthy” and “unhealthy” foods in the effort to more narrowly refine the utility of the SCT. This approach accommodates the possibility that the SCT may be able to explain and predict the consumption of individual food groups independently of each other, increasing specificity and highlighting food groups for special attention.

Analysis of conceptual model. Social-cognitive constructs/scales, falling under the primary categories of cognitive, behavioural and environmental, were developed from responses to appropriate questions on the administered questionnaire. For example, the scale for self-efficacy was developed using questions 11 and 12 from Section B of the administered questionnaire which inquire about students’ confidence to eat healthily. Confirmatory factor analysis was run on the initial scales to determine unidimensionality, that is, that all items in the scale measure one underlying construct (Drenger, Gaus & Jahn, 2008). Subsequent to running confirmatory factor analysis, any items with a factor loading of less than 0.70 were removed from the scale. Finally, scale items were subjected to a reliability analysis to ensure that the scales reliably measured the constructs of the SCT. Cronbach’s alpha statistics was used to measure reliability, and any items for which Cronbach’s alpha was less than 0.60 were removed from the scale. All descriptive statistics, factor analyses and reliability analyses were completed using SPSS software.

As represented in the conceptual model of the SCT to be used for analysis (Fig. 4), the scales to be developed include Outcome Expectancies, Self-Efficacy, Behavioural Strategies, and Situation.

Partial Least Squares (PLS), a form of structural equation modeling (SEM) that requires model creation and validation (Drenger et al., 2008), was used to test the significance of the proposed conceptual model. PLS was deemed as a more appropriate approach than multi-stage multiple regression because of the inter-connected, reciprocal nature of the pathways in the SCT conceptual model. That is, unlike multi-stage multiple regression, PLS

can be successfully used when analyzing independent variables which are correlated (Pirouz, 2006). Furthermore, the strict underlying assumptions of a large sample size and multivariate normality required for SEM do not apply to PLS (Garson, 2008), making it a more feasible approach for this study.

Testing the conceptual model using PLS was conducted using SmartPLS software. PLS is a multi-step analytical process. The first step provided feedback on the regression coefficients in conceptual model, along with information on overall model reliability. The next step involved a bootstrap analysis to test the regression equations and determine the statistical significance of each hypothesized relationship within the model. The 0.05 level of statistical significance or better was used to identify significant relationships in the model. This process was completed for each of the five dietary outcomes of interest. The last step in PLS is a blindfold analysis, which measures the discriminant validity of the model.

Lastly, it should be noted that sample size used for this research was found to be appropriate based on the calculated power of the test, which refers to the ability of a test to detect statistical significance at a certain level, such as the 95% level as used in this thesis (Faul, Erdfelder, Lang & Buchner, 2007). As previously stated, the sample size of the data analyzed was 188. A power analysis was conducted on this sample size, indicating that for a medium effect size of $f^2=0.15$, at the 0.05 alpha level, the power of the test was 0.999 (G-Power, 1998). This exceeded the norm of 0.80 and thus the sample size was acceptable.

Ethical Considerations

This thesis received research ethics clearance for use of secondary data (File No. 2015-017) from the Mount Saint Vincent University Research Ethics Board on July 23, 2015. The use of secondary data posed minimal risk to participants, and no identifying information was made available to the researcher.

Chapter 5: Results

Participant Demographics

A total of 188 students completed the online questions as per the original Student Meal Study (SMS). Majority of the students were female (79%) and ranged in age from 15 to 55 years, with the average age being 22 years. Ninety-five percent of the participants were full-time university students, with almost one third being in their first year of study, followed by 38% being in their second or third year of study, 16% in their fourth year, and 14% in their fifth or greater year. All analyzed data was weighted for the university attended by the students.

Food Group Measures

In order to quantify Dietary Outcomes of Interest, measures were created corresponding to students' intake of daily servings of each food group as per CFG (Vegetables and Fruit; Meat and Alternatives; Grain Products; Milk and Alternatives), as well as Foods to Limit. First, appropriate questionnaire items were chosen to comprise the dietary outcomes measures. Subsequently the results of the selected three-day food frequency questionnaire items were converted to daily measures, used to create the Dietary Outcomes of Interest Measures in SPSS, which were then analyzed using descriptive statistical analysis.

In order to measure vegetable and fruit intake, the Vegetable and Fruit Intake measure was comprised of the following questionnaire items: Question C2a "In the past three days approximately how many times did you eat a serving of: 1) Fresh Fruit; 2) Juice; 3) Green Vegetables and; 4) Orange or Red Vegetables". Table 1 displays the descriptive statistics for the Vegetable and Fruit Intake measure. Vegetable and Fruit intake was measured in number of daily servings of the four groups of food products, with the mean number of daily servings of vegetables and fruit consumed by the students being 3.9, and the standard deviation being 2.12.

In order to measure grain product intake, the Grain Intake measure was comprised of the following questionnaire items: Question C2b “In the past three days approximately how many times did you eat a serving of: 1) Rice; 2) Pasta; 3) Other Grains (couscous, quinoa, etc.); 4) Whole Grain Bread; 5) Enriched White Bread and; 6) Cereal/Granola Bars”. Table 1 displays the descriptive statistics for the Grain Intake measure, and indicates that the mean number of daily servings of grain products consumed by the students was 2.4, with the standard deviation being 1.58.

In order to measure intake of meat and alternatives, the Meat and Alternatives Intake measure was comprised of the following questionnaire items: Question C2d “In the past three days approximately how many times did you eat a serving of: 1) Eggs; 2) Beef and Pork; 3) Poultry or Fish and; 4) Tofu, Beans, Lentils. Table 1 displays the descriptive statistics for the Meat and Alternatives Intake measure, and indicates that the mean number of daily servings of meat and alternatives consumed by the students was 1.56, with the standard deviation being 1.16.

In order to measure intake of milk and alternatives, the Milk and Alternatives Intake measure was comprised of the following questionnaire items: Question C2c “In the past three days approximately how many times did you eat a serving of: 1) Milk, Rice or Soy; 2) Yogurt; and 3) Cheese. Table 1 displays the descriptive statistics for the Milk and Alternatives Intake measure, and indicates that the mean number of daily servings of milk and alternatives consumed by the students was 2.18, with the standard deviation being 1.27.

In order to measure intake of foods to limit, the Foods to Limit Intake measure was comprised of the following questionnaire items: Question C2e “In the past three days approximately how many times did you eat a serving of: 1) French Fries; 3) Pizza; 4) Ice Cream or Pudding; 5) Pie, Cake or other Baked Dessert; 8) Chocolate or Candy and; 9) Chips, Nachos, Popcorn, etc. Table 1 displays the descriptive statistics for the Foods to Limit Intake

measure, and indicates that the mean number of daily servings of foods to limit consumed by the students was 1.53, with the standard deviation being 1.25.

Table 1.
Daily Intake of All Food Groups

Measure	Number	Min	Max	Mean	Std. Deviation
Vegetable and Fruit Intake	146	0.33	16	3.9	2.12
Grain Intake	155	0.00	17.3	2.4	1.58
Meat and Alternatives Intake	158	0.00	9.00	1.56	1.16
Milk and Alternatives Intake	158	0.00	8.33	2.18	1.27
Foods to Limit Intake	158	0.00	6.33	1.53	1.25

Process for Development of Social-Cognitive Scales

As per the conceptual model proposed by Lubans et al. (2012), five social-cognitive constructs were initially developed from items of the SMS questionnaire. However, the final outcome of the scale development process resulted in four social-cognitive constructs. Of these constructs, one was created from a single questionnaire item, while the remaining were multi-item scales.

The first step in creating the multiple item social-cognitive scales was a review of the original questionnaire items. Based on the author's knowledge of the SCT and its components, educated postulations were made about which questionnaire items were suitable for measuring the social-cognitive constructs. The theoretical rationale behind the initial decisions made (including those for the single-item constructs) are described in the section "Social Cognitive Constructs".

The questions used in this thesis as measures of social-cognitive constructs differ from those used by Lubans et al. (2012), not only because the two studies are different overall,

focusing on different populations, but also to provide a different perspective on the developed model. As there are no universally accepted “correct” measures of social-cognitive constructs, using different questions contributes to a broadening of the inclusiveness of the social-cognitive theoretical model. Furthermore, the present study focused on university students, whose life circumstances differ substantially from adolescents attending secondary school, as focused on in Lubans et al.’s study, and as such it is appropriate to have asked and utilized different questions. Lastly, it should be mentioned that majority of the questions used in the SMS were based on previous, similar studies, which were subsequently pilot tested and revised (Mann & Blotnicky, 2015).

The second step in the process, as stated in the Data Analysis section, was to conduct confirmatory factor analysis on each tentative scale. This was done using SPSS, with the purpose being to ensure unidimensionality, that is, that the chosen variables were strongly associated with each other, measuring the same underlying construct (Hair, Anderson, Tatham & Black, 2006). This statistical technique of confirmatory factor analysis determined if each scale consisted of items loading highly on a single factor (Hair et al., 2006). The threshold for an appropriate factor loading was chosen to be ≥ 0.5 , as loadings of this caliber are considered “practically significant” (Hair et al., 2006). Thus, any scale items with a corresponding factor loading of below 0.5 were considered for deletion from the scale.

The next step in the creation of the multiple item social-cognitive scales was to conduct a reliability analysis for each of the additive scales that were confirmed through the factor analysis. Reliability is an assessment of the degree of consistency between the variables within the scale, and the technique used resulted in a reliability coefficient referred, to as Cronbach’s alpha, for each scale (Hair et al., 2006). The lower limit chosen for this coefficient was the generally agreed upon threshold of 0.70 (Hair et al., 2006). The SPSS output from this technique also provided what the Cronbach’s alpha for the scale would be if

individual scale items were deleted. Thus, if the initial Cronbach's alpha was below 0.7, it could be determined from the output which variable needed to be considered for deletion in order to increase overall scale reliability.

At this stage, the constructs/scales were tentatively confirmed as being statistically sound and used to test the conceptual model via PLS using the SmartPLS software. Prior to discussing the results of the hypothesized relationships within the model, unidimensionality within the model was further ensured by examining item loadings across the scales as provided by SmartPLS. Any variables that loaded higher on a construct for which they were not intended to measure were considered for removal. Thus, the "revised" version of the construct was re-evaluated in SPSS (redoing the first steps in scale development). As a result of this analysis, the social-cognitive construct "Intention" was removed entirely, with the single variable used to measure intention added to the variables being used to measure "Self-Efficacy". This decision was made not only because the variable intended to measure "Intention" loaded higher for "Self-Efficacy", but also because all of the cross-loading results for variables measuring the two constructs were almost identical, indicating that they were essentially measuring the same underlying construct.

Analysis of Social Cognitive Scales

Outcome expectancies. The only single item construct developed was Outcome Expectancies, which refers to the value that students place on perceived outcomes of healthy eating. The questionnaire item chosen to represent this construct was Question B3: "Rate how important a nutritious diet is to you". This item acts as a measure of how much the students value healthy eating by degree of importance.

As seen in Table 2.1 below, the number of students who answered Question B3, "Rate how important is a nutritious diet to you", was 177. This question was rated on a scale of one

to five, with one corresponding to “very low”, and five corresponding to “very high”. The mean rating of importance of a nutritious diet was 3.7, with a standard deviation of 0.88.

Table 2.1
Descriptive statistics for Outcome Expectancies Scale

Variable (indicator)	Number	Min	Max	Mean	Std. Deviation
B3 “Rate how important is a nutritious diet to you”	177	1	5	3.7	0.88

Note. Scale: 1) Very low; 2) Low; 3) Moderate; 4) High; 5) Very high

Self-efficacy. The construct of self-efficacy, which refers to students’ confidence in their ability to adopt and maintain healthy eating, required the creation of a scale comprised of three questionnaire items: Question B11: “Please indicate the level of your confidence in your ability to eat a nutritious diet during the academic term”; Question B12: “Please indicate the level of your confidence in your ability to eat a nutritious diet outside of the academic term” and; Question B9a: “Please indicate your level of agreement with the following statements that describes your eating habits: I currently eat a nutritious diet”.

Both questions B11 and B12 clearly inquire about the level at which students rate their confidence in their ability to eat healthily. Such questions coincide with recommendations for measuring self-efficacy as made by Bandura, closely resembling the following measure created by Bandura: “rate your degree of confidence by recording a number from 0 to 100 using the scale given below” (Bandura, 2006). Question B9a was initially intended to measure the construct of “Intention”, but statistically was found to measure the same underlying concept as questions B11 and B12. Theoretically, the results of Question B9a are congruent with a measure of self-efficacy as stating that they “currently eat a nutritious diet” can be interpreted as students having confidence in their ability to eat healthily, as this is what they were currently perceiving themselves to be doing.

Table 2.2 displays the results from the confirmatory factor analysis and reliability analysis run on the scale variables, as well as the descriptive statistical results of the variables and the final scale. As seen, the factor loadings for all three questionnaire items are above the threshold of 0.5, thus indicating unidimensionality. Furthermore, the scale is able to explain 67.5% of the variance within these measures. Cronbach's alpha was 0.76, exceeding the required reliability threshold of 0.7. Questions B11 and B12 were rated on a scale of one to five, with one corresponding to "very low", and five corresponding to "very high". Question B9a was rated on a scale of one to five, with one corresponding to "strongly disagree", and five corresponding to "strongly agree". The mean level of confidence in students' ability to eat a nutritious diet during the academic term was 3.2, which falls below their mean confidence to do so outside of the academic term; 3.9. The mean level of students' agreement to currently eating a nutritious diet was 3.4. The overall mean for the Self-Efficacy scale was 10.5, with a standard deviation of 2.3.

Table 2.2							
<i>Results of descriptive analysis, confirmatory factor analysis and reliability analysis for Self-Efficacy scale creation</i>							
Variable	Number	Min	Max	Mean	St. Deviation	Factor Loading	
B11 level of confidence in "ability to eat a nutritious diet during the academic term"	166	1	5	3.2	0.99	0.85	
B12 level of confidence in "ability to eat a nutritious diet outside of the academic term"	166	1	5	3.9	0.88	0.79	
B9a "I currently eat a nutritious diet"	166	1	5	3.4	0.96	0.83	
Total Variance Explained						67.5%	
Self-efficacy Scale	166			10.5	2.3		
Cronbach's Alpha						0.76	

Note. Scale: 1) Very low; 2) Low; 3) Moderate; 4) High; 5) Very high

Behavioural strategies/capabilities. This construct, which refers to the behavioural strategies used by students to support healthy eating, required the creation of a two-item scale. These questionnaire items were as follows: Question B13b: “Please indicate your level of satisfaction with the following factors as they apply to eating a nutritious diet during the academic term: grocery shopping skills”; and Question B13c: “Please indicate your level of satisfaction with the following factors as they apply to eating a nutritious diet during the academic term: meal preparation skills”. Both of these questions directly inquire about students’ perceptions of their learned behavioural capabilities/skills which contribute to their eating habits.

Table 2.3 displays the results from the confirmatory factor analysis and reliability analysis run on the scale variables, as well as the descriptive statistical results of the variables and the final scale. The factor loadings for the two variables are above the 0.5 threshold, indicating unidimensionality. The Cronbach’s alpha met the reliability threshold of 0.70. The Behavioural Strategies scale is able to explain 77.9% of the variance within these measures. The questions were rated on a scale of one to five, with one corresponding to “very dissatisfied”, and five corresponding to “very satisfied”. Students’ mean levels of satisfaction with their meal preparation skills and grocery shopping skills were 3.5 and 4 respectively. Overall, the mean rating for the Behavioural Strategies scale was 7.6 with a standard deviation of 1.8.

Table 2.3

Results of descriptive analysis, confirmatory factor analysis and reliability analysis for Behavioural Strategies scale creation

Variable	Number	Min	Max	Mean	St. Deviation	Factor Loading
B13c: level of satisfaction with “meal preparation skills”	163	1	5	3.5	1.2	0.88
B13b: level of satisfaction with “grocery shopping skills”	163	1	5	4	0.92	0.88
Total Variance Explained						77.9%
Behavioural Strategies Scale	163			7.6	1.8	
Cronbach’s Alpha						0.70

Note. Scale 1) Very dissatisfied; 2) Dissatisfied; 3) Neutral; 4) Satisfied; 5) Very satisfied

Situation. The final social-cognitive construct, Situation, refers to students’ perception of their environment as related to the availability of food, and required the creation of a three-item scale. The questionnaire items used are derived from three parts of one main question: Question C6 “Please indicate your level of satisfaction with where you eat your meals and snacks while you are at university based on the following criteria: i) hours of operation fit my schedule; j) convenient location and; k) ease of access to kitchen/dining room”. Essentially, these questions inquire about students’ perception of their environment as per the availability/accessibility of food.

Table 2.4 below displays the results from the confirmatory factor analysis and reliability analysis run on the scale variables, as well as the descriptive statistical results of the variables and the final scale. The factor loadings for all three variables are above the 0.5 threshold, indicating unidimensionality. Cronbach’s alpha for the scale met the required threshold of 0.70, indicating sufficient reliability. The scale explained 64.4% of the variability in the measures. The three questions were rated on a scale of one to five, with one corresponding to “very dissatisfied”, and five corresponding to “very satisfied”. Students rated their level of satisfaction with “convenience of location”, “ease of access to kitchen/dining” and “hours of operation” as 4.08, 3.92 and 3.68, respectively. The

corresponding standard deviations to the mean values were 0.76, 0.79 and 0.97, respectively.

The mean value for the overall Situation scale was 11.7, with a standard deviation of 2.0.

Table 2.4
Results of descriptive analysis, confirmatory factor analysis and reliability analysis for Situation scale creation

Variable	Number	Min	Max	Mean	St. Deviation	Factor Loading
C6j: Level of satisfaction with “convenient location”	135	1	5	4.08	0.76	0.88
C6k: Level of satisfaction with “ease of access to kitchen/dining:	135	1	5	3.92	0.79	0.83
C6i: Level of satisfaction with “hours of operation”	135	1	5	3.68	0.97	0.69
Total Variance Explained		1	5			64.6%
Situation Scale	135			11.7	2.0	
Cronbach’s α						0.70

Note. Scale: 1) Very dissatisfied; 2) Dissatisfied; 3) Neutral; 4) Satisfied; 5) Very satisfied

SmartPLS Analysis: Model Refinement

Prior to conducting any analysis, the formative model to be tested was created based on the SCT. Figure 7 displays the formative model created in SmartPLS to test the SCT. It should be noted that as described previously, this model does not contain the construct of Intention, unlike the originally proposed model.

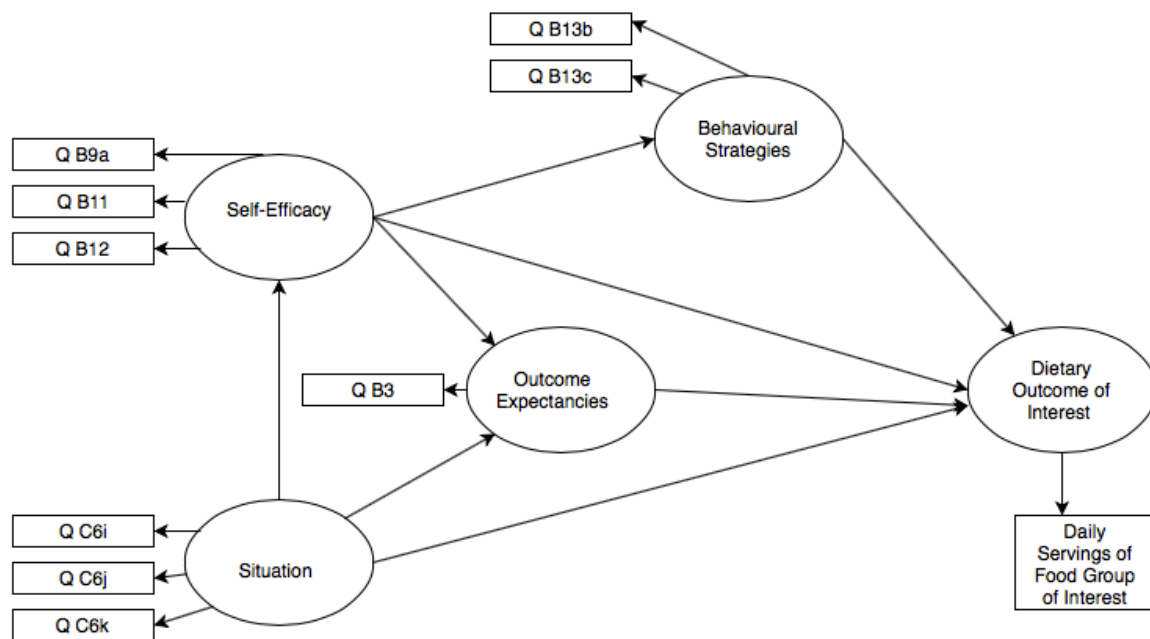


Figure 7. Formative model of social-cognitive constructs and dietary outcomes of interest as inputted to SmartPLS

Cross-loading Summary to Confirm Unidimensionality

The first stage of PLS analysis examined the unidimensionality of the formative model; SmartPLS provided cross-loadings for each variable in the model. All variables loaded mostly highly for the construct that they were intended to measure. The formative model was refined to ensure unidimensionality by removing the Intention construct from the original formative model. The analysis revealed that Intention and Self-Efficacy described the same underlying dimensions. The question in the Intention scale (Question B9a) was incorporated into the Self-Efficacy Scale. As can be seen in Table 3.1.1, the cross-loading results for the two Self-Efficacy variables, Questions B11 and B12, are almost identical to those for Question B9a.

Table 3.1.1

Cross-loading summary to confirm unidimensionality of constructs within the formative model

	Behavioral Strategies	Outcome Expectancies	Self-Efficacy	Situation
B11	0.76	0.54	0.98	0.46
B12	0.74	0.56	0.99	0.49
B9a	0.74	0.56	0.99	0.48
B13b	0.96	0.50	0.72	0.35
B13c	0.96	0.51	0.73	0.40
B3	0.53	1.00	0.56	0.25
C6i	0.38	0.25	0.47	0.99
C6j	0.40	0.25	0.48	0.99
C6k	0.37	0.25	0.47	0.98
Fruit & Vegetable Daily Servings	0.59	0.34	0.63	0.51
Grains Daily Servings	0.65	0.39	0.70	0.60
Meat & Alternatives Daily Serving	0.66	0.41	0.74	0.65
Milk & Alternatives Daily Serving	0.65	0.41	0.74	0.65
Foods to Limit Daily Serving	0.66	0.41	0.74	0.65

Table 3.1.2

Cross-loading summary to confirm unidimensionality of constructs within the formative model

	Fruit & Vegetable Intake	Grain Intake	Meat & Alternative Intake	Milk & Alternative Intake	Foods to Limit
B11	0.60	0.68	0.71	0.71	0.71
B12	0.64	0.71	0.75	0.75	0.75
B9a	0.63	0.71	0.74	0.74	0.74
B13b	0.54	0.56	0.60	0.60	0.60
B13c	0.59	0.67	0.66	0.66	0.66
B3	0.34	0.39	0.41	0.41	0.41
C6i	0.50	0.60	0.64	0.64	0.64
C6j	0.52	0.61	0.65	0.65	0.65
C6k	0.50	0.59	0.63	0.63	0.63
Fruit & Vegetable Daily Servings	1.00	-	-	-	-
Grains Daily Servings	-	1.00	-	-	-
Meat & Alternatives Daily Serving	-	-	1.00	-	-
Milk & Alternatives Daily Serving	-	-	-	1.00	-
Foods to Limit Daily Serving	-	-	-		1.00

Assessment of Construct Reliability and Convergent Validity

SmartPLS software provided sufficient statistical information to further assess construct reliability and convergent validity. This was done by exploring composite reliability values, the Average Variance Extracted (AVE) values and Cronbach's alpha for each construct comprising the tested model. The AVE is a measure of the average amount of variance in an observed variable that a latent construct can explain (Farrell, 2009). While composite reliability and Cronbach's alpha both measure internal consistency reliability, the

rationale for including composite reliability along with the more common Cronbach's alpha is that the latter has been said to provide a "conservative measurement in PLS-SEM" (Wong, 2013). To ensure convergent validity, the AVE is required to be greater than or equal to 0.50 and the composite reliability and Cronbach's alpha should both be greater than or equal to 0.70 (Wong, 2013). As Table 4 indicates, all constructs succeeded in meeting the convergent validity requirements of $AVE \geq 0.50$, composite reliability ≥ 0.70 and Cronbach's alpha ≥ 0.70 .

Table 4.
Assessment of Construct Reliability and Convergent Validity

	AVE	Composite Reliability	Cronbach's Alpha
Behavioural Strategies	0.92	0.96	0.92
Fruit & Vegetable Intake	1.00	1.00	1.00
Outcome Expectancies	1.00	1.00	1.00
Self-Efficacy	0.98	0.99	0.99
Situation	0.97	0.99	0.99
Grain Intake	1.00	1.00	1.00
Meat & Alternative Intake	1.00	1.00	1.00
Milk & Alternative Intake	1.00	1.00	1.00
Foods to Limit Intake	1.00	1.00	1.00

Assessment of Divergent Validity

Subsequent to ensuring convergent validity was assessing discriminant validity, which has been defined as the "extent to which latent variable A discriminates from other latent variables (e.g. B, C, D)" (Farrell, 2009). The measure examined in this step included R^2 values, the Fornell-Larcker test and the Stone-Geisser (Q^2) measures. The threshold of R^2 that needed to be exceeded to ensure discriminant validity was 0.30 (Hair et al., 2006). The following table displays that all constructs met the threshold for R^2 except for Self-Efficacy, which fell short at 0.23. After consideration of reformulation of the scale, it was determined to

keep the scale as it was, as it met all other statistical requirements, and was deemed as theoretically sound. The Fornell-Larcker test posits that to ensure discriminant validity, the AVE of each latent variable must be greater than the squared correlation value for each variable (Wong, 2013). As indicated in the following table, all constructs met this requirement. Lastly is the Stone-Geisser Test (Q^2) which provides cross-validated redundancy measures, and is produced during the third step of the PLS analysis, a process known as Blindfolding (Wong, 2013). To ensure discriminant validity the Q^2 values must be greater than or equal to zero, that is, non-negative (Vinzi, Chin, Henseler & Wang, 2010). As seen in Table 5, all Q^2 values were positive values less than one, thus meeting the requirements for discriminant validity.

Table 5.
Assessment of Model Discriminant Validity

	$R^2 > 0.30$	Fornell-Larcker Test ($AVE > \text{Highest correlation}^2$)	Stone-Geisser Test ($Q^2 > 0$)
Behavioural Strategies	0.57	$0.92 > 0.57$	0.50
Fruit & Vegetable Intake	0.48	$1.00 > 0.48$	0.39
Outcome Expectancies	0.31	$1.00 > 0.31$	0.25
Self-Efficacy	0.23	$0.98 > 0.23$	0.23
Situation	-	$0.97 > 0.00$	0.87
Grain Intake	0.62	$1.00 > 0.62$	0.51
Meat & Alternative Intake	0.68	$1.00 > 0.68$	0.56
Milk & Alternative Intake	0.68	$1.00 > 0.68$	0.56
Foods to Limit Intake	0.68	$1.00 > 0.68$	0.56

SmartPLS Analysis: Testing of Conceptual Model

Initial PLS analysis: Beta values and coefficients of determination. PLS analysis consists of three different procedures. It should be reiterated that while there was one overall model, there were five iterations, as the model was tested for each of the five dietary outcome

measures. The initial PLS analysis resulted in a regression analysis for the relationships within in the model. Any variables into which other variables flowed, known as endogenous variables, resulted in R^2 (Coefficient of Determination) values, with the flows resulting in beta weights.

Table 6.1 displays the results from the first step in PLS analysis for the conceptual model with Fruit & Vegetable Intake being the designated dietary outcome of interest. It should be noted that only relationships within the model, hypotheses one, three, four and eight, link social-cognitive constructs to the dietary outcome of interest. Thus, these relationships were the only ones that produced different results when the model was re-tested per each outcome of interest. Hypotheses two, five, six and seven do not flow into the dietary outcome of interest and thus remain the same as reported above per each re-rest, and will therefore not be included in subsequent tables relating to the first step of PLS analysis.

Table 6.1
Results of Initial PLS Analysis for Fruit and Vegetable Intake

Hypothesis	Beta Value	R^2
H1: Self-efficacy → Fruit & Vegetable Intake	0.33	0.48
H2: Self-efficacy → Behavioural Strategies	0.76	0.57
H3: Behavioural Strategies → Fruit & Vegetable Intake	0.27	0.48
H4: Situation → Fruit & Vegetable Intake	0.27	0.48
H5: Self-efficacy → Outcome Expectancies	0.59	0.31
H6: Situation → Self-efficacy	0.48	0.23
H7: Situation → Outcome Expectancies	-0.02	0.31
H8: Outcome Expectancies → Fruit & Vegetable Intake	-0.06	0.48

As seen in Table 6.1, the R^2 coefficient of determination for Fruit and Vegetable Intake is 0.48, indicating that the inflows into this variable, Self-Efficacy, Behavioural Strategies, Situation and Outcome Expectancies, together explain 48% of the variance in Fruit and Vegetable Intake. The Beta values indicate that Self-Efficacy has the strongest effect on Fruit and Vegetable Intake, with a β value of 0.33, followed by Behavioral Strategies and Situation, both with β values of 0.27. Lastly Outcome Expectancies had a β value of -0.06, indicating an inverse relationship, in which Fruit and Vegetable Intake accounts for a very slightly to variation in Outcome Expectancies.

In terms of relationships between constructs not directly related to the dietary outcome of interest, the R^2 coefficient of determination for Behavioural Strategies is 0.57, indicating that Self-Efficacy, the only inflow to this construct, accounts for 57% of variation in Behavioural Strategies. The R^2 coefficient of determination for Outcome Expectancies is 0.31, indicating that together Situation and Self-Efficacy account for 31% of variation with Outcome Expectancies. The Beta values indicate that Self-Efficacy has the strongest effect on Outcome Expectancies, with a β value of 0.59. The Beta value for Situation as related to Outcome Expectancies is only -0.02, indicating an inverse relationship between the two variables, in which Outcome Expectancies accounts for a minor amount of variation within Situation.

As seen in Table 6.2, the R^2 coefficient of determination for Grain Intake is 0.62, indicating that the inflows into this variable, Self-Efficacy, Behavioural Strategies, Situation and Outcome Expectancies, together explain 62% of the variance in Grain Intake. The Beta values indicate that Self-Efficacy has the strongest effect on Grain Intake, with a β value of 0.37, followed by Situation with a β value of 0.34, and Behavioural Strategies with a β value of 0.26. Lastly is Outcome Expectancies with a β value of -0.04, indicating an inverse

relationship, in which Grain Intake accounts for a very slightly to variation in Outcome Expectancies.

Table 6.2

Results of Initial PLS Analysis for Grain Intake

Hypothesis	Beta Value	R ²
H1: Self-efficacy → Grain Intake	0.37	0.62
H2: Self-efficacy → Behavioural Strategies	0.76	0.57
H3: Behavioural Strategies → Grain Intake	0.26	0.62
H4: Situation → Grain Intake	0.34	0.62
H5: Self-efficacy → Outcome Expectancies	0.59	0.31
H6: Situation → Self-efficacy	0.48	0.23
H7: Situation → Outcome Expectancies	-0.02	0.31
H8: Outcome Expectancies → Grain Intake	-0.04	0.62

As seen in Table 6.3, the R² coefficient of determination for Meat and Alternatives Intake is 0.68, indicating that the inflows into this variable, Self-Efficacy, Behavioural Strategies, Situation and Outcome Expectancies, together explain 68% of the variance in Meat and Alternatives Intake. The Beta values indicate that Self-Efficacy has the strongest effect on Meat and Alternatives Intake, with a β value of 0.42, followed by Situation with a β value of 0.37, and Behavioural Strategies with a β value of 0.21. Lastly is Outcome Expectancies with a β value of -0.03, indicating an inverse relationship, in which Meat and Alternatives Intake accounts for a very slightly to variation in Outcome Expectancies.

Table 6.3

Results of Initial PLS Analysis for Meat and Alternatives Intake

Hypothesis	Beta Value	R ²
H1: Self-efficacy → Meat & Alternatives Intake	0.42	0.68
H2: Self-efficacy → Behavioural Strategies	0.76	0.57
H3: Behavioural Strategies → Meat & Alternatives Intake	0.21	0.68
H4: Situation → Meat and Alternatives Intake	0.37	0.68
H5: Self-efficacy → Outcome Expectancies	0.59	0.31
H6: Situation → Self-efficacy	0.48	0.23
H7: Situation → Outcome Expectancies	-0.02	0.31
H8: Outcome Expectancies → Meat & Alternatives Intake	-0.03	0.68

As seen in Table 6.4, the R² coefficient of determination for Milk and Alternatives Intake is 0.68, indicating that the inflows into this variable, Self-Efficacy, Behavioural Strategies, Situation and Outcome Expectancies, together explain 68% of the variance in Milk and Alternatives Intake. The Beta values indicate that Self-Efficacy has the strongest effect on Milk and Alternatives Intake, with a β value of 0.42, followed by Situation with a β value of 0.37, and Behavioural Strategies with a β value of 0.21. Lastly is Outcome Expectancies with a β value of -0.03, indicating an inverse relationship, in which Milk and Alternatives Intake accounts for a very slightly to variation in Outcome Expectancies.

Table 6.4

Results of Initial PLS Analysis for Milk and Alternatives Intake

Hypothesis	Beta Value	R ²
H1: Self-efficacy → Milk & Alternatives Intake	0.42	0.68
H2: Self-efficacy → Behavioural Strategies	0.76	0.57
H3: Behavioural Strategies → Milk & Alternatives Intake	0.21	0.68
H4: Situation → Milk and Alternatives Intake	0.37	0.68
H5: Self-efficacy → Outcome Expectancies	0.59	0.31
H6: Situation → Self-efficacy	0.48	0.23
H7: Situation → Outcome Expectancies	-0.02	0.31
H8: Outcome Expectancies → Milk & Alternatives Intake	-0.03	0.68

As seen in Table 6.5, the R² coefficient of determination for Foods to Limit Intake is 0.68, indicating that the inflows into this variable, Self-Efficacy, Behavioural Strategies, Situation and Outcome Expectancies, together explain 68% of the variance in Foods to Limit Intake. The Beta values indicate that Self-Efficacy has the strongest effect on Foods to Limit Intake, with a β value of 0.41, followed by Situation with a β value of 0.37, and Behavioural Strategies with a β value of 0.22. Lastly is Outcome Expectancies with a β value of -0.03, indicating an inverse relationship, in which Foods to Limit Intake accounts for a very slightly to variation in Outcome Expectancies.

Table 6.5
Results of Initial PLS Analysis for Foods to Limit Intake

Hypothesis	Beta Value	R ²
H1: Self-efficacy → Foods to Limit Intake	0.41	0.68
H2: Self-efficacy → Behavioural Strategies	0.76	0.57
H3: Behavioural Strategies → Foods to Limit Intake	0.22	0.68
H4: Situation → Foods to Limit Intake	0.37	0.68
H5: Self-efficacy → Outcome Expectancies	0.59	0.31
H6: Situation → Self-efficacy	0.48	0.23
H7: Situation → Outcome Expectancies	-0.02	0.31
H8: Outcome Expectancies → Foods to Limit Intake	-0.03	0.68

PLS analysis: Statistical significance. PLS analysis measured the statistical significance of the relationships (hypotheses) in the conceptual model, using what is known as a bootstrap procedure. Through this procedure, a large number of subsamples, in this case 5000, were taken from the original sample with replacement “to give bootstrap standard errors, which in turn gives approximate T-values for significance testing of the structural path” (Wong, 2013). The resulting t-values indicated significant relationships when the calculated t-values exceeded the critical values of t. The degrees of freedom for this analysis was determined to be 178 (N=188-10 IVs), which in turn resulted in the Critical Value for t at a significance level of $p = 0.05$ to be 1.97, and at a significance level of $p = 0.01$ to be 2.60. The following tables display the t-value per each tested relationship. When the t-values exceeded either critical value, the tables display the level of significance (p-value) for the t-value.

Table 7.1

Results of PLS Bootstrap Analysis for Fruit and Vegetable Intake

Hypothesis	T-Value	Significance (P-Value)
H1: Self-efficacy → Fruit & Vegetable Intake	2.59	0.05
H2: Self-efficacy → Behavioural Strategies	9.80	0.01
H3: Behavioural Strategies → Fruit & Vegetable Intake	2.14	0.05
H4: Situation → Fruit & Vegetable	3.10	0.01
H5: Self-efficacy → Outcome Expectancies	4.29	0.01
H6: Situation → Self-efficacy	7.75	0.01
H7: Situation → Outcome Expectancies	1.05	ns
H8: Outcome Expectancies → Fruit & Vegetable	1.24	ns

In terms of the model with relation to Fruit and Vegetable Intake, Table 7.1 displays that the t-values for Self-Efficacy, Behavioural Strategies and Situation all exceed the determined critical values. The t-values for Self-Efficacy and Behavioural Strategies exceed the critical value of 1.97, indicating levels of significance at $p=0.05$, whereas the t-value for Situation exceeds the critical value of 2.60, indicating a level of significance at $p=0.01$. Conversely, for Outcome Expectancies leading to Fruit and Vegetable Intake, the t-value of 1.24 does not exceed either critical value, indicating that it is not statistically significant.

With regards to the constructs not linked to a dietary outcome of interest, the table displays that for Self-Efficacy leading to Behavioural Strategies, the t-value exceeds the critical value of 2.60, indicating a level of significance at $p=0.01$. Similarly, for Self-Efficacy leading to Outcome Expectancies, the t-value exceeds the critical value of 2.60, indicating a level of significance at $p=0.01$. However, with regards to Situation leading to Outcome Expectancies, the t-value of 1.05 does not exceed either critical value, indicating that it is not statistically significant.

Table 7.2

Results of PLS Bootstrap Analysis for Grain Intake

Hypothesis	T-Value	Significance (P-Value)
H1: Self-efficacy → Grain Intake	2.73	0.01
H3: Behavioural Strategies → Grain Intake	2.04	0.05
H4: Situation → Grain Intake	3.90	0.01
H8: Outcome Expectancies → Grain Intake	1.12	ns

Table 7.2 displays that the t-values for the constructs Self-Efficacy, Behavioural Strategies and Situation, as leading to Grain Intake, all exceed the determined critical values. The t-values for Self-Efficacy and Situation were 2.73 and 3.90 respectively, and both exceeded the critical value of 2.60, indicating statistical significance at the 0.01 level. The t-value for Behavioural Strategies was 2.04, exceeding the critical value of 1.97, indicating statistical significance at the 0.05 level. Conversely, the t-value for Outcome Expectancies leading to Grain Intake was 1.12, and therefore did not exceed either critical value, indicating that this relationship is not statistically significant.

Table 7.3

Results of PLS Bootstrap Analysis for Meat and Alternatives Intake

Hypothesis	T-Value	Significance (P-Value)
H1: Self-efficacy → Meat and Alternative Intake	3.13	0.01
H3: Behavioural Strategies → Meat and Alternative Intake	1.83	ns
H4: Situation → Meat and Alternative Intake	4.39	0.01
H8: Outcome Expectancies → Meat and Alternative Intake	1.06	ns

Table 7.3 displays that the t-values for the constructs Self-Efficacy and Situation, as leading to Meat and Alternative Intake, exceeded the determined critical values. The t-values for Self-Efficacy and Situation were 3.13 and 4.39 respectively, therefore both exceeded the critical value of 2.60, indicating statistical significance at the 0.01 level. Conversely, the t-

values for Behavioural Strategies and Outcome Expectancies leading to Meat and Alternatives Intake were 1.83 and 1.06, therefore neither exceeded the critical values, indicating that these relationships are not statistically significant.

Table 7.4
Results of PLS Bootstrap Analysis for Milk and Alternatives Intake

Hypothesis	T-Value	Significance (P-Value)
H1: Self-efficacy → Milk and Alternative Intake	3.10	0.01
H3: Behavioural Strategies → Milk and Alternative Intake	1.75	ns
H4: Situation → Milk and Alternative Intake	4.45	0.01
H8: Outcome Expectancies → Milk and Alternative Intake	1.01	ns

Table 7.4 displays that the t-values for the constructs Self-Efficacy and Situation, as leading to Milk and Alternative Intake, exceeded the determined critical values. The t-values for Self-Efficacy and Situation were 3.10 and 4.45 respectively, therefore both exceeded the critical value of 2.60, indicating statistical significance at the 0.01 level. Conversely, the t-values for Behavioural Strategies and Outcome Expectancies leading to Milk and Alternatives Intake were 1.75 and 1.01, therefore neither exceeded the critical values, indicating that these relationships are not statistically significant.

Table 7.5
Results of PLS Bootstrap Analysis for Foods to Limit Intake

Hypothesis	T-Value	Significance (P-Value)
H1: Self-efficacy → Foods to Limit Intake	3.06	0.01
H3: Behavioural Strategies → Foods to Limit Intake	1.87	ns
H4: Situation → Foods to Limit Intake	4.36	0.01
H8: Outcome Expectancies → Foods to Limit Intake	0.97	ns

Table 7.5 displays that the t-values for the constructs Self-Efficacy and Situation, as leading to Foods to Limit Intake, exceeded the determined critical values. The t-values for Self-Efficacy and Situation were 3.06 and 4.36 respectively, therefore both exceeded the critical value of 2.60, indicating statistical significance at the 0.01 level. Conversely, the t-values for Behavioural Strategies and Outcome Expectancies leading to Foods to Limit Intake were 1.87 and 0.97, therefore neither exceeded the critical values, indicating that these relationships are not statistically significant.

Overall Hypotheses Testing

Constructs not linked to dietary intake. To determine whether or not an increased self-efficacy contributes to an increase in students' behavioural strategies to eat a healthy diet, the following null and alternative hypotheses were tested:

H2₀: As self-efficacy increases, students' behavioural strategies for eating a healthy diet will not change.

H2_A: As self-efficacy increases, students' behavioural strategies for eating a healthy diet will increase

The reported results support this hypothesis that as self-efficacy increases, students' behavioural strategies for eating a healthy diet will increase. The R² value for Behavioural Strategies of 0.57 indicates that self-efficacy explains 57% of the variation in behavioural strategies. The beta value of 0.76 confirms that there is a positive correlation between self-efficacy and students' behavioural strategies for healthy eating. Thus, the results indicate that as students' self-efficacy increases, their behavioural strategies for healthy eating will increase. The corresponding t-value to this hypotheses was 9.80, indicating that the relationship is statistically significant at the p=0.01 level. As such, the null hypothesis was rejected.

To determine whether or not an increased self-efficacy contributes to an increase in students' outcome expectancies for eating a healthy diet, the following null and alternative hypotheses were tested:

H5₀: As self-efficacy increases, students' outcome expectancies for eating a healthy diet will not change.

H5_A: As self-efficacy increases, students' outcome expectancies for eating a healthy diet will increase.

The reported results support this hypothesis that as self-efficacy increases, students' outcome expectancies for eating a healthy diet will increase. The R² value for Outcome Expectancies of 0.31 indicates that together self-efficacy and situation explain 31% of the variation in students' outcome expectancies. The beta value of 0.59 confirms that there is a positive correlation between self-efficacy and students' behavioural strategies for healthy eating. Thus, the results indicate that as students' self-efficacy increases, their outcome expectancies for healthy eating will increase. The corresponding t-value to this hypotheses was 4.29, indicating that the relationship is statistically significant at the p=0.01 level. As such, the null hypothesis was rejected.

To determine whether or not an increased perception of students' environments as conducive to healthy eating contributes to an increased self-efficacy, the following null and alternative hypotheses were tested.

H6₀: As students perceive their situation to be more conducive to eating a healthy diet, their self-efficacy for eating a healthy diet will not change.

H6_A: As students perceive their situation to be more conducive to eating a healthy diet, their self-efficacy for eating a healthy diet will increase.

The reported results support this hypothesis that as students' perception of their environment as conducive to healthy eating increases, students' self-efficacy to eat a healthy

diet increases. The R^2 value for self-efficacy of 0.23 indicates that self-efficacy explains 23% of the variation in behavioural strategies. The beta value of 0.48 confirms that there is a positive correlation between students' perception of their environment and students' self-efficacy for healthy eating. Thus, the results indicate that as students' perceptions of their environment as conducive to healthy eating increases, their self-efficacy for healthy eating will increase. The corresponding t-value to this hypothesis was 7.75, indicating that the relationship is statistically significant at the $p=0.01$ level. As such, the null hypothesis was rejected.

To determine whether or not an increase in students' perception of their environment as conducive to healthy eating contributes to an increase in students' outcome expectancies for eating a healthy diet, the following null and alternative hypotheses were tested:

H7₀: As students perceive their situation to be more conducive to eating a healthy diet, their outcome expectancies for eating a healthy diet will not change.

H7_A: As students perceive their situation to be more conducive to eating a healthy diet, their outcome expectancies for eating a healthy diet will increase.

The reported results do not support this hypothesis that as students' perception of their environment as conducive to healthy eating increases, students' outcome expectancies for eating a healthy diet will increase. The R^2 value for Outcome Expectancies of 0.31 indicates that together self-efficacy and situation explain 31% of the variation in students' outcome expectancies. However, the beta value of -0.02 indicates a minor negative correlation between situation and outcome expectancies. That is, the negative beta value indicates that as outcome expectancies increase, students' perception of their environment as conducive to healthy eating decreases. This relationship, however, is not statistically significant as the t-value of 1.05 falls below both critical values indicating significance at the $p=0.01$ and $p=0.05$ levels. As such, the null hypothesis was not rejected.

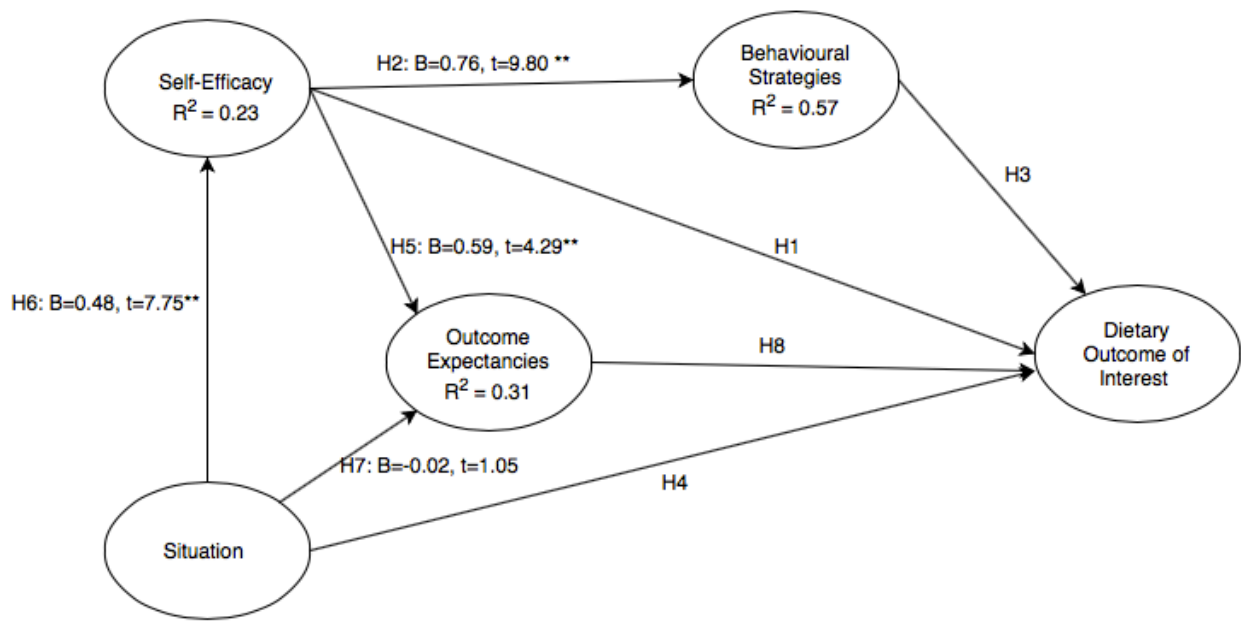


Figure 8. Formative model, excluding links to Dietary Outcomes of Interest, annotated with overall results from PLS analysis (*Significant at 0.05 level, ** Significant at 0.01 level)

Fruits and vegetables. To determine whether or not an increased self-efficacy contributes to an increased intake of fruits and vegetables, the following null and alternative hypotheses were tested:

$H1_0$: As self-efficacy increases, students' consumption of vegetables and fruit will not change.

$H2_A$: As self-efficacy increases, students' consumption of vegetables and fruit will increase.

The reported results support this first hypothesis that as self-efficacy increases, students' consume more daily servings of fruits and vegetables. The R^2 value for Fruit and Vegetable Intake of 0.48 shows that together four variables, self-efficacy included, explains 48% of variation in students' fruit and vegetable consumption. The beta value of 0.33 specifically indicates a positive correlation between self-efficacy and fruit and vegetable intake. Thus, the results show that as self-efficacy increases, students' consumption of fruits

and vegetables increases. The corresponding t-value for this hypothesis was 2.59, indicating that the relationship is statistically significant at the $p=0.05$ level. As such, the null hypothesis was rejected.

To determine whether or not students' behavioural strategies for eating a healthy diet contribute to an increased intake of fruits and vegetables, the following null and alternative hypotheses were tested:

H3₀: As students' behavioural strategies for eating a healthy diet increase, students' consumption of vegetables and fruit will not change.

H4_A: As students' behavioural strategies for eating a healthy diet increase, students' consumption of vegetables and fruit will increase.

The reported results support this hypothesis that as behavioural strategies increase, students' daily consumption of fruits and vegetables increases. As previously stated, the R^2 value for Fruit and Vegetable Intake of 0.48 shows that together four variables, behavioural strategies included, explains 48% of variation in students' fruit and vegetable consumption. The beta value of 0.27 indicates a positive correlation between students' behavioural strategies and their daily consumption of fruits and vegetables. The corresponding t-value to this hypotheses was 2.14, indicating that the relationship is statistically significant at the $p=0.05$ level. As such, the null hypothesis was rejected.

To determine whether or not students' perception of their environment contributes to an increased intake of fruits and vegetables, the following null and alternative hypotheses were tested:

H4₀: As students perceive their situation to be more conducive to eating a healthy diet, students' consumption of vegetables and fruit will not change.

H4_A: As students perceive their situation to be more conducive to eating a healthy diet, students' consumption of vegetables and fruit will increase.

The reported results support this hypothesis that as students' perception of their environment as conducive to healthy eating increases, students' daily consumption of fruits and vegetables increases. As previously stated, the R^2 value for Fruit and Vegetable Intake of 0.48 shows that together four variables, situation included, explains 48% of variation in students' fruit and vegetable consumption. The beta value of 0.27 indicates a positive correlation between students' behavioural strategies and their daily consumption of fruits and vegetables. The corresponding t-value for this hypothesis was 3.10, indicating that the relationship is statistically significant at the $p=0.01$ level. As such, the null hypothesis was rejected.

To determine whether or not students' outcome expectancies for eating a healthy diet contributes to an increased intake of fruits and vegetables, the following null and alternative hypotheses were tested:

H8₀: As students' outcomes expectancies for eating a healthy diet increase, students' consumption of vegetables and fruit will not change

H8_A: As students' outcomes expectancies for eating a healthy diet increase, students' consumption of vegetables and fruit will increase.

The reported results do not support this hypothesis that as outcome expectancies increase, students' daily consumption of fruits and vegetables increases. As previously stated, the R^2 value for Fruit and Vegetable Intake of 0.48 shows that together four variables, outcome expectancies included, explains 48% of variation in students' fruit and vegetable consumption. However, the beta value of -0.06 indicates a minor negative correlation between outcome expectancies and fruit and vegetable intake. That is, the negative beta value indicates that as outcome expectancies increase, fruit and vegetable intake decreases. This relationship, however, is not statistically significant as the t-value of 1.24 falls below the critical values. As such, the null hypothesis was not rejected.

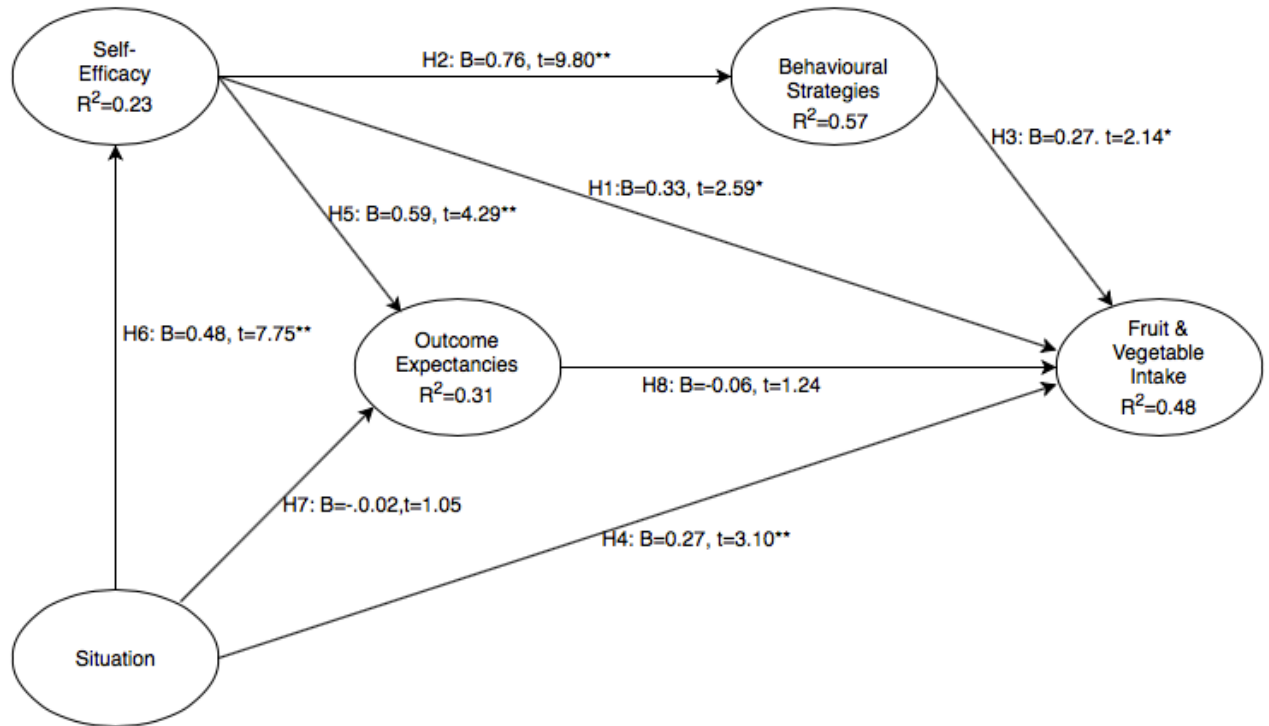


Figure 9. Formative model, as linked to Fruit and Vegetable Intake, annotated with overall results from PLS analysis (*Significant at 0.05 level, ** Significant at 0.01 level)

Grain products. To determine whether or not an increased self-efficacy contributes to an increased intake of grains, the following null and alternative hypotheses were tested:

H1₀: As self-efficacy increases, students' consumption of grain products will not change.

H1_A: As self-efficacy increases, students' consumption of grain products increase.

The reported results support this first hypothesis that as self-efficacy increases, students' consume more daily servings of grain products. The R² value for Grain Intake of 0.62 shows that together four variables, self-efficacy included, explains 62% of variation in students' grain product consumption. The beta value of 0.37 specifically indicates a positive correlation between self-efficacy and fruit and vegetable intake. Thus, the results show that as self-efficacy increases, students' consumption of grain products increases. The corresponding t-value for this hypothesis was 2.73, indicating that the relationship is statistically significant at the 0.01 level. As such, the null hypothesis was rejected.

To determine whether or not students' behavioural strategies for eating a healthy diet contribute to an increased intake of grain products, the following null and alternative hypotheses were tested:

H3₀: As behavioural strategies for eating a healthy diet increase, students' consumption of grain products will not change.

H3_A: As behavioural strategies for eating a healthy diet increase, students' consumption of grain products will increase.

The reported results support this hypothesis that as behavioural strategies increase, students' daily consumption of grain products. As previously stated, the R² value for Grain Intake of 0.62 shows that together four variables, behavioural strategies included, explains 62% of variation in students' grain product consumption. The beta value of 0.26 indicates a positive correlation between students' behavioural strategies and their daily consumption of grain products. The corresponding t-value to this hypothesis was 2.04, indicating that the relationship is statistically significant at the 0.05 level. As such, the null hypothesis was rejected.

To determine whether or not students' perception of their environment contributes to an increased intake of grain products, the following null and alternative hypotheses were tested:

H4₀: As students' perception of their situation/environment as conducive to eating a healthy diet increases, students' consumption of grain products will not change.

H4_A: As students' perception of their situation/environment as conducive to eating a healthy diet increases, students' consumption of grain products will increase.

The reported results support this hypothesis that as students' perception of their environment as conducive to healthy eating increases, students' daily consumption of grain products increases. As previously stated, the R² value for Grain Intake of 0.62 shows that

together four variables, situation included, explains 62% of variation in students' grain product consumption. The beta value of 0.34 indicates a positive correlation between students' behavioural strategies and their daily consumption of grain products. The corresponding t-value for this hypothesis was 3.90, indicating that the relationship is statistically significant at the 0.01 level. As such, the null hypothesis was rejected.

To determine whether or not students' outcome expectancies for eating a healthy diet contributes to an increased intake of grain products, the following null and alternative hypotheses were tested:

H8₀: As students' outcome expectancies for eating a healthy diet increases, students' consumption of grain products will not change.

H8_A: As students' outcome expectancies for eating a healthy diet increases, students' consumption of grain products will increase.

The reported results do not support this hypothesis that as outcome expectancies increase, students' daily consumption of grain products increases. As previously stated, the R² value for Grain Intake of 0.62 shows that together four variables, outcome expectancies included, explains 62% of variation in students' grain product consumption. However, the beta value of -0.04 indicates a minor negative correlation between outcome expectancies and grain product intake. That is, the negative beta value indicates that as outcome expectancies increase, grain product intake decreases. This relationship, however, is not statistically significant as the t-value of 1.24 falls below the critical values. As such, the null hypothesis was not rejected.

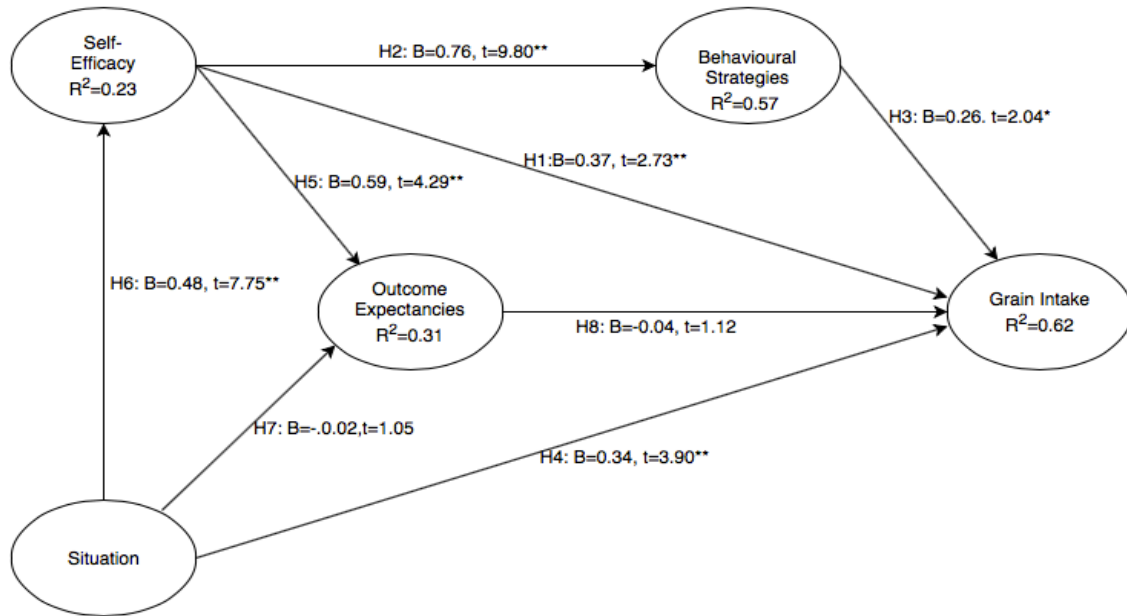


Figure 10. Formative model, as linked to Grain Intake, annotated with overall results from PLS analysis (*Significant at 0.05 level, ** Significant at 0.01 level)

Meat and alternatives. To determine whether or not an increased self-efficacy contributes to an increased intake of meat and alternatives, the following null and alternative hypotheses were tested:

H1₀: As self-efficacy increases, students' consumption of meat and alternatives will not change.

H1_A: As self-efficacy increases, students' consumption of meat and alternatives will increase.

The reported results support this first hypothesis that as self-efficacy increases, students' consume more daily servings of meat and alternatives. The R^2 value for Meat and Alternatives Intake of 0.68 shows that together four variables, self-efficacy included, explains 68% of variation in students' meat and alternatives consumption. The beta value of 0.42 specifically indicates a positive correlation between self-efficacy and meat and alternatives intake. Thus, the results show that as self-efficacy increases, students' consumption of meat and alternatives increases. The corresponding t-value for this hypothesis was 3.13, indicating

that the relationship is statistically significant at the 0.01 level. As such, the null hypothesis was rejected.

To determine whether or not students' behavioural strategies for eating a healthy diet contribute to an increased intake of meat and alternatives, the following null and alternative hypotheses were tested:

H3₀: As behavioural strategies for eating a healthy diet increase, students' consumption of meat and alternatives will not change.

H3_A: As behavioural strategies for eating a healthy diet increase, students' consumption of meat and alternatives will increase.

The reported results support this hypothesis that as behavioural strategies increase, students' daily consumption of meat and alternatives. As previously stated, the R² value for Meat and Alternative Intake of 0.68 shows that together four variables, behavioural strategies included, explains 68% of variation in students' meat and alternatives consumption. The beta value of 0.26 indicates a positive correlation between students' behavioural strategies and their daily consumption of meat and alternatives. However, the corresponding t-value to this hypothesis was 1.83, indicating that the relationship is not statistically significant. As such, the null hypothesis was not rejected.

To determine whether or not students' perception of their environment contributes to an increased intake of meat and alternatives, the following null and alternative hypotheses were tested:

H4₀: As students' perception of their situation/environment as conducive to eating a healthy diet increases, students' consumption of meat and alternatives will not change.

H4_A: As students' perception of their situation/environment as conducive to eating a healthy diet increases, students' consumption of meat and alternatives will increase.

The reported results support this hypothesis that as students' perception of their environment as conducive to healthy eating increases, students' daily consumption of meat and alternatives increases. As previously stated, the R^2 value for Meat and Alternative Intake of 0.68 shows that together four variables, situation included, explains 68% of variation in students' meat and alternatives consumption. The beta value of 0.37 indicates a positive correlation between students' behavioural strategies and their daily consumption of grain products. The corresponding t-value for this hypothesis was 4.39, indicating that the relationship is statistically significant at the 0.01 level. As such, the null hypothesis was rejected.

To determine whether or not students' outcome expectancies for eating a healthy diet contributes to an increased intake of meat and alternatives, the following null and alternative hypotheses were tested:

H8₀: As students' outcome expectancies for eating a healthy diet increases, students' consumption of meat and alternatives will not change.

H8_A: As students' outcome expectancies for eating a healthy diet increases, students' consumption of meat and alternatives will increase.

The reported results do not support this hypothesis that as outcome expectancies increase, students' daily consumption of meat and alternatives increases. As previously stated, the R^2 value for Meat and Alternatives Intake of 0.68 shows that together four variables, outcome expectancies included, explains 68% of variation in students' meat and alternatives consumption. However, the beta value of -0.03 indicates a minor negative correlation between outcome expectancies and consumption of meat and alternatives. That is, the negative beta value indicates that as outcome expectancies increase, meat and alternatives intake decreases. This relationship, however, is not statistically significant as the t-value of 1.06 falls below the critical values indicating. As such, the null hypothesis was not rejected.

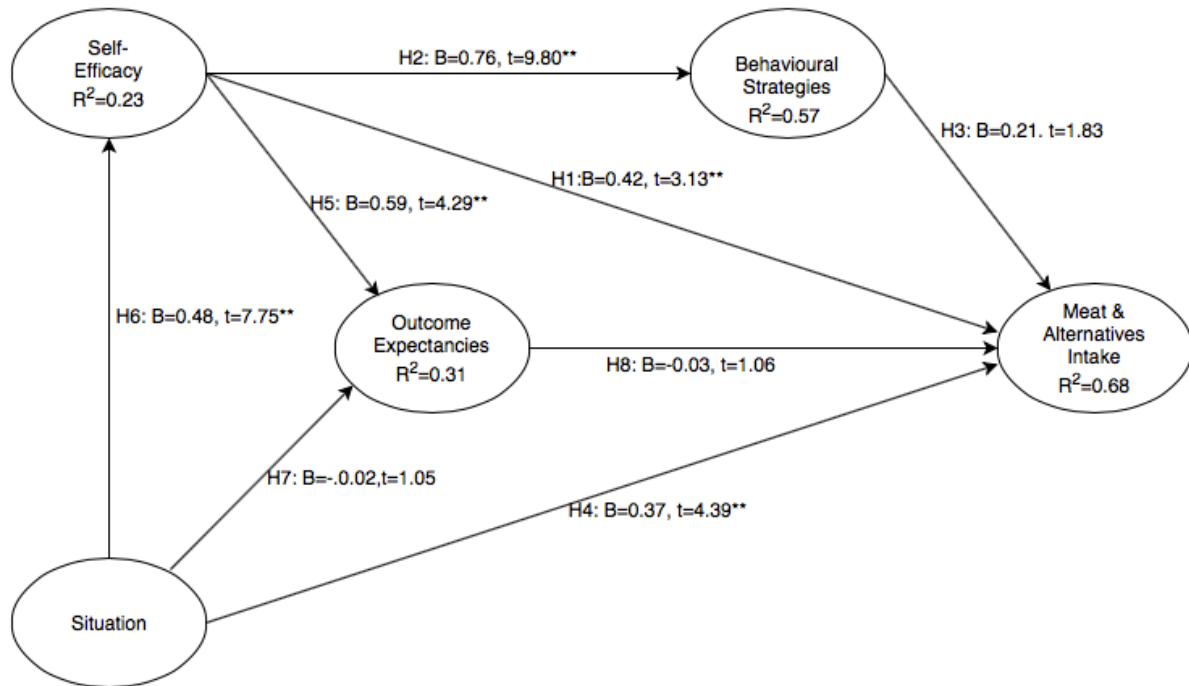


Figure 11. Formative model, as linked to Meat and Alternatives Intake, annotated with overall results from PLS analysis (*Significant at 0.05 level, ** Significant at 0.01 level)

Milk and alternatives. To determine whether or not an increased self-efficacy contributes to an increased intake of milk and alternatives, the following null and alternative hypotheses were tested:

H1₀: As self-efficacy increases, students' consumption of milk and alternatives will not change.

H1_A: As self-efficacy increases, students' consumption of milk and alternatives will increase.

The reported results support this first hypothesis that as self-efficacy increases, students' consume more daily servings of milk and alternatives. The R^2 value for Milk and Alternatives Intake of 0.68 shows that together four variables, self-efficacy included, explains 68% of variation in students' meat and alternatives consumption. The beta value of 0.42 specifically indicates a positive correlation between self-efficacy and meat and alternatives intake. Thus, the results show that as self-efficacy increases, students' consumption of meat and alternatives increases. The corresponding t-value for this hypothesis was 3.10, indicating

that the relationship is statistically significant at the 0.01 level. As such, the null hypothesis was rejected.

To determine whether or not students' behavioural strategies for eating a healthy diet contribute to an increased intake of milk and alternatives, the following null and alternative hypotheses were tested:

H3₀: As behavioural strategies for eating a healthy diet increase, students' consumption of milk and alternatives will not change.

H3_A: As behavioural strategies for eating a healthy diet increase, students' consumption of milk and alternatives will increase.

The reported results support this hypothesis that as behavioural strategies increase, students' daily consumption of meat and alternatives. As previously stated, the R² value for Milk and Alternative Intake of 0.68 shows that together four variables, behavioural strategies included, explains 68% of variation in students' meat and alternatives consumption. The beta value of 0.21 indicates a positive correlation between students' behavioural strategies and their daily consumption of meat and alternatives. However, the corresponding t-value to this hypothesis was 1.75, indicating that the relationship is not statistically significant. As such, the null hypothesis was not rejected.

To determine whether or not students' perception of their environment contributes to an increased intake of milk and alternatives, the following null and alternative hypotheses were tested:

H4₀: As students' perception of their situation/environment as conducive to eating a healthy diet increases, students' consumption of milk and alternatives will not change.

H4_A: As students' perception of their situation/environment as conducive to eating a healthy diet increases, students' consumption of milk and alternatives will increase.

The reported results support this hypothesis that as students' perception of their environment as conducive to healthy eating increases, students' daily consumption of milk and alternatives increases. As previously stated, the R^2 value for Milk and Alternative Intake of 0.68 shows that together four variables, situation included, explains 68% of variation in students' milk and alternatives consumption. The beta value of 0.37 indicates a positive correlation between students' behavioural strategies and their daily consumption of milk and alternatives. The corresponding t-value for this hypothesis was 4.45, indicating that the relationship is statistically significant at the 0.01 level. As such, the null hypothesis was rejected.

To determine whether or not students' outcome expectancies for eating a healthy diet contributes to an increased intake of milk and alternatives, the following null and alternative hypotheses were tested:

H8₀: As students' outcome expectancies for eating a healthy diet increases, students' consumption of milk and alternatives will not change.

H8_A: As students' outcome expectancies for eating a healthy diet increases, students' consumption of milk and alternatives will increase.

The reported results do not support this hypothesis that as outcome expectancies increase, students' daily consumption of milk and alternatives increases. As previously stated, the R^2 value for Milk and Alternatives Intake of 0.68 shows that together four variables, outcome expectancies included, explains 68% of variation in students' milk and alternatives consumption. However, the beta value of -0.03 indicates a minor negative correlation between outcome expectancies and consumption of meat and alternatives. That is, the negative beta value indicates that as outcome expectancies increase, meat and alternatives intake decreases. This relationship, however, is not statistically significant as the t-value of 1.01 falls below the critical values indicating. As such, the null hypothesis was not rejected.

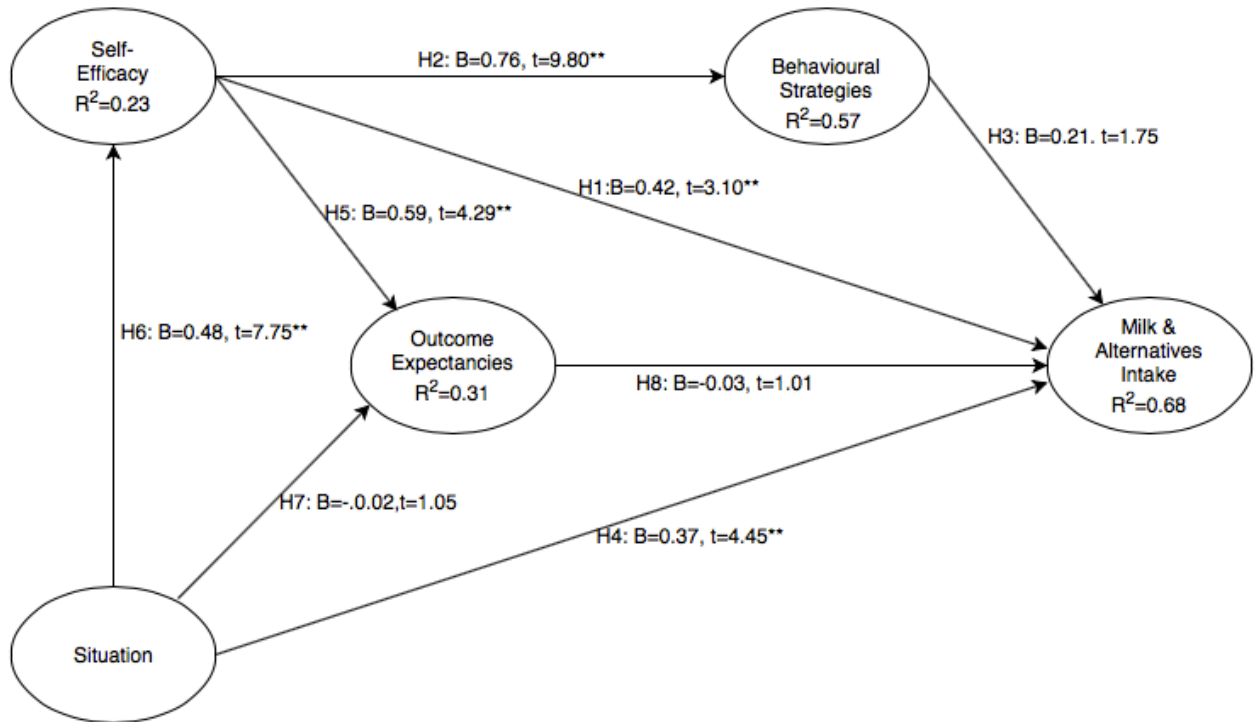


Figure 12. Formative model, as linked to Milk and Alternatives Intake, annotated with overall results from PLS analysis (*Significant at 0.05 level, ** Significant at 0.01 level)

Foods to limit. To determine whether or not an increased self-efficacy contributes to a decreased intake of foods to limit, the following null and alternative hypotheses were tested:

H1₀: As self-efficacy increases, students' consumption of "foods to limit" will not change.

H1_A: As self-efficacy increases, students' consumption of "foods to limit" will decrease.

The reported results do not support this first hypothesis that as self-efficacy increases, students' consume less daily servings of foods to limit. The R² value for Foods to Limit Intake of 0.68 shows that together four variables, self-efficacy included, explains 68% of variation in students' meat and alternatives consumption. However, the beta value of 0.41 specifically indicates a positive correlation between self-efficacy and meat and alternatives intake, rather than an inverse relationship as hypothesized. Thus, the results show that as self-efficacy increases, students' consumption of foods to limit increases. The corresponding t-value for

this hypothesis was 3.13, indicating that the relationship is statistically significant at the 0.01 level, but in the opposite direction as hypothesized. As such, the null hypothesis was rejected.

To determine whether or not students' behavioural strategies for eating a healthy diet contribute to a decreased intake of foods to limit, the following null and alternative hypotheses were tested:

H3₀: As behavioural strategies for eating a healthy diet increase, students' consumption of "foods to limit" will not change.

H3_A: As behavioural strategies for eating a healthy diet increase, students' consumption of "foods to limit" will decrease.

The reported results do not support this hypothesis that as behavioural strategies increase, students' daily consumption of foods to limit decreases. As previously stated, the R² value for Foods to Limit Intake of 0.68 shows that together four variables, behavioural strategies included, explains 68% of variation in students' consumption of foods to limit. However, the beta value of 0.22 indicates a positive correlation between students' behavioural strategies and their daily consumption of foods to limit, rather than the inverse relationship hypothesized. That is, as behavioural strategies increase, consumption of foods to limit also increases. The corresponding t-value to this hypothesis was 1.87, indicating that the resulting inverse relationship is not statistically significant. As such, the null hypothesis was not rejected.

To determine whether or not students' perception of their environment contributes to a decreased intake of foods to limit, the following null and alternative hypotheses were tested:

H4₀: As students' perception of their situation/environment as conducive to eating a healthy diet increases, students' consumption of "foods to limit" will not change.

H4_A: As students' perception of their situation/environment as conducive to eating a healthy diet increases, students' consumption of "foods to limit" will decrease.

The reported results support this hypothesis that as students' perception of their environment as conducive to healthy eating increases, students' daily consumption of foods to limit decreases. As previously stated, the R^2 value for Foods to Limit Intake of 0.68 shows that together four variables, situation included, explains 68% of variation in students' consumption of foods to limit. The beta value of 0.37 indicates a positive correlation between students' perception of their situation/environment as conducive to healthy eating and their daily consumption of foods to limit, rather than the inverse relationship hypothesized. The corresponding t-value for this hypothesis was 4.36, indicating that the resulting inverse relationship is statistically significant at the 0.01 level. As such, the Null hypothesis is rejected, with the observed change occurring in the opposite direction as hypothesized.

To determine whether or not students' outcome expectancies for eating a healthy diet contributes to a decreased intake of foods to limit, the following null and alternative hypotheses were tested:

H8₀: As students' outcome expectancies for eating a healthy diet increases, students' consumption of "foods to limit" will not change.

H8_A: As students' outcome expectancies for eating a healthy diet increases, students' consumption of "foods to limit" will decrease.

The reported results do not support this hypothesis that as outcome expectancies increase, students' daily consumption of foods to limit decreases. As previously stated, the R^2 value for Foods to Limit Intake of 0.68 shows that together four variables, outcome expectancies included, explains 68% of variation in students' consumption of foods to limit. The beta value of -0.03 indicates a minor negative correlation between outcome expectancies and consumption of meat and alternatives. That is, the negative beta value indicates that as hypothesized, when outcome expectancies increase, consumption of foods to limit decreases.

This relationship, however, is not statistically significant as the t-value of 0.97 falls below the critical values. As such, the null hypothesis was not rejected.

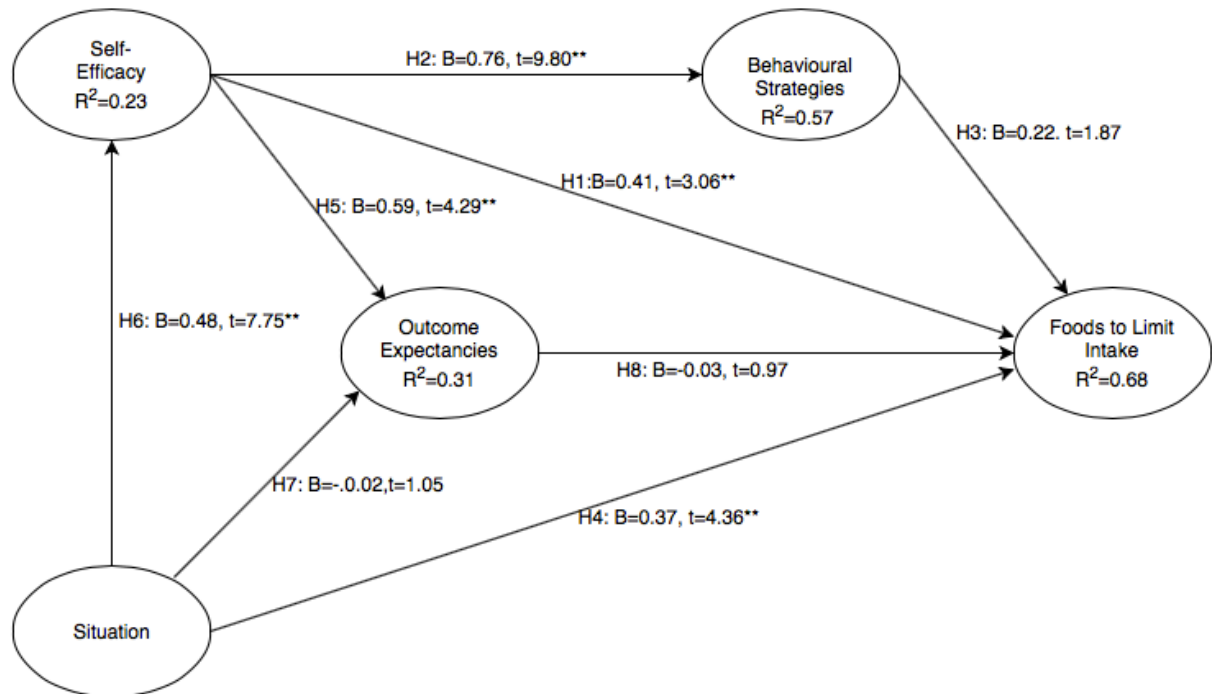


Figure 13. Formative model, as linked to Foods to Limit Intake, annotated with overall results from PLS analysis (*Significant at 0.05 level, ** Significant at 0.01 level)

Chapter 6: Discussion

The aim of this thesis was to assess the effectiveness of the Social Cognitive Theory in explaining the dietary behaviours of a sample of university students. The SCT is a broad, and limitedly validated theory (National Cancer Institute, 2012) and thus the rationale for this thesis was that via testing a conceptual model of the SCT with this particular sample, it could be validated and refined for use in guiding interventions targeting university students. The SCT conceptual model explained 48% of the variance in students' vegetable and fruit intake, 62% of the variance in grain intake, and 68% of the variance in students' intake of meat and alternatives, milk and alternatives and foods to limit. While there is no one widely accepted, detailed model of the SCT (beyond that seen in Figure 3), these final models with the best-fit indices differ from the model proposed by Bandura (2004), as well as the model proposed and tested by Lubans et al. (2012). These differences indicate that the final models have indeed been altered/refined, tailored to explaining dietary behaviours of university students, while still falling within the overarching SCT.

Social-Cognitive Constructs Linked to Dietary Outcomes of Interest

Self-efficacy. Self-efficacy refers to the “conviction that one can successfully execute the behaviour required to produce the outcomes” (Bandura, 1997). The construct of self-efficacy is key within multiple health behaviour theories, including the SCT, represented within the realm of “cognitive factors”. With regards to dietary behaviour, it was hypothesized that as students' self-efficacy for eating a healthy diet increased, their intake of the food groups promoted by CFG would increase; Vegetables and Fruits; Grain Products; Meat and Alternatives; Milk and Alternatives, while their intake of Foods to Limit would decrease.

Hypothesis one, positing that an increased in self-efficacy was associated with an increase in consumption of dietary outcomes of interest, was confirmed for the following food

groups: Vegetables and Fruits; Grain Products; Meat and Alternatives; Milk and Alternatives. That is, for the included sample of university students, Self-Efficacy was found to be a statistically significant predictor of students' intake of food items from said food groups. Self-efficacy is one of the most heavily researched constructs of the SCT, and was one of only two constructs within this thesis to have a statistically significantly positive correlation to all examined food groups. This indicates that self-efficacy is one of the strongest correlates within the SCT with regards to the current sample, which is congruent with the findings from Lubans et al. (2012). Lubans et al. (2012) tested the ability of the SCT to explain dietary intake in a sample of adolescent girls, and was the study from which the conceptual model of the SCT arose for use of analysis in this thesis. Similar to the findings from this thesis, Lubans et al. (2012) reported that self-efficacy was significantly correlated with dietary behaviour (percentage energy from saturated fat, core food and non-core food intake) in each model tested. Unlike this thesis, the Lubans et al. (2012) study did not look at the food groups individually but rather used the outcome of "core foods". The study's findings remain relevant to, but less specific than is the aim of this thesis, as "core foods" was comprised of items such as "breads and cereals, fruit and vegetables, dairy foods and meat and/or alternatives". Thus, this one outcome encompassed the four CFG food groups used in this thesis.

Such results are also congruent with those of Pearson, Ball and Crawford (2011), who analyzed associations between individual, social and physical environmental factors, and changes in dietary behaviours of adolescents over a two-year period. While this study only focused on vegetable and fruit intake, its results remain relevant to this thesis and the researchers found that dietary self-efficacy was positively associated with vegetable and fruit intake. Further supporting the significance of the relationship between self-efficacy and fruit and vegetable intake are the results from Luszczynska, Tryburcy and Schwarzer (2007), who

examined the implementation of an intervention to increase self-efficacy on fruit and vegetable consumption. Two interventions were implemented among 200 adults; one targeting only self-efficacy, while the other combining efforts to increase self-efficacy with action planning skills. The results were that in both intervention groups, an increase in self-efficacy predicted an increase in fruit and vegetable consumption. The aforementioned studies therefore support the findings from this study that among the population of university students, there is a sound rationale for implementing interventions/programs aimed at increasing dietary self-efficacy as a means of increasing students' intake of fruits and vegetables, along with grain products, meat and alternatives and milk and alternatives.

Despite the above congruencies between this thesis and existing research with regards to self-efficacy and dietary intake, inconsistencies arise when examining the outcome of Foods to Limit. It was hypothesized that as students' self-efficacy increased, their intake of Foods to Limit, i.e. "unhealthy" foods or snacks such as cakes, candy and pizza, would decrease. This was not the case, as the results indicated a statistically significant positive relationship between self-efficacy and intake of Foods to Limit, denoting that within the population of university students, an increased self-efficacy for eating healthy foods also predicted an increased intake of Foods to Limit. This result is contradicted by the findings of Lubans et al. (2012), and Pearson et al. (2011) which were that self-efficacy was inversely associated with energy-dense (high in fat and/or sugar), nutrient-poor items, such as cakes, cookies, candy.

The inconsistencies between the relationship of self-efficacy and foods to limit as found in this thesis and the existing research may be explained by characteristic differences among the samples. That is, both Lubans et al. (2012) and Pearson et al. (2011) used samples of adolescents, whereas this thesis used a sample of university students. It can thus be assumed that there are differences between how these two groups make decisions around their

dietary behaviours, which in fact relates to the purpose of this thesis; refining/tailoring the SCT as related to the dietary intake of university students specifically. One postulation is that the environment experienced by university students, in which research indicates that food items included in the list of Foods to Limit are very easily available, nullifies or weakens one of the effects of a high dietary self-efficacy. That is, while the results of this thesis indicate that a high self-efficacy predicts, for example, an increased intake in fruits and vegetables, it is possible that this increased self-efficacy is not sufficient to also simultaneously decrease students' intake of unhealthy foods. Should this be the case, it would be an exemplary example of the reciprocal relationship between the constructs of the SCT; self-efficacy and the environment (availability of unhealthy foods) both impacting, in different ways, subsequent dietary intake. As such, the indication is that interventions focusing on an increase in self-efficacy, with the aim being to decrease students' intake of foods to limit, may not be an effective course of action.

It should also be noted that students' mean daily intake of servings of Foods to Limit was only 1.53. This reported average intake of approximately one and a half servings of unhealthy food items daily appears relatively low, thus perhaps an increased self-efficacy may have the hypothesized impact in samples with a greater baseline intake of foods to limit. Lastly, the potential implication regarding students' perception of the items included in the foods to limit grouping as healthy should be noted. That is, a rationale for any unexpected results concerning this food group could further be explained by the possibility of students perceiving French fries for example (including oven baked fries, and those made from sweet potato), as healthy.

Behavioural strategies. Within this thesis, behavioural strategies/skills was conceptualized as students' meal preparation/cooking skills and grocery shopping skills. The results were that the positive correlations between Behavioural Strategies and Vegetable and

Fruit Intake and Grain Intake were statistically significant. Thus, students who reported being more confident in their meal preparation and grocery shopping skills, had increased intakes of fruits and vegetables and grain products. While a positive correlation was also found between this construct and the remaining foods groups, none were statistically significant.

The link between food preparation skills and intake of fruits and vegetables and whole grain products as found in this thesis are corroborated by findings from Larson et al. (2006), who examined food preparation behaviours, cooking skills and diet quality among young adults. The authors found that inadequate cooking skills were a barrier for 23% of males and 18% of females, and that the majority of the food-preparation behaviours (e.g. writing a grocery list, buying fresh vegetables, preparing a dinner with chicken, fish or vegetables) were not performed by most participants even weekly. Similar to this thesis, Larson et al. (2007) reported that young adults with greater food preparation skills were more likely to meet dietary recommendations for fat, calcium, fruit, vegetables and whole grains. Particularly of note was that 31% of young adults who reported a high degree of preparation ate five servings of fruits or vegetables daily, as compared with 3% of individuals with very low preparation skills. Along similar lines are the findings from Kourajian (2015), who investigated confidence in cooking skills, food preparation frequencies and average daily intake of fruits, vegetables, whole grains and low-fat dairy. Kourajian (2015) reported that university students (n=9680) with a higher level of skills and a higher cooking score were correlated to a higher vegetable intake ($p<0.001$). However, these constructs were not found to be associated with consumption of fruits and grains, unlike this thesis.

Overall, it appears consistent that perceptions of behavioural skills/strategies most profoundly correlate to vegetable intake, as per this thesis, Kourajian (2015) and Larson et al. (2006), and secondly to fruit and whole grain intake, as per findings of this thesis and Larson et al. (2006). Interestingly, Larson et al. (2006) also found that participants who prepared food

more frequently consumed fast foods less often, which can be compared to the hypothesis from this thesis, that as students' perceive themselves as having better behavioural strategies, their intake of foods to limit will decrease. However, the results indicated that this was not the case; instead an insignificant correlation between behavioural strategies and foods to limit was reported.

The positive correlation between behavioural strategies and consumption of milk and alternatives was not statistically significant, which is supported by Kourajian's (2015) results, that there was no effect on intake of low-fat dairy products. The positive correlation between behavioural strategies and consumption of meat and alternatives was also not statistically significant. To the authors knowledge there is no existing research focusing on this construct and the food group of meat and alternatives with which to support or contest the findings of this thesis. The findings do indicate however that interventions aiming at improving students' meal preparation/cooking skills and grocery shopping skills will likely be most effective if they are focused on fruits and vegetable and whole grain products, and to a lesser degree, meats and alternatives.

Situation/Environment. For the purposes of this thesis, the construct of situation/physical environment was conceptualized as students' perception of how conveniently available food was in terms of their location, along with how easily accessible a kitchen/dining area was and the operating hours of said areas. It was hypothesized that as students' perception of these situational aspects was more satisfactory, their consumption of vegetables and fruits, grains, meats and alternatives and milk and alternatives would increase. These hypotheses were confirmed, as the positive relationships between Situation and all of the aforementioned food groups were statistically significant. The construct of Situation, which plays an integral role within the SCT, with one of the theory's main three overarching

constructs being ‘environmental factors’, was the only social-cognitive construct within this thesis to have a positive correlation to each of the food groups as per CFG at the $p=0.01$ level.

The basic premise of the valuable role of the environment/situation, as per the SCT, is that in order to change health behaviour, the provisions of new structures or resources (i.e. environmental changes) can enable/make easier the desired behaviours (Glanz et al., 2008). In search of supporting/refuting extant literature on this topic, it became apparent that while there has been a movement in recent times towards a focus on how the environment impacts diet, the existing studies were often inconsistent, and examined different aspects of the environment (e.g. physical, or social/cultural). However, in response to the lack of consistency and overarching conclusions in this area, two systematic reviews were completed; one by Giskes et al. (2007), and another by Kamphuis et al. (2006). The review by Giskes et al. (2007) focused on studies examining environmental factors associated with energy, and total and saturated fat intake. Only 21 studies met the inclusion criteria, and in totality they examined 81 associations between dietary intakes and various environmental factors, of which only 41 were significant (Giskes et al., 2007). As such, despite increasing interest of health professionals in the presumed impact of the environment on diet and health, the authors of the review concluded that there is “insufficient evidence to conclude that environmental factors do or do not influence obesogenic or unhealthy dietary behaviours” (Giskes et al., 2007). In contrast to the dietary outcomes focused on by Giskes et al. (2007), Kamphuis et al. (2006) focused on studies examining the associations between environmental factors and fruit and vegetable consumption specifically. Similar to the previous review, only 24 articles met the authors’ inclusion criteria, and in totality the studies examined 97 associations between environmental factors and diet, with 57 of these being statistically significant. Thus, a similar trend between the two reviews is noted; approximately half of the examined associations were statistically significant. The impact of these findings is limited, however, because of the

variety of the environmental factors. That is, when taking into account the proportion of significant findings between, for example, food availability/accessibility (as opposed to income or social environment) and dietary intake, the number of such studies remains too small to confidently make overall conclusions (Kamphuis et al. 2006). That being said, in support of the important role of Situation as found in this thesis, Kamphuis et al. (2006) were able to conclude that fruit and vegetable intake is positively associated with individuals who have a good local availability and accessibility of fruits and vegetables. However, the authors did follow up by stating that the evidence for this conclusion remains “too thin to justify large-scale interventions targeting those environmental determinants” (Kamphuis et al. 2006).

Despite the lack of strong concluding evidence on the importance of the environment and dietary intake as presented in the systematic reviews, the implication should not be that the findings from this thesis are refuted, nor that there is an absence of a relationship between the environment and dietary behaviour (Brug, 2008). The weak conclusions are likely due to the lack of high-quality studies and study replications, as well inconsistency among which environmental factors are studied (Brug, 2008). Furthermore, while the results of the existing quantitative studies on the environment and dietary intake provided relatively weak evidence, multiple qualitative research studies exist, which support the important role of the physical environment/food availability and diet among university students.

The findings from a qualitative study conducted by Blissmer et al. (2009), which aimed to identify barriers and enablers for healthy weight management among college students, were that students reported that healthy eating was difficult due to perceived easy access of unhealthy foods. This finding supports that of this thesis, provided that the inverse relationship can be assumed; students perceiving easy access to healthy foods becomes an enabler of meeting dietary recommendations/consuming a healthy diet. Further indicating support of the results of this thesis are findings from Kocos et al. (2009). University students

living on-campus in Kocos et al.'s (2009) study reported that they had no access to full kitchens, making the storage, preparation and consumption of healthy foods challenging. Similarly, a study by Dauner et al. (2011) found that students who reported dormitories not being sufficiently equipped for cooking was a barrier to eating healthy, balanced meals. This is congruent with the confirmation of this thesis' hypotheses that as students consider their access to kitchen/dining spaces to be more adequate, their consumption of vegetables and fruits, grain products, meat and alternatives and milk and alternatives will increase.

Previous research examining the differences in the dietary behaviours of university students who live on campus, rather than off campus, also support the notion of the SCT, and results of this thesis, that situation/food availability plays a significant role in diet. For example, Brunt and Rhee (2008) set out to determine if and how living arrangements influence dietary variety of American college students. The authors found that students who lived off-campus, as compared to those living on-campus (relying on the university cafeteria), consumed less vegetables, fruits and dairy products. Similarly, Brown et al. (2005) reported that students living on-campus, who had purchased a meal plan, ate more fruits and vegetables than students living off-campus. Taking such findings into account, along with the fact that typical university cafeterias offer students a variety of fresh fruits and vegetables (Buscher, Martin, & Crocker, 2001), at a prepaid cost (Drewnowski & Darmon, 2005), on a daily basis, it can be posited differences in environment/situation contributed to the observed dietary differences between on-campus and off-campus students. It should also be noted, however, that other factors may contribute to said differences, such as perceived lack of time and cooking/food preparation skills (students living on-campus are often provided with ready-to-eat/pre-prepared meals or food items).

Thus far, the hypotheses that as students are more satisfied with their environment/Situation, the greater their intake of "healthy" food items; Vegetables and Fruits,

Grains, Meats and Alternatives and Milk and Alternatives, have been confirmed and partially supported by existing quantitative and qualitative research. However, the hypothesis that as students are more satisfied with their Situation (food/dining accessibility), the lesser their intake will be of Foods to Limit, was not confirmed. As has been the trend with hypotheses associated with Foods to Limit, a statistically significant positive correlation, rather than the expected negative correlation, was found. This could indicate that students reported themselves to be satisfied with their Situation because, along with offering a variety of healthy foods, it also offers easy access to snack foods, which they perceive to be a positive occurrence. Interestingly, a study by Horacek et al. (2012), which aimed to evaluate the dining venues on and near post-secondary campuses, reported that campus dining halls “provided the greatest variety of healthy entrees”, but also “had the most barriers to healthy eating” when compared with student union eateries and snack bars. This is congruent with findings from this thesis by indicating that one particular venue for sourcing meals, such as a university cafeteria, can simultaneously promote healthy and unhealthy dietary behaviours. Thus, while the results from this thesis and findings from previous research indicate that interventions on the Situation/environment of university students have the potential to greatly influence dietary intake, it is likely not sufficient to only make healthy foods (e.g. fresh fruits and vegetables, whole grains, low-fat dairy products) more conveniently, and economically, available. That is, there is a need to simultaneously address, and reduce, the accessibility of Foods to Limit within the environments of university students.

Outcome expectancies. For the purpose of this thesis, the construct of Outcome Expectancy included in the conceptual model was defined as the value/importance that students place on eating a nutritious diet. Unlike this thesis, most existing research only focused on the construct of Outcome Expectations, which refers to an individual’s recognition of the outcomes of behaviour, e.g. the health benefits of a nutritious diet. According to

Lubans et al. (2012), the distinction between the two constructs is valuable as “individuals may recognize the benefits of healthy eating (i.e., outcome expectations), but unless they consider those benefits to be of value (i.e., outcome expectancies), it is unlikely that they will be motivated to eat healthfully”.

The results from this thesis did not confirm any of the hypotheses related to the construct of Outcome Expectancies and Dietary Outcomes of Interest. That is, there were no statistically significant relationships indicating that as students’ self-rated importance of healthy eating increased, their intake of Fruits and Vegetables, Grains, Meat and Alternatives and Milk and Alternatives increased, while their intake of Foods to Limit decreased. Findings from Lubans et al.’s (2012) study were that there was no relationship between participants’ outcome expectancies and their caloric intake from core and non-core foods, appearing to support the findings of this thesis. A rationale for this could be that, even if students perceive themselves as valuing a healthy diet, other factors such as food availability, satiations, pleasure etc., are overriding and nullifying this notion. However, surprisingly, the negative beta values resulting from analysis of the conceptual model in this thesis indicated inverse relationships between Outcome Expectancies and Intake of Fruits and Vegetables, Grains, Meat and Alternatives and Milk and Alternatives. That is, the non-significant relationships detected between the construct and the aforementioned dietary outcomes were opposite to those hypothesized. One potential explanation for these unexpected results is that they may be the impact of a social desirability bias displayed by students when answering the questionnaire.

Outcome Expectancies was measured by the students’ results to Question B3, “Rate how important a nutritious diet is to you”. This question was rated on a scale of one to five, with one corresponding to “very low”, and five corresponding to “very high”. The mean rating of importance of a nutritious diet was quite high, at 3.7, and may be a result of social

desirability, which is known as “a response set reflecting the defensive tendency to respond in a manner consistent with perceived social norms” (Hebert et al., 2008). This bias is relatively prevalent in self-reported health questionnaires, with evidence indicating that the social desirability bias is often present in dietary self-reports on structured questionnaires (Hebert et al., 2008). Taking this into consideration, it is likely that most student participants “know” that a nutritious diet is important to health, and therefore “should” be important to them personally, even if it truly is not. As such, many students may have rated the importance of a nutritious diet to them as “high” or “very high”, when this is not the case, and despite their dietary quality. This brings to light one of the main negative implications of this bias; it can confound research by “creating false relationships or obscuring relationships between variables” (van de Mortel, 2008). It could thus be posited that due to the presence of the social desirability bias, causing some students to rate a nutritious diet as important while simultaneously reporting their actual and potentially poor dietary intake, non-significant negative correlations were observed between Outcome Expectancies and Intake of Fruits and Vegetables, Grains, Meat and Alternatives and Milk and Alternatives.

While a negative correlation was in fact expected to occur between Outcome Expectancies and intake of Foods to Limit, this relationship was observed but was also non-significant. As such, the practical implications from the non-significant relationships leading from Outcome Expectancies to all Dietary Outcomes of Interest are that, for the population of university students, this is not an area that dietary interventions need to prioritize. That is, interventions focusing mainly or solely on increasing the value students place on eating a nutritious diet is unlikely to effectively positively impact dietary behaviour. It is likely that within the population of university students, either the importance of a nutritious diet to students is not truly high, or believing it to be important is not enough to significantly impact dietary intake, perhaps because of the stronger roles played by other variables, e.g.

environment/situation. Furthermore, because of their youth, university students may perceive that their risk of becoming ill due to unhealthy dietary patterns is minimal, making the benefits of healthy eating appear irrelevant. Practical implications of this phenomenon are highlighted in a study on the Health Belief Model by Deshpande, Basil and Basil (2009). These authors reported on the need for campaigns aimed at increasing female university students' perceptions of the severity of eating unhealthily, while increasing male students' perceptions of susceptibility to chronic illness (Deshpande, Basil and Basil, 2009).

A potential means for minimizing the any potential social desirability bias in future similar research could be better designed questionnaire measures for the construct of outcome expectancies. Only one question was used in this thesis to measure this construct; multiple well-designed questions may be more successful in measuring actual true responses than one single measure.

Social-Cognitive Constructs Not Linked to Dietary Outcomes of Interest

With regards to how social-cognitive constructs within the tested model relate to each other, the results of this thesis indicated a statistically significant positive relationship between Self-Efficacy and Behavioural Strategies. That is, the hypothesis that as students' self-efficacy for eating a healthy diet increases, their behavioural strategies for eating healthy will increase, was confirmed. This relationship is empirically supported by the statistical significance of the relationship between these two constructs in the model tested by Lubans et al. (2012). While this relationship is widely posited as one of the key links of the SCT, it has undergone minimal statistical analysis, and thus limited existing empirical data exists with which to support or refute the findings from this thesis.

The practical implication of the finding that dietary self-efficacy can positively impact students' behavioural strategies for healthy eating falls within the notion of creating well-rounded dietary interventions/programs throughout university campuses. That is, program

components can work towards increasing students' self-efficacy from the angle of directly influencing dietary behaviour, as well as relating specifically to skills such as food preparation and grocery shopping techniques. In this way, self-efficacy can be harnessed in different ways to both directly and indirectly improve students' dietary behaviours. Furthermore, moving beyond the approach of intervention, this relationship is relevant for the creation of overall healthy eating environments, which is the ultimate goal needed for sustainability of healthy dietary behaviours. The relationship between promoting self-efficacy as a means of increasing behaviours for healthy eating should be harnessed in the promotion of healthy eating behaviours as a social norm, rather than solely a byproduct of interventions.

The relationship between Self-Efficacy and Outcome Expectancies was also found to be significant, confirming the hypothesis that as students' self-efficacy for eating a healthy diet increases, so does the value they place on eating a healthy diet. While this may appear to be without consequence, as this thesis failed to confirm any significant dietary effects of a high outcome expectancy, this is not necessarily true. The indication that as students' dietary self-efficacy increases, the value that they place upon healthy eating also increases, could result in a perpetuation of the high self-efficacy, and thus the benefits that arise from this. That is, based upon the concept of reciprocal determinism as per the SCT, it could be postulated that if self-efficacy works towards increasing outcome expectancy, the subsequent increase in outcome expectancy could in turn work towards maintaining and/or increasing students' high self-efficacy. Any means by which students' self-efficacy can be increased or maintained at a high level is valuable, due to the profound role played by self-efficacy and dietary intake as found in this thesis.

Another analyzed relationship within the conceptual model was between Situation and Self-Efficacy, and the results of this thesis confirmed the hypothesis that as students' perception of their environment as conducive to healthy eating increased, students' self-

efficacy to eat a healthy diet increased. As with the previously discussed relationship, this is one of the primary relationships posited by the SCT, the efficacy of which has undergone minimal analysis/testing (National Cancer Institute, 2012).

The significance of this relationship reinforces the central concept of the SCT, reciprocal determinism, and indicates that the physical environment/availability of food as perceived by students can positively impact their self-efficacy. That is, if students perceive their environment as one that makes healthy decisions easy, e.g. by increasing the availability of fruits and vegetables while decreasing the accessibility to fast foods, this can cause students to believe in their abilities to eat healthily, thus increasing their self-efficacy to choose healthy foods. This domino effect may be posited as follows: the university campus makes changes to increase the availability of fresh fruits to students throughout the day; students take advantage of this and begin eating more fruits because of their convenient availability; students take note of their increasing fruit consumption and conceptualize this as an increased confidence in their ability to eat a healthy diet, as such increasing their dietary self-efficacy. The implication of this relationship is similar to that of the relationship between self-efficacy and behavioural strategies; it can inform the development of a multi-faceted, well-rounded nutrition program, supporting healthy eating on university campuses from multiple angles. That is, while this thesis has indicated that students' situation has a significant positive impact directly on their dietary intake, improving food availability on campus can also increase students' self-efficacy. This reinforces the effort to improve dietary behaviours as self-efficacy in turn positively contributes to Behavioural Strategies and dietary intake. This described interplay between social-cognitive constructs internally, and with dietary intake, exemplifies reciprocal determinism, the basis of the SCT. Taking all of these relationships into account may not only contribute to the development of effective nutrition

interventions, but also promote that ultimate goal of healthy eating being the social norm on university campuses.

Summary of Practical Implications and Recommendations

The initial recommendation arising from this research would be to support the use of the tested conceptual models of the SCT in intervention design targeting university students, as the models had high predictive ability, explaining from 48% to 68% of the sample populations' eating behaviours. Overall, the social-cognitive constructs that appear to play the most important roles in explaining the dietary behaviours of university students are Self-Efficacy and Situation, followed to a lesser degree by Behavioural Strategies. These constructs all play a central role in the theory as described by Bandura (2004). The significant role of Self-Efficacy is consistent with existing research, while the role of Situation has been less thoroughly researched and consistently supported (Brug, 2008). The overarching implication is that university students should be experiencing supportive environments in which healthy dietary choices are more convenient than unhealthy choices, while also having the opportunity for their self-efficacy to be enhanced and supported. This knowledge can be used to guide the development of appropriate changes in university campus environments. A study by Luszczynska et al. (2007) was previously mentioned in this discussion, with reference to supporting that self-efficacy has a statistically significant positive association with fruit and vegetable intake. This study provides an example of an effective dietary intervention, functioning by means of increasing self-efficacy. The researchers implemented three stages in attempts to increase the participants' self-efficacy for eating healthily (specifically increasing their fruit and vegetable consumption), which were as follows: i) information on the value of a high self-efficacy and maintaining self-efficacy; ii) feedback on participants' results on a test defined to measure self-efficacy and; iii) information on ways to increase self-efficacy. This third step is what likely contributed to the measurable increase in

participants' self-efficacy, and involved examining recollections of dietary behaviour. For example, they were asked the following:

Please try to recollect a situation when you decided not to eat some less healthy food (e.g., fat or sweet snacks) and to eat or drink something healthy instead, (e.g. fruit, or vegetables or drink water or herbal tea), or not to eat anything. At least sometimes you certainly managed to stick to your decision, although you craved less healthy food. Try to recollect the circumstances in which this took place (Where was it? What type of food was it?). You may have felt some positive feelings that accompanied the successful achievement of your goal. In any case, you can be proud of yourself now and feel that you are successful in achieving what you intended to do and sticking to your decisions. (Luszczynska et al., 2007)

Subsequently, participants received supportive feedback for any positive emotions, encouraging their mastery of eating healthily, and enhancing their self-efficacy. This intervention was effective in that regression analyses indicated that changes in fruit and vegetable intake was predicted by the self-efficacy interventions (versus the control), $\beta=0.34$, $P<0.001$, $R^2=0.12$. While this serves as an example of an intervention proving to effectively improve dietary self-efficacy, such a hands on approach may not be feasible for implementation at large universities. Alternatives may lie in using web-based approaches, such as that implemented by Franko et al. (2008). In this study, university students used *MyStudentBody.com-Nutrition (MSB-N)*, an internet based nutrition and physical activity educational program designed for university students. While specific details on how the program worked towards increasing self-efficacy were not provided, interaction with the program was found to increase students' self-efficacy for dietary change ($P<0.05$).

This previously implemented interventions indicate that there has been practical success with programs designed to increase dietary self-efficacy, and that these programs can

be delivered in a variety of ways. That is, as with the case of using an online program, the interventions can be delivered in pragmatic ways, tailored to effectively reaching university students. These examples did, however, mainly focus on self-efficacy alone, while thesis has indicated that interventions should simultaneously focus on improving students' perception of their situation/environment, as well as their behavioural skills, to optimize positive changes in dietary intake.

The value of improving the food environments for school children has widely been recognized to play a vital role in making healthy eating easy, and in encouraging healthy dietary behaviours, as children and adolescents typically eat up to two meals and snacks at school daily (Story et al., 2008). As such, it is becoming more common for governments to implement policies dictating the types/quality of foods to be served or sold within the school environments. For example, beginning in 2006, Nova Scotia began implementing their Food and Nutrition Policy for Nova Scotia Public Schools. The objective of the policy is to make the “healthy food and beverage choice the easier choice in the school setting”, and is thus congruent with the implications of the role of the environment as arising from this thesis. Through such a policy, foods offered in Nova Scotian public school settings must meet the criteria of the Food and Beverage Standards for Nova Scotia Public Schools. As such, foods that are termed to be of “maximum nutrition”, i.e. nutrient dense, and have undergone minimal processing, become much more available to students than foods of “minimum nutrition”, such as foods high in sugar, fat and salt.

It is important to note that this policy within Nova Scotia does not extend to publicly funded university settings, and yet represents a means by which university environments can be changed so as to improve dietary behaviours. Researchers in Nova Scotia conducted a study to assess population-level trends in children's nutrition intake from 2003 to 2011 as a way of examining the effectiveness of the provincial school nutrition policy (Fung et al.,

2013). The findings were that students were consuming significantly more milk products, and significantly less sugar-sweetened beverages, however there was no difference in consumption of fruits and vegetables (Fung et al., 2013). That being said, policy implementation did lead to improvements in diet quality, which have the potential to become even more pronounced with time. As such, it could be posited that such policies with specific food and nutrition standards, if implemented in university settings, including campus dining halls and eateries, could effectively improve students' dietary behaviours.

As previously mentioned, in order to elicit the greatest change in eating behaviours, modifications made to university environments, along with self-efficacy and behavioural skills improvement interventions are needed. With regards to improving behavioural skills, in this case referring mainly to food preparation and grocery shopping skills, a Canadian government synthesis paper reported that clear evidence detailing successful interventions on this issue for specific ages/populations do not currently exist (Chenhall, 2010). However, it was stated that the evidence does indicate that for the variety of interventions designed for children, with some involvement of adults, have common characteristics. Some of these characteristics are as follows: i) a theoretical basis; ii) opportunities for experiential/hands on learning; iii) social support components and regular positive reinforcement; iv) measureable, specific goals set by participants and; v) a focus on cost-effective meals that can be planned, prepared and served in limited time. As such, these commonalities can be use to guide interventions targeting behavioural skills to be implemented on university campuses, which should then be evaluated and further tailored to the population. This thesis already provides one aspect of tailoring by indicating that significant relationships only occurred between Behavioural Strategies and Fruit and Vegetable Intake and Grain Intake.

In general, the findings from this thesis have many implications for the design strategies of effective dietary interventions. That being said, it should be noted that these

interventions and their specific desired dietary behaviours/outcomes are not the “end game”, but rather tools to be used in the health promoting process of creating a culture of healthy eating amongst university students. As stated by Albert Bandura (2004), “behaviour is also partly regulated by the social reaction it evokes”, as such, the social approval or disapproval that health behaviour produces in students’ interpersonal relationships will affect said behaviour. Along with interventions promoting self-efficacy, making healthy food easily available etc., there needs to be an underlying push towards making healthy eating on university campuses the social norm, so that students evoke nothing but positive reactions from those in their environment.

Thus far, the implications of the findings of this thesis have been discussed in relation to the dietary behaviours of university students. However, the general implications of the findings on the SCT, for application to the population of university students, should be noted. That is, through this process it has been confirmed that while the SCT is an appropriate framework for understanding the dietary behaviours of university students, certain theoretical constructs play a more important role than others, sometimes differing per food group, potentially distinguishing this theory/model from those which should be used among other populations. This is clearly indicated through the differences in the SCT conceptual model as tested and accepted by Lubans et al. (2012), from which the initial model to be tested in this thesis arose, and the final conceptual models as produced from this thesis. For example, the initial model of the SCT included the construct of Intention, which was removed from that of this thesis, as well as significant relationships between Outcome Expectancies and Intention, while this thesis found no significant relationships with regards to the impact of Outcome Expectancies. Furthermore, the relationship between Situation and intake of Core foods was non-significant in the Lubans et al. (2012) study, yet this construct represented one of the two most important factors in explaining dietary intake within this thesis. Therefore, it can be

deemed that the purpose of this thesis was achieved, as refined models of the SCT, tailored to the population of university students, was the outcome. While one specific, refined model cannot be presented, due to the testing of different food groups, a generally strong composite model is presented below:

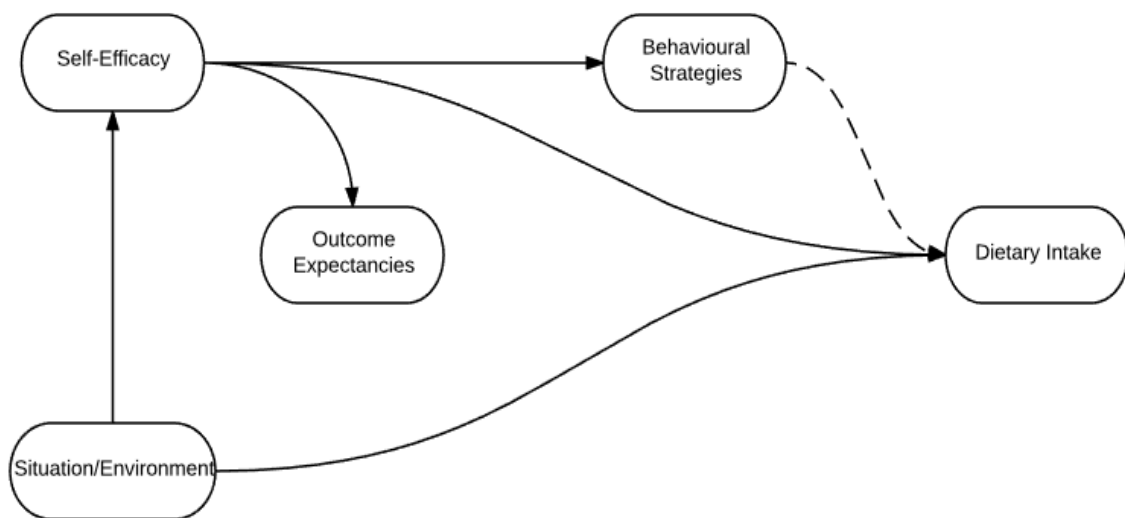


Figure 14. Composite model of the Social Cognitive Theory as developed from this thesis

Note. Dotted line between Behavioral Strategies and Dietary Intake is present as this construct only significantly predicted intake of Vegetables and Fruit and Grain Products.

Limitations

In terms of sources of limitations within this thesis, it is acknowledged that the questionnaire tool used to gather data for the Student Meal Study was not the most effective means of collecting data on social-cognitive constructs. Despite its development being guided by the Determinants of Healthy Eating, which has similarities to the SCT, data on some of the unique social-cognitive constructs could have been better gathered using a tool specifically informed by the SCT.

Secondly, it is acknowledged that the accuracy of self-reported data, specifically Food Frequency Questionnaires, cannot be fully ensured. Not only do FFQs rely on participants'

memory/recall, but also their perceptions of dietary serving sizes (despite being provided with images of servings as per Canada's Food Guide) may negatively impact data accuracy

Another limitation is that the sample for this thesis was drawn from two Nova Scotian universities, with majority of the students being female, and in their first or second year of study. As a result of this skew, the limitation is that the findings may not be representative of all university students. Lastly, it should be noted that due to the cross-sectional design of the study, causality could not be determined.

Chapter 7: Summary

University students have been found to typically consume a diet low in vegetables and fruit, but excessive in high fat and fast foods, as well as high in snack foods (Brunt et al., 2008). These poor dietary habits can result in both short- and long-term negative health consequences. As such, effective dietary interventions are needed that aim to improve the eating habits of university students.

Theoretically based interventions have been found to be more effective at altering behaviour than non-theoretical interventions (Lubans, et al., 2012). The SCT has been deemed as one such theory appropriate in guiding dietary interventions. However, the SCT is currently too broad a framework to be applied to a specific population, such as university students. There is, therefore, a need to test individual social-cognitive constructs in their ability to explain/predict dietary behaviours of university students, with the outcome being a refined conceptual model of the SCT, pertaining specifically to the population of university students

This thesis used a conceptual model of the SCT, as developed by Lubans et al. (2012), to assess the effectiveness of social-cognitive constructs in explaining the dietary outcomes of a sample of university students. Five dietary outcomes of interest, as per Canada's Food Guide, were used in data analysis. Social-cognitive scales were developed from appropriate responses to questionnaire items. This resulted in eight separate hypotheses which required testing by inserting the scales into the conceptual model of the SCT, which was analyzed using Partial Least Squares regression.

The following relationships, pertaining to social-cognitive constructs leading to a dietary outcome of interest, were found to be statistically significant: i) Self-Efficacy leading to an increased intake of Fruits and Vegetables; Grains; Meat and Alternatives; Milk and Alternatives; and Foods to Limit; ii) Situation leading to an increased intake of Fruits and

Vegetables; Grains; Meat and Alternatives; Milk and Alternatives; and Foods to Limit and; iii) Behavioural Strategies leading to an increased intake of Fruits and Vegetables and; Grains. The constructs found to most strongly associate with the dietary behaviours of university students were Self-Efficacy, congruent with all iterations of the SCT, and Situation (or environment). Behavioural Strategies was less strongly associated to overall dietary intake, appearing to only be associated with two food groups. Outcome Expectancies was not significantly associated to any dietary behaviours. The result was refined models of the SCT, pertaining to the specific food groups, tailored to the population of university students. The implications of these were discussed, with the overarching theme being that dietary interventions should simultaneously work to improve students' self-efficacy, cooking/food preparation skills, and accessibility of healthy food, in order to be most effective.

With regards to social-cognitive constructs within the model that do not lead to dietary outcomes of interest, the following relationships were found to be statistically significant: i) Self-Efficacy leading to increased Behavioural Strategies; ii) Self-Efficacy as leading to Outcome Expectancies and; iii) Situation as leading to increased Self-Efficacy. The significance of these relationships perpetuated the concept of reciprocal determinism within the SCT, as the overarching implications were that promoting/supporting these social-cognitive constructs work towards self-perpetuation, and a greater likelihood of positive dietary changes. That is, for example, an intervention targeting an improvement in students' situation, which has been found to be directly strongly associated to dietary outcomes, will also contribute to increasing students' self-efficacy. This in turn was found to be strongly directly associated to dietary outcomes.

Thus, the overall results of this thesis support the appropriateness of using the SCT as a framework for developing effective dietary interventions for university students, which should primarily work toward simultaneously improving self-efficacy and situation as

pertaining to all food groups, and behavioural skills as focused on vegetables and fruits and grain products. Practical implications of this thesis focus on the development of nutrition intervention as guided by the SCT that simultaneously enhance students' self-efficacy for healthy eating, increase their access to healthy food while decreasing availability of foods to limit, and enhance their behavioral skills for preparing items from specific food groups. The concurrent promotion and interplay of these constructs is highlighted as a means for self-perpetuating the outcomes of increasing or decreasing consumption of items from different food groups, which in turn will work towards creating an overall "culture" of healthy eating amongst university students.

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