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USING THE INTEGRATIVE MODEL TO PREDICT VEGETABLE SUBGROUP CONSUMPTION AMONG COLLEGE STUDENTS

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USING THE INTEGRATIVE MODEL TO PREDICT VEGETABLE SUBGROUP CONSUMPTION AMONG COLLEGE STUDENTS

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Abstract

Introduction: Although eating the recommended amount of vegetables is associated with many health benefits, vegetable consumption is low among college students in the United States. "Vegetable consumption" is a behavioral category, consisting of consuming a wide range of foods, which the United State Department of Agriculture (USDA) has further divided into 5 vegetable subgroups: dark green vegetables, red and orange vegetables, beans and peas, starchy vegetables, and other vegetables. While daily recommendations exist for overall vegetable consumption based on gender and age, there are also weekly recommendations for each vegetable subgroup. However, these subgroups are rarely discussed or evaluated in research. While vegetable consumption is typically studied as a single behavior, understanding the behavioral determinants for consuming defined vegetable subgroups, such as those developed by the USDA, may be more beneficial, as it would provide targeted information about these foods, from which theory based interventions can be developed. The Integrative Model (IM) is a relatively new health behavior theory that shows potential with nutrition related behaviors. Therefore, this purpose of this study was to utilize the IM to predict the intentions and behaviors of consuming each vegetable subgroup among college students.

Methods: No instruments were available examining the constructs of the IM as they relate to each vegetable subgroup, therefore one was developed and evaluated for validity and reliability. Face and content validity were established through review by a panel of experts, construct validity was evaluated using confirmatory factor analysis, internal consistency reliability was assessed using a Cronbach's alpha, and test-retest reliability was assessed using correlation coefficients and t-tests. Participants were recruited to take an online survey through convenience sampling. Each vegetable subgroup was evaluated independently. Stepwise multiple regression was used with the dependent variable of intentions towards consuming the recommended amounts of a subgroup of vegetable, and three independent variables of attitudes towards meeting subgroup recommendations, perceived norms towards meeting subgroup recommendations, and perceived behavioral control (PBC) towards meeting subgroup recommendations. Logistic regression was also used with the dependent variable of meeting subgroup recommendations, and the independent variables of intentions towards meeting subgroup recommendations, perceived behavioral control, skills, and environment.

Results: Only 2.3% (n=9) of participants met all five subgroup recommendations. Most of the instrument scales were found to be reliable and valid. Stepwise multiple regression resulted in significant models ($p \leq 0.001$) for all five subgroups of attitudes, perceived norms, and PBC predicting intentions to meet subgroup recommendations. Binary logistic regression resulted in significant models ($p \leq 0.001$) for all five vegetable subgroups of intentions, PBC, skills, and environment predicting meeting subgroup recommendations for all five vegetable subgroups.

Discussion: Attitudes, perceived norms, and PBC accounted for 40.5%-54.6% of the variance of intentions to meet subgroup recommendations for the five vegetable subgroups. Attitudes was found to be the most important predictor of intentions for all five subgroups. Intentions, PBC, environment, and skills accounted for 22.6%-46.0% of the variance of meeting subgroup recommendations. Intentions was the strongest predictor of meeting subgroup recommendations for all subgroups except for starchy, of which environment was the strongest predictor.

Conclusion: The IM was determined to be an appropriate framework for investigating vegetable subgroup consumption among college students. Understanding interrelated behaviors within a behavioral category can lead to more effective targeting of antecedents of behavioral change in lifestyle interventions.

Chapter 1

Introduction

Introduction

Vegetables provide nutrients, water, and fiber that can aid in weight management and lower risk for many chronic diseases; however, vegetable consumption is low among US adults (USDA 2010). Oftentimes in research and practice, vegetables are studied and targeted as one behavior, when in fact, vegetable consumption can be categorized as a 'behavioral category' consisting of the consumption of many different types of vegetables. The United States Department of Agriculture (USDA) categorizes vegetables into five subgroups (dark-green, starchy, red and orange, beans and peas, and other vegetables) and has a corresponding weekly recommendation for each subgroup (USDA, n.d.). Research has shown that in addition to total vegetable consumption, consuming a variety of vegetables is inversely related to risk for cancer (Jansen et al., 2004) and obesity (McCrory et al., 2000).

Evolution of Vegetable Dietary Guidelines

The USDA first published guidelines about consuming different food groups in 1916, and originally included the five food groups of milk and meat, cereals, vegetables and fruits, fats and fatty foods, and sugars and sugary foods (United States Department of Agriculture, Human Nutrition Information Service, 1993). Over the years the food groups have been systematically redefined based on emerging data on macronutrient and micronutrient needs of the average American. Table 1.1 shows the restructuring of the food group recommendations as they apply to vegetables.

Table 1.1: Evolution of Vegetable Food Groups by USDA

Year	**Number of food groups**	**Number of vegetable based groups**	**Fruits and Vegetables Recommendations (in daily servings unless otherwise stated)**
1930's	12	4 groups, includes fruits	• Leafy green/yellow – 1 ½ servings/week • Potatoes/sweet potatoes -1 daily • Other vegetables and fruits -3 daily • Tomatoes and citrus – 1 daily
1940's	7	3 groups, includes fruits	• Leafy green/yellow – 1 or more • Potatoes and other fruits and vegetables – 2 or more • Citrus, tomato, cabbage, salad greens – 1 or more
1956-70's	4	1 group, includes fruits	• Vegetable-fruit group- 4 or more servings/day (dark green/yellow frequently, citrus daily) ½ cup or average sized piece as serving size
1979	5	1 group, includes fruits	• Vegetable-fruit group- 4 or more servings/day (vitamin c source daily and dark green/yellow frequently) ½ cup or typical portion as serving size
1984	6	1 group, does not include fruits 3 subgroups (first appearance)	• Vegetable group - 3-5 servings (1 cup raw, ½ cup cooked) • Vegetables now have 3 subgroups – Dark green/dark yellow, Starchy/legumes, Other
2005	5	1 group, does not include fruits 5 subgroups with recommendations	• Total daily and weekly recommendations in cups and servings based on caloric needs • Vegetables have five subgroups - Dark green, orange, legumes, starchy, other
2010	5	1 group, does not include fruits 5 subgroups with recommendations	• Total daily and weekly recommendations in cups based on age and gender • Vegetables have five subgroups - Dark green, red and orange, beans and peas, starchy, other

Before 1956, fruits and vegetables were divided into three or four food groups, and emphasis was placed on potatoes, citrus, and leafy green/yellow types. After 1956, fruits and vegetables were typically classified together as a single food group, although dark green vegetables and citrus were still emphasized. It was not until 1984 that fruits and vegetables were classified as two separate food groups, and vegetables were given recommendations for three subgroups: dark green/dark yellow, starchy/legume, and other. The food guide pyramid was introduced in 1992, which emphasized the importance of a variety of fruits and vegetables but did not specify which subgroups to eat daily or weekly. This pyramid was updated in 2005 to the MyPyramid design, which featured vertical bars to represent food groups and a staircase to represent exercise.

Although the Dietary Guidelines for Americans have been published by the USDA every five years since 1980, vegetable subgroups were not mentioned until the 2005 publication, which classified the five subgroups as dark green, orange, legumes, starchy, and other (USDA 2005). The development of these subgroups led to specific weekly recommendations, which were influenced by recommendations from the Institute of Medicine for helping individuals consume adequate levels of potassium (IOM 2004) and fiber (IOM 2005). The current subgroup categories and recommendations appear in the 2015 Dietary guidelines for Americans (USDA, 2015).

The five subgroups are defined based on nutrient content, and although vegetables may have vitamins or minerals that could qualify them for inclusion in multiple subgroups, each vegetable is assigned to only one subgroup that best fits its nutrient profile. Dark green vegetables are characterized by their leafy green appearance, and nutrients including, but not limited to, folate, iron, and calcium. Examples of dark green vegetables include spinach, romaine, and broccoli. Red and orange vegetables are characterized by their red and orange color (given by carotenoids) and nutrients such as antioxidants and vitamins A and C. Examples of red and orange vegetables include red peppers, carrots, and sweet potatoes. Beans and peas are characterized by their appearance as legumes and high protein content, as well as vitamins and minerals such as zinc and potassium. Examples of beans and peas are pinto beans, lentils, and chickpeas. Starchy vegetables are characterized by their high carbohydrate or starch content, and vitamin B. Examples of starchy vegetables are corn, green peas, and white potatoes. Finally other vegetables are any vegetables that do not fit into the first four vegetable subgroups, and have a variety of nutrient profiles. Examples of starchy vegetable include onions, green beans, iceberg lettuce. Although iceberg lettuce may appear to be a leafy green, it does not have the nutrients required to be categorized into that group. The weekly recommendations for each vegetable subgroup in cups are shown in Table 1.2 for adolescent and adult men and women ages 14-50 years old. Red and orange, starchy, and other vegetables are needed in the largest quantities, while dark green vegetables and beans and peas have much lower recommendations.

Table 1.2: USDA Weekly vegetable subgroup recommendations for adults aged 14-50 years old

	Dark green	Red and orange	Beans and peas	Starchy	Other
Women	1 ½ cups	5 ½ cups	1 ½ cups	5 cups	4 cups
Men	2 cups	6 cups	2 cups	6 cups	5 cups

Vegetable Consumption in the United States

In the United States, nearly 90% of the population does not meet their daily vegetable intake recommendations (USDA, 2015). Vegetable consumption is also low among the young adult population; less than 10% of young adults ages 19-30 meet the 2-3 ½ cups daily recommendation. Overall the U.S. population also does not meet the weekly vegetable subgroup intake recommendations. Among all ages, consumption of other vegetables is the closest with nearly 40% of the population meeting or exceeding recommendations. However, more than 90% of the population does not meet the recommended intake of red and orange vegetables, and more than 80% of the population does not meet the recommendations for starchy vegetables, dark green vegetables, and beans and peas. In terms of volume and cups of vegetables eaten, there are also disparities in which kinds of vegetables individuals tend to consume per day (USDA, 2010). Starchy and other vegetables are eaten the most at an average of 0.5 cups per day, while dark-green and beans and peas are eaten the least at an average of 0.1 cups per day. It should be noted that since there are different volume recommendations for each subgroup of vegetables per week, it is more accurate to examine the percent that meet subgroup recommendations rather than average cups of vegetables consumed to evaluate whether people are eating enough of a particular vegetable subgroup. Data is also available on how often adults eat vegetables, using the average number of times adults eat vegetables in a day, where a time is any time a vegetable is eaten, whether for a meal or snack. According to the State Indicator Report on Fruits and Vegetables 2013 by the Centers for Disease Control and Prevention

(CDC), 22.6% of adults eat vegetables less than one time per day, and the median number of times adults eat vegetables per day is 1.6.

College students in particular have low vegetable intake. One national study spanning across 40 universities and colleges in the U.S. found that only 4.6% of students met the recommended five servings of vegetables and fruits per day (Wald et al., 2014). Furthermore, this study found that meeting fruit and vegetable recommendations was a significant predictor of grade point average, and that students who met recommendations had a 0.15 point higher grade point average than students who did not meet fruit and vegetable intake recommendations. In order to improve the health of college students, overall vegetable consumption must increase as well as targeting increased consumption of the specific vegetable subgroups that have proportionally low consumption rates compared to their recommendations.

Health Benefits of Eating Vegetables

The USDA promotes vegetables as an essential part of maintaining a healthy diet, and consuming vegetables provides many health benefits (USDA, 2015 June 16). Vegetables have no cholesterol, are low in fat and calories, and provide micro and macro essential nutrients such as fiber, folic acid, vitamin A, vitamin C, calcium, and potassium. Vegetables also contain a high amount of fiber, which may reduce the risk for heart disease and lower cholesterol, as well as improve digestive health by reducing constipation and diverticulosis. In addition, fiber rich foods also provide feelings of satiety and fullness, which can be used to maintain a healthy weight and lower the risk for obesity and type 2 diabetes (USDA, 2015 June 16).

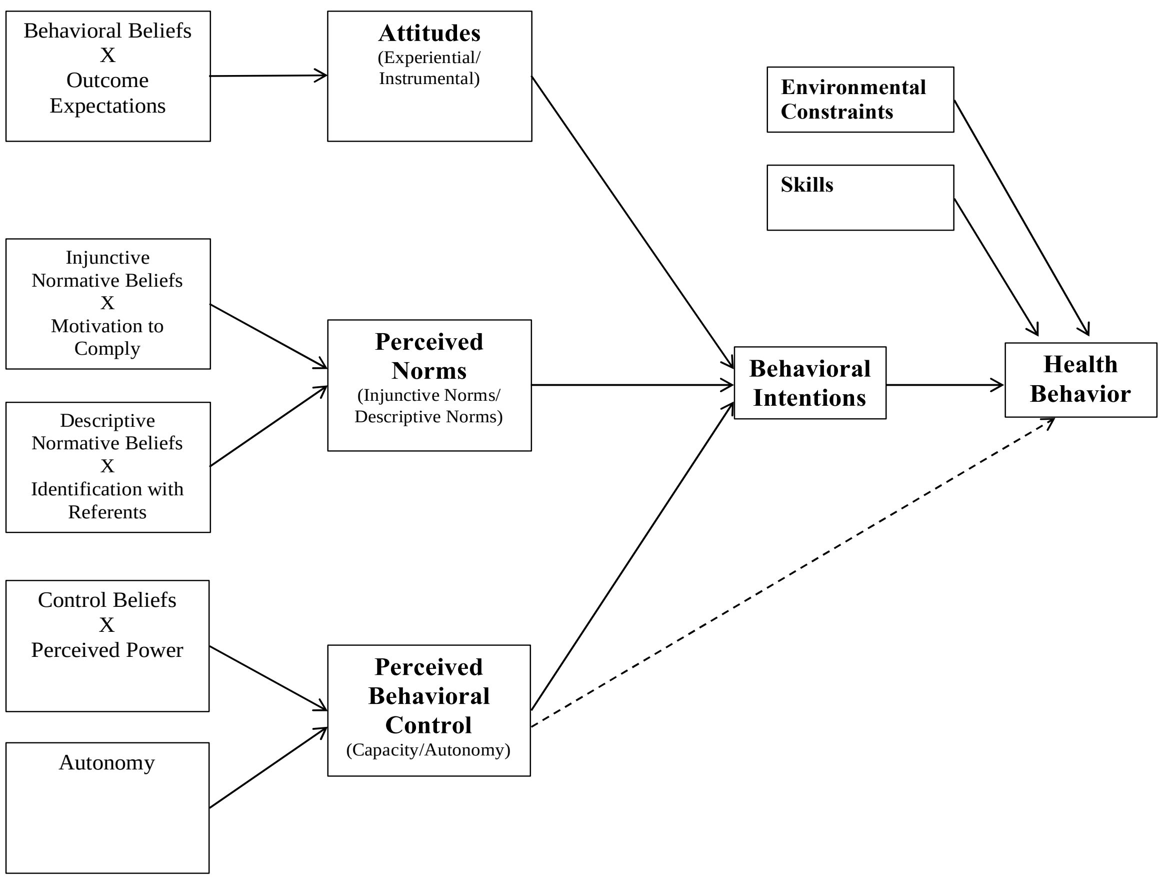
Vegetable Subgroups and Health Benefits

To maximum health benefits of eating vegetables, individuals should consume weekly recommended amounts from each vegetable subgroup (based on age, activity level, and gender), and a variety of vegetables within each subgroup (USDA, 2015). Health benefits from the different vegetable subgroups may overlap. For example, potassium is associated with maintaining healthy blood pressure, and individuals obtain potassium from vegetables from the starchy group (white potatoes), beans and peas group (kidney beans), dark green vegetables group (spinach), or red and orange vegetables (tomatoes). Health benefits can also be specific to the vegetable subgroups consumed. A meta-analysis covering 3 cohort studies, spanning 24 years, and involving 133,468 participants, found that different kinds of vegetables have different effects on weight management (Bertoia et al., 2015). An increased intake of total vegetables, tofu/soy, and cauliflower were inversely associated with weight change, while increased intake of starchy vegetables, such as potatoes, peas, and corn, were associated with weight gain. Analysis on fiber content and glycemic load (a measure of effect on blood sugar based on carbohydrate content) found that high fiber/low glycemic load vegetables were strongly inversely associated with weight change compared to low fiber/high glycemic load vegetables (Bertoia et al., 2015).

Integrative Model of Behavioral Prediction

Understanding significant behavioral and social determinants of health is critical for developing effective theory-based and evidence-based programs, and such determinants should be housed within a theoretical model given the benefits such models possess. The theoretical framework for this study is the Integrative Model (IM), also known as the Integrative Model of Behavioral Prediction. This model was originally conceptualized as a composite model of the most prominent health behavior theories of its time, and was further operationalized by Martin Fishbein and Icek Ajzen in their book Predicting and Changing Behavior: The Reasoned Action Approach (2010). The primary constructs of the IM are a defined behavior, intentions towards a behavior (intentions), attitudes towards a behavior (attitudes), perceived norms towards a behavior (perceived norms), and perceived behavioral control towards a behavior (perceived behavioral control). A visual representation of the IM is shown in Figure 1.1.

Figure 1.1 Integrative Model



According to the IM intentions are the largest predictor of behavior, with attitudes, perceived norms, and perceived behavioral control each acting as a determinant of intentions. Skill and environmental barriers are also moderators that can influence the link between intentions and behavior (such that insufficient skill, or significant environmental barriers can overrule high intentions), while background influences such as demographics, socioeconomic factors and cultural factors are accounted for in the model as influencers of attitudes, perceived norms, and perceived behavioral control.

Purpose of the study

The purpose of this study was to investigate the use of the Integrative Model (IM) as a theoretical framework in order to predict the intentions and behaviors of consuming the recommended amount of vegetables each week for five vegetable subgroups among college students. The objectives of this study are:

1. Examine to what extent are the IM constructs of attitudes towards meeting subgroup recommendations (attitudes), perceived norms towards eating subgroup recommendations (perceived norms), and perceived behavioral control towards eating subgroup recommendations (perceived behavioral control) associated with intentions to meet subgroup recommendations (intentions).

2. Examine to what extent the IM constructs of intentions, perceived behavioral control, environment, and skills are associated with meeting subgroup recommendations.

Research Questions

The following research questions were explored in this study:

1. To what extent are the IM constructs of attitudes, perceived norms, and perceived behavioral control associated with intentions to meet subgroup recommendations among college students?

2. To what extent are the IM constructs of intentions, perceived behavioral control, environment, and skills associated with meeting subgroup recommendations?

Research Hypotheses

The following hypotheses were investigated for each of the five behaviors (meeting subgroup recommendations for dark green, red and orange, beans and peas, starchy, and other vegetables) in this study and tested at an alpha level of 0.05 significance.

Hypothesis 1: There is a significant positive relationship between the constructs of attitudes, perceived norms, and perceived behavioral control towards the construct of intentions for each of the five vegetable subgroups (dark green, red and orange, beans and peas, starchy, other).

Alternative Hypothesis 1: There is a significant negative relationship between the constructs of attitudes, perceived norms, and perceived behavioral control towards the construct of intentions for each of the five vegetable subgroups (dark green, red and orange, beans and peas, starchy, other).

Null Hypothesis 1: There is no significant relationship between the constructs of attitudes, perceived norms, and perceived behavioral control towards the construct of intentions for each of the five vegetable subgroups (dark green, red and orange, beans and peas, starchy, other).

Hypothesis 2: There is a significant positive relationship between the constructs of intentions, perceived behavioral control, skills, and environment to the behavior of meeting subgroup recommendations for each of the five vegetable subgroups (dark green, red and orange, beans and peas, starchy, other).

Alternative Hypothesis 2: There is a significant negative relationship between the constructs of intentions, perceived behavioral control, skills, and environment to the behavior of meeting subgroup recommendations for each of the five vegetable subgroups (dark green, red and orange, beans and peas, starchy, other).

Null Hypothesis 2: There is no significant negative relationship between the constructs of intentions, perceived behavioral control, skills, and environment to the behavior of meeting subgroup recommendations for each of the five vegetable subgroups (dark green, red and orange, beans and peas, starchy, other).

Significance of the Research Problem

This study is significant because it applies the IM to vegetable consumption in a way that has not been presented in the literature. First, very little research has been done operationalizing and applying the IM to health behaviors, especially those related to diet. Second, exploring determinants of the consumption of each vegetable subgroup as a separate behavior, with different measurements for each of the theoretical constructs, has not been presented in the literature. Third, college students have low rates of vegetable consumption and could benefit from interventions, but no research has been done that explores the IM and vegetable consumption, or utilizes all five vegetable subgroups. The findings of this study have both theoretical and practical applications by identifying the constructs that are most relevant to understanding vegetable subgroup consumption among college students, which then may be used in the development of targeted interventions.

Delimitations of the Study

The population of interest in this study is college students. The data collection method was a quantitative survey. In order to generate generalizable findings with statistical power, this study was delimited to the following:

1. Recruitment of at least 300 college students between the ages of 18 and 30.
2. Participants must be enrolled at least part-time (1 hour) at the University of Oklahoma at the time of participation.
3. Participants must have an OU email address and ability to fill out an online survey.

Limitations of the Study

Potential limitations of this study include:

1. This survey was distributed through email, which may have influenced participation rates and volunteer self-selection (for example, email could go to spam folder or students may 'opt out' of university email lists).
2. The data collected from this study was self-reported, and there is an inherent potential of error associated with this kind of measure.
3. Response bias may limit generalizability of results to all college students at the University of Oklahoma.
4. This survey recruited exclusively from University of Oklahoma college students, which limits generalizability to other college students or the general population.

5. The instrument used in this study was created specifically for this study. Although the instrument was evaluated by pilot testing and expert review, the overall reliability and validity was not be known at the time of distribution.

6. A potential uncontrollable variable might be any healthy eating events at the University (Local and sustainable promotions, cultural food promotions, full plate presentations, etc.) that occur around the same time as the study

Assumptions

Assumptions of this study include:

1. The questions presented in the survey are representative of the constructs of the IM.

2. Participants were honest with their responses and filled out the whole survey to the best of their ability.

3. Participants' recall of their past behavior was be a reasonable approximation to their actual behavior.

4. All definitions provided in the survey were easily and uniformly understood by the study participants.

Operational Definitions

1. Behavior: refers to an observable event that is defined in terms of *Target (the subgroup of vegetables), Action (eat at least the recommended amounts) Context (everyday living), and Time (each week).* In this study, there are five behaviors under investigation, one for each subgroup of vegetables:

   a. "**Eat at least the recommended amount of dark green vegetables each week"**

The weekly recommended amount of dark green vegetables is 1 ½ cups for women and 2 cups for men.

b. **"Eat at least the recommended amount of red and orange vegetables each week"**

The weekly recommended amount of red and orange vegetables is 5 ½ cups for women and 6 cups for men.

c. **"Eat at least the recommended amount of beans and peas each week"**

The weekly recommended amount of beans and peas is 1 ½ cups for women and 2 cups for men.

d. **"Eat at least the recommended amount of starchy vegetables each week"**

The weekly recommended amount of starchy vegetables is 5 cups for women and 6 cups for men.

e. **"Eat at least the recommended amount of other vegetables each week".**

The weekly recommended amount of other vegetables is 5 cups for women and 6 cups for men.

2. Attitudes towards a behavior: refers to an individual's overall perception of favorableness or un-favorableness towards a behavior comprised of affective (experiential attitudes) and cognitive dimensions (instrumental attitudes) (Fishbein & Ajzen, 2010).

a. Experiential attitude: the individual's emotional response to the idea of performing the behavior

b. Instrumental attitude: beliefs about outcomes of doing the behavior

3. Perceived behavioral control towards a behavior: the extent to which people believe they are capable of performing a given behavior (Fishbein & Ajzen, 2010).

    a. Capacity beliefs: the belief that one is capable of performing the behavior
    b. Autonomy: an individual's perceived amount of control over behavioral performance. It is determined by control beliefs (an individual's perception of the degree to which various environmental factors make it easy or difficult to perform a behavior)

4. Perceived norms towards a behavior: refers to the social pressure one feels to perform or not perform a particular behavior (Fishbein & Ajzen, 2010).
    a. Injunctive norms: normative beliefs about what whichever people a participant might identify as 'important people in their life' thinks one should do and motivation to comply
    b. Descriptive norms: norms based on perceptions about what other people are doing
5. Intentions towards a behavior: An indication of an individual's readiness or decision to perform the behavior
6. Past Behavior: an individual's perception of how much they have engaged in the behavior in the past
7. Skills/Abilities: volitional control in the performance of a behavior and in the attainment of behavioral goals
8. Environment: the environmental constraints preventing behavioral performance

Chapter 2

Literature Review

Introduction

The purpose of this study was to investigate the use of the Integrative Model (IM) as a theoretical framework in order to predict intentions and behaviors of consuming the recommended amounts of five vegetable subgroups among college students. As the IM is relatively new, there is limited research that has operationalized the model, and none that use college students as the target population. However, there is substantial research that uses constructs that are similar or identical to those within the IM, primarily in the use of the Theory of Planned Behavior. Therefore, the first part of this literature review will discuss the IM and vegetable consumption, while the second part of this literature review will examine vegetable consumption in college students, how studies utilize the four primary theoretical constructs of intentions, attitudes, norms, and perceived behavioral control, and whether those constructs are cited as the IM or as part of some other theoretical foundation.

Literature Search

Two search strategies were used to locate articles for this review. The first review was used to identify theory-based (TPB/IM) vegetable consumption research among the college student population. For the first search, studies were located by searching six electronic databases: MEDLINE, PsychInfo, Web of Science, ProQuest, Academic Search Elite, and Google Scholar. Searches were limited to peer-reviewed, English language articles published after 2004. The following search terms were entered into each database: (vegetable) AND (Integrative Model); (vegetable) AND (intention) AND (college OR "young adult"); (vegetable) AND (Theory of Planned Behavior) AND (college OR "young adult").

A second search was conducted to locate any remaining studies that use the IM to examine vegetable consumption in any age group, as well as studies that refer to the IM by another name, the reasoned action approach (RAA). In the second search, the studies were located using five electronic databases: MEDLINE, PsycINFO, JSTOR, Pubmed, PMC, and Google Scholar. Searches were limited to peer-reviewed, English language articles published after 1991. The following search terms were entered into each database: (Integrative Model) AND (Intervention) AND (Behavioral Prediction) AND (Peer Reviewed); (Reasoned Action Approach) AND (Intervention) AND (Peer Reviewed).

Articles that did not describe a predictive relationship between vegetable intake and one or more constructs of the IM (intentions, attitudes, norms, or perceived behavioral control) were excluded. If the article did not describe the IM specifically, the target population had to include college students or young adults representative of the general population, therefore studies that focused exclusively on children, older adults, or specific clinical groups (i.e. cancer patients) were excluded. Studies that examined additional constructs unrelated to the IM were also excluded unless the IM construct results were described independently of the additional construct results. Duplicate articles were removed throughout the searches.

The Integrative Model as a Universal Model

The goal of a predictive theoretical model is to identify significant behavioral antecedents that can be used to account for the greatest amount of variance for a given behavior in a given population. The IM was developed as a result of a theorist workshop, in 1991 when the theorists Albert Bandura (Social Cognitive Theory), Marshall Becker (Health Belief Model), Martin Fishbein (Theory of Planned Behavior), Fredrick Kanfer (Self-regulation Theory), and Harry Triandis (Subjective Culture & Interpersonal Relations) met at an NIMH workshop to identify the most important determinants of predicting behavior and to develop a unified behavioral prediction theory. The theorists agreed upon eight variables that were critical to behavior change: strong positive intentions towards a behavior, no prohibitive environmental constraints, necessary skills to perform behavior, perceived advantages outweigh disadvantages, normative pressure to perform behavior, behavior is consistent with self-image, emotional reaction to performing behavior is more positive than negative, and self-efficacy (Fishbein & Ajzen 2010). However, they did not agree upon the structure of the model or assessment on relative importance of each variable. In 2000 the Integrative Model of Behavioral Prediction (IM or IMBP) was defined and included modifications to the norms construct, as well as included skills and environmental barriers as moderating variables. Martin Fishbein and Icek Ajzen continued to expand their research using the IM, and in 2010 published their book that operationalized the model Predicting and Changing Behavior: The Reasoned Action Approach (Fishbein & Ajzen, 2010).

Measuring the IM

Before the determinants of a behavior can be measured, the behavior must be clearly defined. Defining a behavior can be one of the most difficult tasks when working with a theoretical model. Abstract concepts such as ‘have a healthy diet’ can only be investigated once underlying behaviors have been identified (Branscum & Sharma, 2014). One way to ensure a behavior is well defined is conforming to the TACT principle, made popular by Martin Fishbein, and later, Icek Ajzen: that is, it must have a clear Target (the target at which the action is directed), Action (the action performed), Context (the context in which the action is performed), and Time (the time parameters in which the action is performed). This process is useful for investigating behavioral categories, in that it can be preferable to investigate a defined behavior (eating at least the recommended amount of dark green vegetables each week) rather than investigating the whole continuum (vegetable consumption). Once a behavior is defined using the TACT principle, in order to establish relationships between the IM's constructs, each construct measure should conform to the principle of compatibility. This requires that once a behavior has been defined, all of the other constructs (in this case intentions, attitudes, subjective norm, and perceived behavioral control) must be defined using the same TACT specific behavior. If there is a low consistency between the defined behaviors, then each measure could be said to be examining a different behavior, or simply an action, which would likely decrease the association between the construct and behavior.

Fishbein and Ajzen define three types of beliefs that influence intentions, or readiness to perform a behavior. Attitudes towards a behavior are influenced by outcome expectancies, or positive or negative evaluation of performing the behavior. Perceived norms are perceived social pressure to perform a behavior that includes beliefs about whether important individuals or groups would approve or disapprove of that person performing a behavior, and whether those people perform the behavior themselves. Finally perceived behavioral control is beliefs about personal and environmental factors that help or limit their ability to perform the behavior.

The Integrative Model and Vegetable Consumption

Three studies have used the IM to examine vegetable consumption: two were elicitation studies and one was a cross sectional design. Elicitation studies are used to find salient beliefs about a topic, and can aid with developing theory-based instruments, while cross-sectional studies are used to identify correlations between theory constructs. The first study was an elicitation of beliefs with 30 mid-western African American women to determine advantages/disadvantages (attitudes), perceived referents who approve/disapprove (injunctive norms-although the article claimed this was perceived norms), and what factors make it easy/difficult (perceived behavioral control) for two TACT specific behaviors: "eat more dark green leafy vegetables each week over the next 3 months" and "buy more dark green leafy vegetables each week over the next 3 months" (Sheats & Middlestadt, 2013). Semi-structured interviews were conducted face-to-face. Participants answered six open-ended questions about eating dark green leafy vegetables (DGLV) and four questions about buying DGLV to identify consequences, referents, and circumstances. The results showed that cost was the biggest disadvantage of buying dark green vegetables, while improving the health of their families and eating more cups were the primary advantages. Salient circumstances included individual factors such as a lack of skills or knowledge to prepare dark green vegetables, while community and environmental factors included the relative location of food stores relative to their homes. For perceived norms, most respondents (83.3%) indicated that nobody would disapprove of them eating more cups of DGLV, and when respondents did indicate that someone disapproved (10%) it was usually children (Sheats & Middlestadt, 2013).

The second study examined the predictive power of the Reasoned Action Approach with 410 African American women to consume dark green vegetables (Sheats et al., 2013). Women completed a survey measuring their attitudes, perceived norms (injunctive and descriptive), self-efficacy, and intentions towards buying, preparing, and consuming dark green leafy vegetables (DGLV), as well as food related practices and preferences, purchasing and consumption of DGLV, and health status. The researchers defined two TACT specific behaviors: the first was "eat more cups of DGLV each week over the next 3 months"; the second was to "buy more DGLV each week over the next 3 months". The researchers found that intentions, attitudes, and self-efficacy to buy vegetables were strongly associated with intentions, attitudes, and self-efficacy to eat vegetables. The results showed that the RAA constructs of attitudes, perceived norms, and self-efficacy explained 60.9% of the variance ($P < .001$) for intentions to eat more DGLV. However, correlations between the reported consumption of DGLV and intentions to eat and purchase more DGLB were low. Both attitudes and self-efficacy had significant weights for explaining intentions to buy and eat DGLV. One limitation of these first two studies is that even though the behaviors are TACT defined, the concept of eat 'more' is vague. This was done to personalize the goal behavior for each participant since the participants varied in the amount of vegetables consumed, and to align with the Healthy people 2020 goals of increasing overall vegetable consumption. However, since 'more' is abstract, participants will interpret this objective in different ways. One way to clearly define the behavior is to use recommendations that specify an exact target for cups of vegetables to consume, which shifts the focus from a goal (such as eat more) to an action (such as eat 2 cups of vegetables each day).

The third study was an elicitation study with 243 adults and 344 middle school children examining the beliefs pertaining to advantages/disadvantages, who might approve/disapprove, and what makes it easier/more difficult with regards to total vegetable, dark green vegetable, and orange vegetable consumption (Middlestadt 2012). The TACT specific behaviors were “Eat at least 2 cups of orange vegetables every week for the next three months” and “Eat at least 2 cups of orange vegetables every week for the next three months”. This study reported that while salient advantages for dark green and orange vegetables were similar in that participants identified that they made them ‘healthier’, provided energy, tasted good, and provided vitamins, dark green vegetables were more likely to elicit the beliefs of helpful to lose weight or provide minerals, while orange vegetables were more likely to elicit the belief that they would help eyesight. Participants provided both instrumental and affective consequences about advantages and disadvantages, who might approve or disapprove, and what makes the behavior easier or harder for the defined behaviors.

Theory-based Vegetable Research with College Students

While there is limited research using the IM to explore vegetable consumption among college students, there is research available on this topic with other theoretical models. Nine articles were found for inclusion in this section of review, which cover ten unique studies. Of the nine articles, five studies were conducted in the United States (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Emanuel et al., 2012; Larson, Laska et al., 2012; Larson, Neumark et al., 2008), two in Australia (Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012), one in the Netherlands (Stok et al., 2014), and one in Thailand (Kreausukon et al., 2011). One study was based on national survey data (Emanuel et al., 2012), while the rest were primary data analyses. The sample size of the studies varied: five studies had fewer than 200 participants (Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012; Kreausukon et al., 2011; Stok et al., 2014) and five studies had greater than 400 participants (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Emanuel et al., 2012; Larson, Laska et al., 2012; Larson, Neumark et al., 2008).

All of the studies included both male and female participants. Seven studies recruited college students exclusively (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012; Kreausukon et al., 2011; Stok et al., 2014), two recruited high school students and followed them throughout young adulthood (Larson, Laska et al., 2012; Larson, Neumark et al., 2008), and one analyzed data that included young, middle, and older adults (Emanuel et al., 2012).

All ten studies used theory: five used the Theory of Planned Behavior (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Emanuel et al., 2012; Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012), two used Social Cognitive Theory (Larson, Laska et al., 2012; Larson, Neumark et al., 2008), one used Health Action Process Approach (Kreausukon et al., 2011), and two studies used Self-Categorization Theory (Stok et al., 2014). While no studies were found using the IM to predict vegetable consumption in college students, constructs from other theories that are similar or identical have been evaluated, such as intentions, attitudes, and norms.

Constructs of the IM

Atittudes toward a behavior. Of the ten studies in this review, seven explicitly measure the construct of attitudes specific to the theory of planned behavior (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Emanuel et al., 2012; Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012; Stok et al., 2014), two measure attitudes (not necessarily specific to theory of planned behavior) (Larson, Laska et al., 2012; Larson, Neumark et al., 2008), and one study does not reference attitudes (Kreausukon et al., 2011). Of the studies that included attitudes, one study indirectly measured attitudes for fruit and vegetable intake (Emanuel et al., 2012), two measured instrumental and affective attitudes towards eating five servings of fruits and vegetables each day in the next week (Blanchard, Fisher et al., 2009) or next two weeks (Blanchard, Kupperman et al., 2009), two studies measured attitudes on a bipolar semantic differential scale towards eating 5 servings of vegetables each day (Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012) and two measured attitudes on a bipolar semantic differential scale towards vegetable consumption (Stok et al., 2014).

Perceived Norms. Of the ten studies in this review, five explicitly measure either the construct Perceived Norm (Emanuel et al., 2012) or Subjective Norm (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012). Three studies measure norms (Larson, Laska et al., 2012; Larson, Neumark et al., 2008) or identification with a norm referent group (Stok et al., 2014), and one study does not reference norms at all (Kreausukon et al., 2011). Of the studies that measured subjective norms, one study evaluated both injunctive and descriptive norms (Kothe, Mullan, & Butow, 2012), four studies measured only injunctive norms (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Emanuel et al., 2012; Kothe & Mullan, 2011), two studies only measured descriptive norms (Stok et al., 2014), and one study was unclear (Larson, Laska et al., 2012; Larson, Neumark et al., 2008).

Perceived Behavioral Control. All ten studies in this review measure either Self-Efficacy or Perceived Behavioral Control: five explicitly measure the construct of Self-Efficacy (Larson, Laska et al., 2012; Larson, Neumark et al., 2008; Kreausukon et al., 2011; Stok et al., 2014), and five explicitly measure the construct of Perceived Behavioral Control (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Emanuel et al., 2012; Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012).

Intentions. Of the ten studies in this review, six explicitly measure the construct of Intentions (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Kreausukon et al., 2011; Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012; Stok et al., 2014), and three studies did not examine intentions (Emanuel et al., 2012; Larson, Laska et al., 2012; Larson, Neumark et al., 2008). Intentions were for eating a specific number of fruit or vegetable servings each day (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009; Kothe & Mullan, 2011; Kothe, Mullan, & Butow, 2012; Kreausukon et al., 2011) or intention to eat sufficient vegetables in the near future (Stok et al., 2014).

Methods

Among the nine studies (across ten articles), two were cross sectional (Emanuel et al., 2012; Stok et al., 2014), two were longitudinal (Larson, Laska et al., 2012; Larson, Neumark et al., 2008), two were randomized controlled trial (Kothe & Mullan, 2011; Kreausukon et al., 2011), three were prospective studies (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009) and one was quasi-experimental (Kothe, Mullan, & Butow, 2012).

The first cross sectional study utilized data from the National Cancer Institute's Food Attitudes and Behaviors survey in Fall of 2007, which evaluated a variety of health behaviors, including fruit and vegetable intake (Emanuel et al., 2012). The authors constructed three variables from items on the survey to evaluate beliefs about attitudes, perceived behavioral control, and perceived norms. The sample included 3,397 participants, of which 27.94% (n=949) were between the ages of 18 to 34, 64.38% were white (n=2187) and 59.14% were female (n=2009). Results showed that females had significantly higher behavioral beliefs for each item in the attitudes construct ($p<0.001$), as well as total attitudes towards FVI (fruit and vegetable intake) ($p<0.001$), perceived behavioral control over FVI, and higher confidence in all PBC items ($p<0.01$) than males. Males had higher perceived norms for FVI ($p<0.01$) than females, and stronger normative beliefs for all items except "I want others to see I can do it" ($p>.10$). Results also showed that attitudes and perceived behavior control were significant predictors of higher FVI ($p<0.01$), while perceived norms were not a significant predictor of higher FVI ($p>0.05$). The conclusion was that gender did not have a significant direct effect on FVI ($p>0.05$), but attitudes, perceived norms, and perceived behavioral control account for 87% of the association between gender and

FVI, which indicted that gendered differences in behavioral beliefs could be associated with gender differences in FVI.

The second cross sectional study within Stok, et al. (2014) was referred to as Study 2, and examined descriptive social norms, self-efficacy, attitudes, and self-identification as predictors of vegetable consumption. This study used a sample of Dutch college students (n=52), of which 73% were female. An ANOVA was done using experimental condition of majority norm (where participants are told that most people eat sufficient vegetables) or minority norm (where participants are told that most people do not eat sufficient vegetables) from the first study as an independent variable and intention as the dependent variable, which showed that participants in a majority norm condition show significantly higher intentions to consume adequate vegetables than participants in a minority norm condition ($p<0.01$).

The one longitudinal study published as two reports evaluated predictors of vegetable consumption in a group of high school as they transitioned into young adulthood (Larson, Laska et al., 2012; Larson, Neumark et al., 2008). Project EAT (Eating and Activity in Teens and Young Adults) was a ten year study, beginning in 1998, with high school students (n=476 males and n=654 females) completing surveys at Eat -1 (mean age 15.8 +/- 0.8 years), Eat – II (mean age 20.4 +/- 0.8 years) and Eat-III (mean age 26.2 +/- 0.8 years) (Larson, Laska et al., 2012). Self-efficacy was found to be a statistically significant predictor in model 1 of vegetable consumption at both the five year ($p<0.01$) and ten year ($p<0.05$) follow ups.

Two studies utilized the randomized controlled trial design. The first was an intervention to increase fruit and vegetable consumption that used a questionnaire and thirty day intervention to assess changes in intentions, attitudes, perceived behavioral control, and subjective norms using repeated measure ANOVAS (Kothe & Mullan, 2011). No significant effects were found between changes in attitude, perceived behavioral control and intention, and changes in intentions were not significantly correlated with behavior change. Therefore, changes in attitude and perceived behavioral control may not lead to behavior changes.

The second randomized controlled trial examined intentions, planning, dietary self-efficacy, and fruit and vegetable intake along with a HAPA intervention program (Kreausukon et al., 2011). The intervention was effective for increasing fruit and vegetable consumption, and for increasing intentions, self-efficacy, and coping related to fruit and vegetable consumption.

One study utilized the quasi-experimental design (Kothe, Mullan, & Butow, 2012). This study had pre and post-tests, at baseline and at the end of the thirty day study, which utilized email to deliver targeted messages related to the constructs of attitudes, intentions, perceived behavioral control, and subjective norms. Data was analyzed using paired sample t-tests and structural equation modeling. Subjective norms and perceived behavioral control were found to be significant predictors of intention, and intention was found to be a significant predictor of baseline fruit and vegetable consumption. In addition, 44.5% of the variance of intention and 16.8% of variance of behavior could be accounted for at baseline. One assertion made by the authors is that the results support applying the theory of planned behavior to cross-sectional behavioral prediction.

The two prospective studies both used surveys to measure the Theory of Planned Behavior constructs of intentions, attitudes, perceived behavioral control, and subjective norms (Blanchard, Fisher et al., 2009; Blanchard, Kupperman et al., 2009). Blanchard, Fisher et al., (2009) found that attitudes and perceived behavioral control were both significant predictors of intentions ($p<0.05$), and that intentions was a significant predictors of fruit and vegetable consumption ($p<0.05$). The model accounted for 50% of the variance in intentions, which were significantly predicted by perceived behavioral control and affective attitude. In addition, intentions accounted for 11% of the variance in fruit and vegetable consumption. Blanchard, Kupperman et al., (2009) confirmed these results, and added that in a gender and ethnicity analysis, subjective norms were significant predictors only among blacks, males, and females.

Approaches to the problem

Healthy People 2020 recognizes the need to address the disparities in vegetable consumption among the American population with two goals: NWS-15-1 focuses on increasing the variety and contribution of vegetables to the diets of the population aged 2 years and older from 0.77 cup equivalent per 1000 calories to 1.14 cup equivalent per 1,000 calories, while NWS-15.2 focuses on increasing consumption from the dark green, red and orange, and beans and peas subgroups from 0.29 cup equivalent per 1000 calories to 0.55 cup equivalent per 1,000 calories (US Department of Health and Human Services, 2010). There are a variety of intervention approaches that have been shown to increase quantity and variety of vegetable consumed among adults (Pomerleau et al., 2005). A systematic review of fruit and vegetable interventions found that tailored messaging with feedback about the patient's dietary behavior, motivations, attitudes, norms, and skills had higher increases in motivation to make healthy changes than interventions without tailored feedback. Computer-based or printed information can have positive effects relative to in person or telephone contact, with less cost than traditional dietary counseling. These interventions included targeting towards specific vegetable groups, as well as approaches to increase total vegetable consumption. In addition, government resources such as choosemyplate.gov provide helpful tips to increase vegetable consumption such as buying fresh vegetables in season, how to choose vegetables that are easy to prepare, and how to select vegetables with the highest levels of nutrients (USDA 2015 June 12).

Conclusion

While the IM theoretical constructs of attitudes, intentions, perceived behavioral control, and perceived norms can be measured by using the proxy of theory of planned behavior constructs such as perceived behavioral control and subjective norms, more research is needed to investigate the merits of the IM itself. Further research must be done to treat eating vegetables and fruits as separate behaviors, as well as use vegetable subgroups.

Chapter 3

Methods

Introduction

The purpose of this study was to investigate the use of the Integrative Model (IM) as a theoretical framework in order to predict the intentions and behaviors of consuming the recommended amount of vegetables each week for five vegetable subgroups among college students. Typically, vegetable intake research has combined fruits and vegetables into one group, such as providing general information about daily recommendations or vouchers for any fruits or vegetables, or focuses on increasing intake of a specific vegetable or fruit, such as providing participants with several servings of a specific fruit like blueberries (Mytton et al., 2014). However, the classification of vegetables into subgroups, with their own weekly recommendations and disparities, warrants research to investigate how attitudes, perceived norms, perceived behavioral control, and intentions about the different subgroups are associated with consumption (CDC 2013). This study examines the extent to which the IM constructs can be used to predict intentions to consume each subgroup of vegetables and meeting vegetable subgroups recommendations. This chapter describes the sample and recruitment processes, instrumentation, research design, data collection procedures, and data management that were used in this study.

Sample

Determining a minimum sample size for this study is difficult, since little research has been done using the IM, which means little information is available on what the expected effect size is for this study. A recent meta-analysis on the Theory of

Planned Behavior with nutrition behaviors in youth calculated small, medium, and large effect sizes (d=0.30, 0.50, and 0.80) (Riebl et al., 2011). Therefore a minimum sample size for this study was found using a power analysis with G*power software with a=0.05, B=0.80, and p=0.30. However, another criteria for determining sample size is what statistical tests are employed. In this study factor analysis was used to determine construct validity of each scale (more details about this method is discussed later). Tabachnick and Fidell suggest a minimum sample size of 300 to support factor analysis (Vincent & Weir, 2012). Therefore, a minimum of 300 participants were recruited.

Inclusion criteria for this study includes: college students between the ages of 18 and 30, and must be enrolled in at least 1 credit hour at the University of Oklahoma at the time of participation. Participants were excluded if they did not meet the above inclusion criteria, if they were unable to take an online survey, or if they did not complete at least 85% of the survey. The sampling technique used was convenience sampling, and participation was voluntary. Recruitment was done through email listings, and all students on the available email listings at the University of Oklahoma were given the opportunity to participate.

Instrumentation and Measurement Protocols

The instrument used in this study was an online survey of 111 questions in length (Appendix A). The survey was divided into five vegetable subgroup sections, a skills and environment section, and a demographics section. Through a literature search, no existing instruments that utilize the IM constructs with the five vegetable subgroups was found. Therefore, an instrument was developed specifically for use in this study, using the guidelines on how to create a theory of planned behavior questionnaire (Ajzen, 2002; Fishbein and Ajzen, 2010). These guidelines were developed by Martin Fishbein and Icek Ajzen, the creators of the Theory of Reasoned Action and Planned Behavior, and are highly likely to be representative of the constructs identified for exploration in this study because the IM is adapted from the theory of planned behavior. This instrument was reviewed in two rounds by a panel of 6 experts, revised, and pilot tested with thirty students at the University of Oklahoma. The panel of experts consisted of two nutrition experts, two IM experts, and two experts with experience with the target population of college students (Appendix B). The pilot test used in the formative evaluation process gathered feedback about the survey from thirty college students who were members of the target population. As they went through the instrument online, the students wrote down their impressions of the survey (clarity, difficulty, appeal, etc) on a hard copy comments sheet. A timing feature embedded in the survey was also used to determine an accurate estimate of the time necessary for participants to complete the survey. At the conclusion of pilot testing the instrument was modified to address concerns about readability before dissemination. This instrument and delivery method is appropriate because it allows the researchers to contact the greatest proportion of potential participants, and the participants can choose to take the survey at a time that is convenient for them.

Research Design and Data Collection Procedures

This study has a cross-sectional design. Data collection began in February of 2016 and was completed in March of 2016. In order to begin data collection, the researchers received the approval of the University of Oklahoma Institutional Review Board (IRB #6386) and permission to use University wide email lists. Once these approval measures were obtained, a mass email was sent out inviting students to participate in a survey. The email acted as an informed consent page, and outlined the purpose of the study, that participation was voluntary, listed any potential risks or benefits associated with participation, included the estimated time requirement for participation, and stated that no identifying information would be kept. Students were then able to click on a link and begin the survey. The survey was standardized so that all participants received an identical survey and all sections were presented in a consistent manner. There was no time limit for completion of the survey. At the end of participation there was an opportunity for students to submit their email address to be entered into a random drawing to win one of three $20 gift cards. The email addresses were not associated with the participants' survey responses. Participants had to complete 85% of the survey questions for their data to be included in the final data analysis.

Operationalized Definitions of Integrative Model Constructs

The instrument consisted of one section evaluating each vegetable subgroup consumption, a section evaluating skills and environment related to preparing vegetables for consumption, and a demographics page. The demographics section evaluated age, gender, major, class standing, ethnicity, living arrangements, and vegetable consumption. Each vegetable subgroup section assessed vegetable consumption within the last week, as well as the IM constructs of attitudes, perceived norms, perceived behavioral control, and intentions. All subgroup, skills, and environment questions were assessed using a bipolar 7-point sematic differential scale.

"Attitudes towards a behavior" (or simply attitudes) refers to an individual's overall perception of favorableness or un-favorableness towards a behavior comprised of affective and cognitive dimensions. There are two major types of attitudes: **instrumental attitudes** refer to beliefs about the outcomes of behavior, and **experiential attitudes** refer to the individual's emotional response to the idea of performing the behavior. In this study, this construct was operationalized using direct measures. Four items (two instrumental and two experiential) per subscale were used to determine attitudes for each of the five behaviors, and were measured by items 1-4, 17-20, 33-36, 49-52, 65-68 with a possible range of 4-28 per behavior. These ranges were then transformed into a -3 to +3 scale, indicating that those that score -3 have strong negative attitudes, and 3 have strong positive attitudes.

"Perceived norms" refers to the social pressure one feels to perform or not perform a particular behavior. There are also two major types of perceived norms: **injunctive norms**: normative beliefs about what others think one should do and motivation to comply, and **descriptive norms** refers perceptions about what others in one's social or personal networks are doing. In this study, this construct was operationalized using direct measures. Four items (two injunctive and two descriptive) per subscale were used to determine perceived norms for each of the five behaviors, and were measured by items 8-11, 24-27, 40-43, 56-59, 72-75 with a possible range of 4-28 per behavior. During analysis one question was found to be inadequate and removed per subscale, which created a possible range of 3-21. These ranges were then transformed into a -3-+3 scale. These ranges indicate that those that score -3 have strong negative norms, and 3 have strong positive perceived norms.

"Perceived behavioral control" (or PBC) refers to individual's capability to originate and direct actions for given purposes. There are also two types of PBC: **capacity beliefs** refers to an individual's belief in his/her effectiveness in performing specific tasks as well as by their actual skill, and **autonomy** refers to an individual's perceived amount of control over behavioral performance. It is determined by control beliefs (an individual's perception of the degree to which various environmental factors make it easy or difficult to perform a behavior). In this study, this construct was operationalized using direct measures. Four items (two capacity beliefs and two autonomy beliefs) per subscale were used to determine PBC for each of the five behaviors, and were measured by items 5-7, 12, 21-23, 28, 37-39, 44, 53-55, 60, 69-71, 76 with a possible range of 4-28 per behavior. These ranges were then transformed into a -3-+3 scale. These ranges indicate that those that score -3 have strong negative PBC, and 3 have strong positive PBC.

"Intentions" refers to an individual's readiness to engage in a particular behavior. In this study, this construct was operationalized as individual responses to items referring to "I will", "I intend", and "I will try" directed towards each of the five behaviors. Three items per subscale were used to determine intentions for each of the five behaviors, and were measured by items 13-15, 29-31, 45-47, 61-63, 77-79 with a possible range of 3-21 per behavior. These ranges were then transformed into a -3-+3 scale. These ranges indicate that those that score -3 have strong negative intentions, and 3 have strong positive intentions.

"Skills/Abilities" refers to volitional control in the performance of a behavior and in the attainment of behavioral goals. In this study, this construct was operationalized as "I can" and refers to the behavior of preparing each vegetable subgroup. This construct was measured by items 81-85 with a possible range of 1-7. This range indicated that those that score 1 have strong negative skills, and 7 strong positive skills.

"Environment" refers to the environmental constraints preventing behavioral performance. In this study, this construct was operationalized as "There are always vegetables available for me to eat in my home" for each vegetable subgroup. This construct is being measured by items 86-90 with a possible range of 1-7. This range indicated that those that score 1 have strong negative environmental constraints, and 7 have strong positive environmental constraints. In addition, participants indicated whether they primarily prepare their food, or if other people primarily prepare their food in item 91.

"Behavior" refers to consuming at least the recommended amount of each vegetable subgroup per week. This variable was calculated using the self-reported measurements of average number of times that the participant eats vegetables per week, multiplied by the average number of cups of vegetables that participants eats per time, to get a total vegetable consumption score per week. Total consumption was then recoded into meeting or not meeting subgroup recommendations for each subgroup, based on gender.

Finally, two types of regression were used in this study because analyses have to be appropriate for the type of variables that researchers study. Dr. Fishbein and Dr. Ajzen (2010) describe the importance of behavioral compatibility when studying behaviors, and how coding variables as dichotomous (doing or not doing the behavior) can be preferable to exploring a whole behavior continuum because it is a more simple approach than trying to explain a wide expression of behaviors, and counteracts problems that would arise related to different magnitudes and frequencies of the behavior. Therefore, multiple regression is appropriate for the continuous scales of attitudes, perceived norms, and perceived behavioral control to predict intentions, while binary logistical regression is appropriate for intentions, perceived behavioral control, skills, and intentions to predict the dichotomous variable of meeting or not meeting recommendations. Even when the behavior is quantified as dichotomous (meeting or not meeting), all scales must be compatible, in that they measure the same behavior in terms of target, action, context, and time. Therefore, all of the scales inquire about attitudes, perceived norms, perceived behavioral control, and intentions towards meeting the recommended amount of vegetable subgroups each week. Attitudes, perceived norms, and perceived behavioral control scales each consisted of multiple indicators (such as instrumental and experiential kinds of attitudes) which could be useful for structural equation modelling, but they should still be treated as unitary constructs when used to predict intentions as a direct test of the model (Fishbein & Ajzen, 2010). Skills and environment were proxy measures that were not fully compatible with the behavior, but rather closely related behaviors (preparing vegetables for skills, and having vegetables in the home for environment).

Data Management and Analysis

All data was stored electronically on a password protected computer and only IRB approved researchers had access to the data. SPSS version 21 was used to analyze the data collected. A panel of experts evaluated the survey for face and content validity, and a pilot test was conducted to ensure that the scales are consistent and understandable. Internal consistency was evaluated to determine how well the items in the scale relate to one another using a Cronbach's alpha, and it must meet 0.7 or higher to accept reliability. Construct validity of the survey was evaluated using confirmatory factor analysis to establish how well the items in the survey measured the constructs that they are intended to measure. Factors were included if they had an Eigenvalue greater than 1, and accounted for at least 70% of variance. Test-retest reliability was assessed using data from a subset of ten participants who took the survey twice, then a Pearson's correlation was calculated. Values must be 0.7 or higher to be accepted.

Once data collection concluded, two kinds of regression were used to evaluate which constructs of the IM account for the highest amount of variance in intentions and behavior for the five vegetable subgroups. Stepwise multiple regression was used to determine how the constructs of attitudes, perceived norms, and perceived behavioral control of the IM are related to intentions to consume the different recommendations for subgroups of vegetables. Logistic regression was used to determine how intentions, perceived behavioral control, skills, and environment are related to meeting vegetable subgroup recommendations.

Two types of regression were used in this study because analyses have to be appropriate for the type of variables that researchers study. Dr. Fishbein and Dr. Ajzen (2010) describe the importance of behavioral compatibility when studying behaviors, and how coding variables as dichotomous (doing or not doing the behavior) can be preferable to exploring a whole behavior continuum because it is a more simple approach than trying to explain a wide expression of behaviors, and counteracts problems that would arise related to different magnitudes and frequencies of the behavior. Therefore, multiple regression is appropriate for the continuous scales of attitudes, perceived norms, and perceived behavioral control to predict intentions, while binary logistical regression is appropriate for intentions, perceived behavioral control, skills, and intentions to predict the dichotomous variable of meeting or not meeting recommendations.

Even when the behavior is quantified as dichotomous (meeting or not meeting), all scales must be compatible, in that they measure the same behavior in terms of target, action, context, and time. Therefore, all of the scales inquire about attitudes, perceived norms, perceived behavioral control, and intentions towards meeting the recommended amount of vegetable subgroups each week. Attitudes, perceived norms, and perceived behavioral control scales each consisted of multiple indicators (such as instrumental and experiential kinds of attitudes) which could be useful for structural equation modelling, but they should still be treated as unitary constructs when used to predict intentions as a direct test of the model (Fishbein & Ajzen, 2010). Skills and environment were proxy measures that were not fully compatible with the behavior, but rather closely related behaviors (preparing vegetables for skills, and having vegetables in the home for environment). More detail about statistical procedures are provided in Chapter 4.

Chapter 4

Results

Introduction

The majority of adults in the United States do not eat enough variety or quantity of vegetables, which leads to greater risk of malnutrition and chronic disease (US Department of Health and Human Services, 2010). The United States Department of Agriculture (USDA) defines five vegetable subgroups (USDA, n.d.), which in this section will be abbreviated as: dark green (DG), red and orange (RO), beans and peas (BP), starchy (S) and other (O). The USDA also recommends adults to consume a certain amount of each of the subgroups every week. The purpose of this study was to investigate the use of the Integrative Model (IM) as a theoretical framework in order to predict intentions and behaviors of consuming the recommended amounts of five vegetable subgroups each week among college students. Although vegetable consumption has been widely studied, this study is the first to use the IM to investigate vegetable consumption as a behavioral category consisting of all of the five USDA sub-groups.

This study required the development of an instrument to answer the aforementioned research questions. For this study, the different types of validity and reliability of the instrument were evaluated. Furthermore, the findings from this study show which constructs of the IM are associated with predicting intentions and behaviors of meeting vegetable subgroup recommendations for five different vegetable subgroups. To predict behavioral intentions, stepwise multiple regression was used with attitudes, perceived norms, and perceived behavioral control for each behavioral sub-group. To predict each behavioral sub-group, logistic regression was used to investigate how intentions, perceived behavioral control, skills, and environment predicted meeting or not meeting the recommended amount of vegetables sub-group each week. Finally, one-way ANOVA tests and correlations were performed to identify the relationships between attitudes, perceived norms, and perceived behavioral control and background factors, such as gender. SPSS Version 21 data analysis software was used to run all analyses.

Reliability & Validity

Cronbach's alpha was used to establish internal consistency reliability for each subscale of each subgroup behavior in the instrument. Subscales with an alpha of ≥ 0.7 were considered acceptable. When Cronbach's alpha was <0.7, items in the scale were evaluated to investigate the presence of weak or redundant items, which could impact the Cronbach's alpha score. Test-retest reliability was assessed using a Pearson's correlation coefficient to determine the stability of the scale when the survey was taken twice by the same participants at least one week apart. Values were accepted if the correlation (r) was ≥ 0.7 or greater. It should be noted that an assumption of using this statistical procedure was that at least thirty participants were needed; however, only 10 participants (n=10) completed this assessment twice, therefore the results cannot be interpreted as if that assumption had been met. When test-retest reliability did not meet acceptable standards, t-tests were used between time points one and two to determine if they were significantly different. Factor loadings in confirmatory factor analysis ≥ 0.269 were considered acceptable and each scale needed to contain a single factor with an

Eigenvalues ≥ 1. The results for the reliability statistics are summarized in Table 4.1, and the confirmatory factor analysis in Table 4.2.

Table 4.1 A Summary of the Reliability Statistics and Survey Scales

Theoretical Construct	Possible Minimum-Maximum	Observed Minimum-Maximum	Mean (SD)	Cronbach's Alpha (α)	Stability (Pearson's r)
DG – Total Attitudes	-3 - +3	-3- +3	1.26 (1.28)	0.827	0.415
DG – Total Perceived Norms	-3 - +3	-2 - +3	0.40 (1.02)	0.455	0.869
DG – Total Perceived Behavioral Control	-3 - +3	-2.5 - +3	1.51 (1.24)	0.814	0.806
DG – Intentions	-3 - +3	-3 - +3	1.17 (1.55)	0.927	0.514
RO – Total Attitudes	-3 - +3	-3- +3	1.39 (1.25)	0.854	0.539
RO – Total Perceived Norms	-3 - +3	-2.67 - +3	0.27 (1.06)	0.520	0.897
RO – Total Perceived Behavioral Control	-3 - +3	-2.25 - +3	1.47 (1.24)	0.826	0.748
RO – Intentions	-3 - +3	-3 - +3	0.85 (1.50)	0.915	0.776
BP – Total Attitudes	-3 - +3	-3- +3	1.17 (1.52)	0.900	0.528
BP – Total Perceived Norms	-3 - +3	-3 - +3	0.07 (1.13)	0.576	0.747
BP – Total Perceived Behavioral Control	-3 - +3	-2.25 - +3	1.65 (1.27)	0.836	0.737
BP – Intentions	-3 - +3	-3 - +3	0.76 (1.73)	0.937	0.366
S – Total Attitudes	-3 - +3	-3- +3	1.58 (1.21)	0.853	0.671
S – Total Perceived Norms	-3 - +3	-3 - +3	0.06 (1.25)	0.623	0.779
S – Total Perceived Behavioral Control	-3 - +3	-2.25 - +3	2.00 (1.11)	0.842	0.543
S – Intentions	-3 - +3	-3 - +3	1.01 (1.60)	0.930	0.711
O – Total Attitudes	-3 - +3	-3- +3	1.78 (1.32)	0.919	0.159
O – Total Perceived Norms	-3 - +3	-3 - +3	0.29 (1.16)	0.593	0.737
O – Total Perceived Behavioral Control	-3 - +3	-2.5 - +3	1.75 (1.24)	0.860	0.885
O – Intentions	-3 - +3	-3 - +3	1.23 (1.58)	0.941	0.467

Table 4.2. Summary of Factor Analysis for Establishing Construct Validity for Attitudes

Variable	Eigenvalue	Factor Loadings
Dark Green - Attitudes	***2.637***	
Ins 1 - Worthless:Valuable		0.466
Ins 2 – Unnecessary:Necessary		0.477
Exp 1 - Unpleasant:Pleasant		0.942
Exp 2 - Unappetizing:Tasty		0.942
Red and Orange - Attitudes	***2.791***	
Ins 1 - Worthless:Valuable		0.528
Ins 2 - Unnecessary:Necessary		0.507
Exp 1 - Unpleasant:Pleasant		0.977
Exp 2 - Unappetizing:Tasty		0.923
Beans and Peas - Attitudes	***3.090***	
Ins 1 - Worthless:Valuable		0.635
Ins 2 – Unnecessary:Necessary		0.616
Exp 1 - Unpleasant:Pleasant		0.976
Exp 2 - Unappetizing:Tasty		0.974
Starchy - Attitudes	***2.799***	
Ins 1 - Worthless:Valuable		0.487
Ins 2 - Unnecessary:Necessary		0.514
Exp 1 - Unpleasant:Pleasant		0.981
Exp 2 - Unappetizing:Tasty		0.936
Other - Attitudes	***3.235***	
Ins 1 - Worthless:Valuable		0.681
Ins 2 – Unnecessary:Necessary		0.717
Exp 1 - Unpleasant:Pleasant		0.982
Exp 2 - Unappetizing:Tasty		0.964

Note: Maximum likelihood estimation used for all subscales

Table 4.3. Summary of Factor Analysis for Establishing Construct Validity for Perceived Norms

Variable	Eigenvalue Initial	Factor Loadings Initial	Eigenvalue Final	Factor Loadings Final
Dark Green – Perceived Norms	***1.562/1.141***		***1.461/1.019***	
Inj 1 – People important to me think I should eat recommended		0.383		0.696
Inj 2 – I want to do what important people think I should do		0.999		0.863
Des 1 – Most college students like me eat recommended		0.105		
Des 2 – I want to do what others like me are doing		0.273		0.481
Red and Orange – Perceived Norms	***1.671/1.162***		***1.588***	
Inj 1 – People important to me think I should eat recommended		0.488		0.763
Inj 2 – I want to do what important people think I should do		0.931		0.855
Des 1 – Most college students like me eat recommended		0.140		
Des 2 – I want to do what others like me are doing		0.279		0.495
Beans and Peas – Perceived Norms	***1.768***		***1.631***	
Inj 1 – People important to me think I should eat recommended		0.460		0.687
Inj 2 – I want to do what important people think I should do		0.915		0.863
Des 1 – Most college students like me eat recommended		0.181		
Des 2 – I want to do what others like me are doing		0.423		0.644
Starchy – Perceived Norms	***1.743/1.049***		***1.714***	
Inj 1 – People important to me think I should eat recommended		0.429		0.681
Inj 2 – I want to do what important people think I should do		0.955		0.853
Des 1 – Most college students like me eat recommended		0.052		
Des 2 – I want to do what others like me are doing		0.477		0.723
Other– Perceived Norms	***1.821/1.108***		***1.665***	
Inj 1 – People important to me think I should eat recommended		0.489		0.722
Inj 2 – I want to do what important people think I should do		0.959		0.871
Des 1 – Most college students like me eat recommended		0.190		
Des 2 – I want to do what others like me are doing		0.400		0.621

Note: Maximum likelihood estimation used for all subscales

Table 4.4. Summary of factor analysis for establishing construct validity for Perceived Behavioral Control (PBC)

Variable	Eigenvalue	Factor Loadings
Dark Green – Perceived Behavioral Control	***2.606***	
Cap 1 – Difficult:Easy		0.455
Cap 2 – Impossible:Possible		0.692
Aut 1 – Out of my control:Within my control		0.653
Aut 2 - Completely up to me		0.229
Red and Orange - Perceived Behavioral Control	***2.673***	
Cap 1 – Difficult:Easy		0.732
Cap 2 – Impossible:Possible		0.847
Aut 1 – Out of my control:Within my control		0.829
Aut 2 - Completely up to me		0.583
Beans and Peas - Perceived Behavioral Control	***2.724***	
Cap 1 – Difficult:Easy		0.796
Cap 2 – Impossible:Possible		0.941
Aut 1 – Out of my control:Within my control		0.779
Aut 2 - Completely up to me		0.486
Starchy - Perceived Behavioral Control	***2.749***	
Cap 1 – Difficult:Easy		0.766
Cap 2 – Impossible:Possible		0.954
Aut 1 – Out of my control:Within my control		0.821
Aut 2 - Completely up to me		0.503
Other - Perceived Behavioral Control	***2.859***	
Cap 1 – Difficult:Easy		0.742
Cap 2 – Impossible:Possible		0.952
Aut 1 – Out of my control:Within my control		0.864
Aut 2 - Completely up to me		0.594

Note: Maximum likelihood estimation used for all subscales

Table 4.5. Summary of factor analysis for establishing construct validity for Intentions

Variable	Eigenvalue	Factor Loadings
Dark Green – Intentions	***2.622***	
Int 1 – I will eat the recommended		0.889
Int 2 – I will try to eat the recommended		0.876
Int 3 – I intend to eat the recommended		0.937
Red and Orange - Intentions	***2.569***	
Int 1 – I will eat the recommended		0.814
Int 2 – I will try to eat the recommended		0.909
Int 3 – I intend to eat the recommended		0.936
Beans and Peas - Intentions	***2.667***	
Int 1 – I will eat the recommended		0.870
Int 2 – I will try to eat the recommended		0.911
Int 3 – I intend to eat the recommended		0.959
Starchy - Intentions	***2.630***	
Int 1 – I will eat the recommended		0.825
Int 2 – I will try to eat the recommended		0.928
Int 3 – I intend to eat the recommended		0.957
Other - Intentions	***2.685***	
Int 1 – I will eat the recommended		0.862
Int 2 – I will try to eat the recommended		0.937
Int 3 – I intend to eat the recommended		0.955

Note: Maximum likelihood estimation used for all subscales

Subgroup Attitudes

Each of the five attitudes scales consisted of four items, including two items evaluating instrumental attitudes and two items evaluating experiential attitudes. After initial analysis for each subscale, the Cronbach's alpha for DG was 0.827, RO was 0.854, BP was 0.900, S was 0.853, and O was 0.919 with all items included. Since all attitudes subscales had a Cronbach's alpha value greater than 0.7, and excluding items did not significantly increase the existing scores, no items were excluded from any of the subscales. Using confirmatory factor analysis, the four items in the DG attitudes scale loaded onto one factor with an Eigenvalue of 2.637, and the factor loadings ranged from 0.466-0.942. The four items in the RO attitudes loaded onto one factor with an Eigenvalue of 2.791, and the factor loadings ranged from 0.507-0.977. The four items in the BP attitudes scale loaded onto one factor with an Eigenvalue of 3.090, and the factor loadings ranged from 0.616-0.976. The four items in the S attitudes scale loaded onto one factor with an Eigenvalue of 2.799, and the factor loadings ranged from 0.487-0.981. Finally, the four items in the O attitudes scale loaded onto one factor with an Eigenvalue of 3.235, and the factor loadings ranged from 0.681-0.982. All values were ≥ 0.269, therefore all four items were retained for all attitudes scales.

Subgroup Perceived Norms

Each of the five perceived norms scales consisted of four items, of which two evaluated instrumental norms and two evaluated descriptive norms. After initial analysis for each scale, the Cronbach's alpha for DG was 0.478, RO was 0.533, BP was 0.574, S was 0.531, and O was 0.599. Since no score was ≥ 0.70, the inter-item correlations were examined, and as a result one item from each scale appeared that it did not contribute significantly in the Cronbach's alpha analysis [the descriptive norms question "Most college students like me eat the recommended amount of (subgroup) vegetables each week"]. After excluding this item from each scale the final Cronbach's alpha scores changed to DG 0.455, RO 0.520, BP 0.576, S 0.623, and O 0.593. While these Cronbach's alpha scores were lower than the standard 0.7 cutoff, they were considered satisfactory for retaining items for this study because no further changes could improve the Cronbach's alpha scores. It should also be noted that Cronbach's alpha scores are sensitive to the number of items on a scale, and low scores may not necessarily be indicative of problematic internal consistency (Spiliotopoulou 2009). Concurrently, using confirmatory factor analysis with four items for the perceived norms scale found that the items did not load into a single factor, and that removing the aforementioned item significantly improved the results. After using the modified three item scale in the RO perceived norms scale contained an Eigenvalue of 1.588, with factor loadings ranging from 0.495-0.855. The modified three item BP scale resulted in an Eigenvalue of 1.631, with factor loadings ranging from 0.644-0.863. The modified three item S perceived norms scale resulted in an Eigenvalue of 1.714, with factor loadings ranging from 0.681-0.853. The modified three item O perceived norms scale resulted in an Eigenvalue of1.665, with factor loadings ranged from 0.621-0.871. All values greater than 0.269 were considered acceptable values, therefore after the removal of the one unacceptable item from each scale the remaining three items were retained for all perceived norms scales.

Subgroup Perceived Behavioral Control

Each of the five perceived behavioral control scales consisted of four items, including two items evaluating capacity and two items evaluating autonomy. After initial analysis for each subscale, the Cronbach's alpha for DG was 0.814, RO was 0.826, BP was 0.836, S was 0.842, and O was 0.860 with all items included. Using confirmatory factor analysis, the four items in the DG PBC scale loaded onto one factor with an Eigenvalue of 2.606, and the factor loadings ranged from 0.229-0.692. The four items in the RO PBC scale loaded onto one factor with an Eigenvalue of 2.673, and the factor loadings ranged from 0.583-0.847. The four items in the BP PBC scale loaded onto one factor with an Eigenvalue of 2.724, and the factor loadings ranged from 0.486-0.941. The four items in the S PBC scale loaded onto one factor with an Eigenvalue of 2.749, and the factor loadings ranged from 0.503-0.954. The four items in the O PBC scale loaded onto one factor with an Eigenvalue of 2.859, and the factor loadings ranged from 0.594-0.952. All values greater than 0.269 were considered acceptable values. Only one item in the DG PBC scale did not meet this minimum standard, but it was close that all four items were retained in all scales for perceived behavioral control so that the scales would be consistent in further analysis.

Subgroup Intentions.

Each of the five intentions scales consisted of three items. After initial analysis for each scale, the Cronbach's alpha for DG was 0.927, RO was 0.915, BP was 0.937, S was 0.930, and O was 0.941 with all items included. Using confirmatory factor analysis, the three items in the DG intentions scale loaded onto one factor with an Eigenvalue of 2.622, with factor loadings ranging from 0.876-0.937. The three items in the RO intentions scale loaded onto one factor with an Eigenvalue of 2.569, with the factor loadings ranging from 0.814-0.936. The three items in the BP intentions scale loaded onto one factor with an Eigenvalue of 2.667, with the factor loadings ranging from 0.870-0.959. The three items in the S intentions scale loaded onto one factor with an Eigenvalue of 2.630, with the factor loadings ranging from 0.825-0.957. The three items in the O intentions scale loaded onto one factor with an Eigenvalue of 2.685, with the factor loadings ranging from 0.862-0.955. All values greater than 0.269 were considered acceptable values, therefore all three items for intentions were retained for all intentions scales.

Test-retest Reliability

Only ten participants completed the survey twice. Pearson's r correlation coefficients were used to determine the test-retest reliability of the constructs of each subgroup. The Pearson's correlation coefficients for attitudes of the five subgroups ranged from 0.415 to 0.671, none of which met the acceptable Pearson's correlation cutoff of 0.7 or greater. This indicated that none of the five attitudes scales appeared to be test-retest reliable. Perceived norms of each subgroup were better, with Pearson's correlation coefficients ranging from 0.747 to .897, which indicates all five of the subgroups' perceived norms scales were acceptable for test-retest reliability. Perceived behavioral control ranged from 0.543 to 0.885, of which all subgroups were acceptable except for S. Finally, intentions ranged from 0.366 to 0.776, of which only RO and S were acceptable. However, when t-tests were used to determine whether the scales, and items in the scales, were significantly different between time point 1 and time point 2, all but one of the scales were found to be not significantly different across time, with the exception of dark green perceived behavioral control (p=0.017), of which only one item [For me eating the recommended amount of dark green vegetables each week is difficult::easy] was significantly different (p=0.003). One item in the attitudes starchy scale [For me eating the recommended amount of starchy vegetables each week is unappetizing::tasty] was also significantly different (p=0.029), but the scale was not significantly different across time.

Summary of Reliability & Validity

The scales for each vegetable subgroup within this instrument were evaluated using internal consistency, test-retest reliability and confirmatory factor analysis. Internal consistency found the most of the scales were reliable and valid, although one item in perceived norms was consistently underscoring and problematic in both internal consistency and confirmatory factor analysis. This deficiency was corrected by eliminating that item from each of the subgroups' perceived norm scales. The test-retest Pearson's r values could be improved by using a large enough group of participants for test-retest, and t-tests show that the participants' answers were not significantly different between the first and second survey for most scales. Cronbach's alpha could be improved if the instrument had more items in the perceived norms scales for all vegetable subgroups. Future research is needed to determine what kinds of perceived norms items will result in the most clearly understood, construct representative, and consistent scales. This instrument was created for use in this study and had not been tested before, so future research can also be used to further expand these scales and retest them with more items.

Assumptions Evaluation

To run regression models, assumptions about the number of participants needed and normality of the data must be considered. For stepwise multiple regression the ratio of subjects to independent variables needs to be greater than or equal to 40:1 (Vincent & Weir, 2012). For this study, there were no more than three independent variables per subgroup, and subgroups were run independently, so one hundred twenty participants were needed. This study met this assumption with 386 participants.

Normality of the data was assessed using the measures of skewness and kurtosis. Values between -3 and +3 were considered to be normal and did not exceed normal skewness and kurtosis standards. All of the scales in this study (attitudes, perceived norms, perceived behavioral control, and intentions) had normal distribution; however, the total vegetable consumption for each subgroup did not appear to be normally distributed. An analysis of means, standard deviations, and frequencies was used to detect outliers for the variables *times (of vegetable sub-group) eaten per week, cups (of vegetable sub-group) eaten per week*, and *overall consumption* that were greater than three standard deviations away from the mean. Overall there were 22 outliers (6 times, 6 cups, 10 consumption) in dark green, 28 outliers (6 times, 10 cups, 12 consumption) in red and orange, 20 outliers (7 times, 5 cups, 8 consumption) in beans and peas, 32 outliers (7 times, 10 cups, 15 consumption) in starchy, and 32 outliers (11 times, 11 cups, and 10 consumption) in other vegetables. Each outlier was transformed into the variables' mean plus three standard deviations, as a way to remove implausible outliers (ie. 100 cups per week) and establish normality for each variable (Perez, 2002). After this transformation, skewness measures reached normality for all vegetables subgroups;

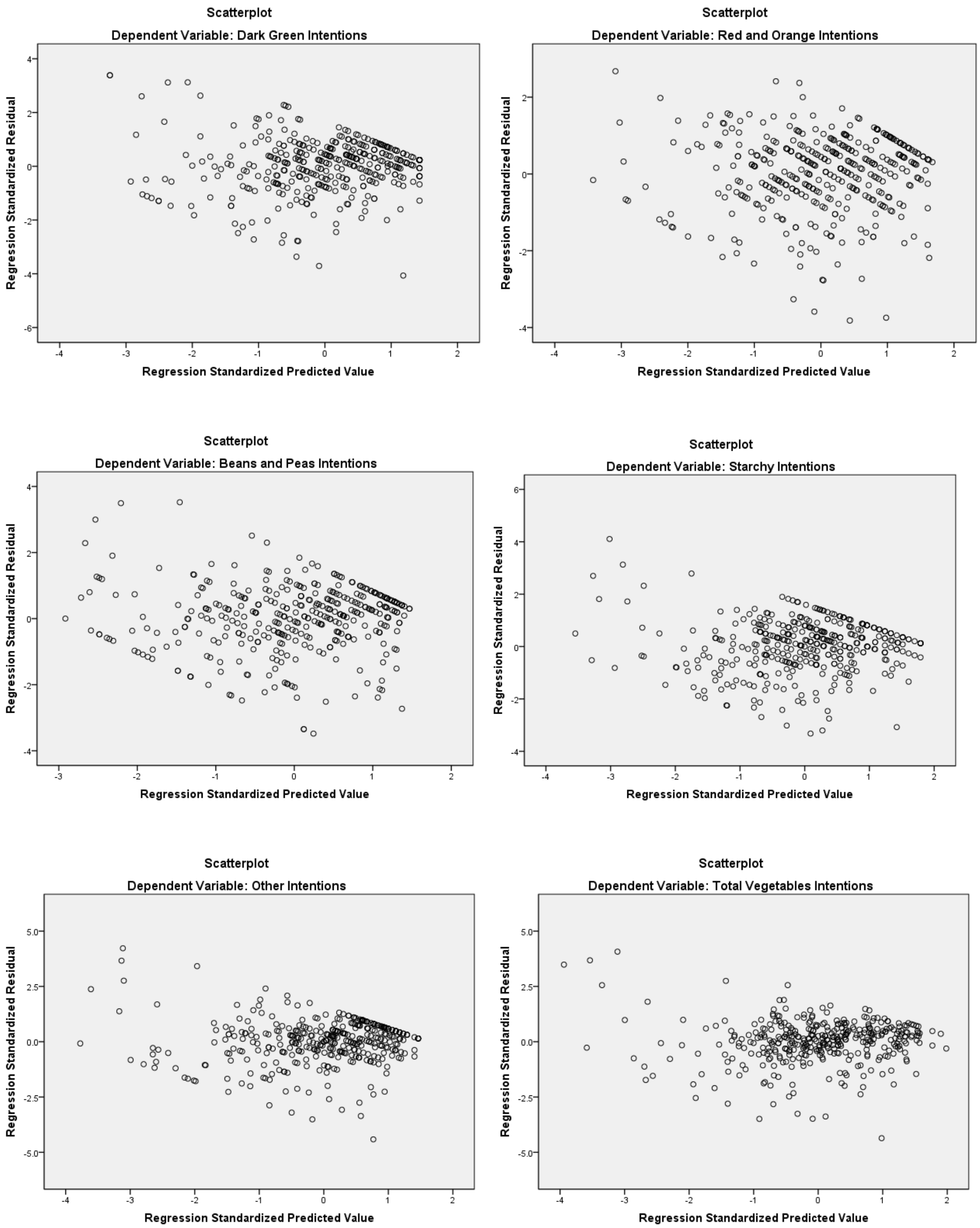
however, several kurtosis measures were still above accepted standards of normality (Table 4.6). However, these values can be accepted for this study in light of evidence that suggests that small deviations from normality have limited impact on the power of statistical tests (Stevens 2009).

Table 4.6. Skewness and Kurtosis Before and After Transforming Outliers (n=386)

	DG	RO	BP	S	O
Skewness Times per week					
Before	1.786	2.740	1.606	2.181	2.099
After	1.014	1.054	1.229	0.997	1.091
Skewness Cups per week					
Before	4.100	4.224	5.621	5.934	3.707
After	1.798	2.213	2.213	1.602	1.928
Skewness total consumption					
Before	4.922	4.182	12.251	8.115	3.281
After	1.759	2.056	2.298	1.953	1.786
Kurtosis Times per week					
Before	6.359	14.226	.3.318	9.616	8.993
After	1.379	1.897	1.199	1.602	1.979
Kurtosis Cups per day					
Before	24.245	25.667	45.158	41.287	20.943
After	3.827	5.556	6.186	7.676	4.617
Kurtosis total consumption					
Before	31.994	25.557	172.646	82.364	14.369
After	2.928	3.887	5.701	3.721	2.794

Homoscedasticity of residuals was inspected using a scatter plot, which uses the predicted dependent variable scores and errors of prediction to determine whether the variances of each set of residuals are equal for each independent variable. Figure 4.1 shows that although there was some clustering, homoscedasticity was maintained because the variances remain equidistant from the line of best fit.

Figure 4.1. Homoscedasticity of Residuals



Multicollinearity

Correlation coefficients proved that none of the constructs were so closely related that they were redundant measures, and this was confirmed through testing for multicollinearity. Multicollinearity was assessed using the variance inflation factor (VIF) to determine if there would be issues in the regression models. The VIF must not exceed 10 (Vincent & Weir 2012) for the assumption of multicollinearity to be met. Multicollinearity is assessed by using each of the independent variables as a dependent variable against all of the other independent variables in the model. All of the constructs of attitudes, perceived norms, and perceived behavioral control had VIFs significantly lower than 10 for all of the five vegetable subgroups. For dark green vegetables, when perceived norms were used as the dependent variable, attitudes and PBC both had a VIF of 1.663. (T .601), when attitudes was used as the dependent variable, PBC and perceived norms both had a VIF of 1.001 (T .999), and when PBC was used as the dependent variable, attitudes and perceived norms both had a VIF of 1.008 (T .993). For red and orange vegetables, when perceived norms were used as the dependent variable, attitudes and PBC both had a VIF of 1.614 (T .620). When attitudes was used as the dependent variable, PBC and perceived norms both had a VIF of 1.011 (T .989), and when PBC was used as the dependent variable, attitudes and perceived norms both had a VIF of 1.038 (T .963). For beans and peas, when perceived norms was used as the dependent variable, attitudes and PBC both had a VIF of 2.119 (T .472), when attitudes was used as the dependent variable, PBC and perceived norms both had a VIF of 1.018 (T .982), and when PBC was used as the dependent variable, attitudes and perceived norms both had a VIF of 1.084 (T .923). For starchy vegetables, when perceived norms was used as the dependent variable, attitudes and PBC both had a VIF of 1.657 (T .603), when attitudes was used as the dependent variable, PBC and Norms both had a VIF of 1.009 (T .991), and when PBC was used as the dependent variable, attitudes and perceived norms both had a VIF of 1.104 (T .906). For other vegetables, when perceived norms was used as the dependent variable, attitudes and PBC both had a VIF of 1.910. (T .524), when attitudes was used as the dependent variable, PBC and perceived norms both had a VIF of 1.010 (T .990), and when PBC was used as the dependent variable, attitudes and perceived norms both had a VIF of 1.025 (T .976). Multicollinearity was also assessed for dependent variable of intentions, which were all significantly under 10 for all vegetable subgroups. For dark green vegetable scales using intentions as the dependent variable, the VIF was 1.675 for attitudes, 1.664 for perceived behavioral control, and 1.009 for perceived norms. For red and orange vegetable scales using intentions as the dependent variable, the VIF was 1.657 for attitudes, 1.614 for perceived behavioral control, and 1.038 for perceived norms. For beans and peas vegetable scales using intentions as the dependent variable, the VIF was 2.280 for attitudes, 2.142 for perceived behavioral control, and 1.096 for perceived norms. For starchy vegetable scales using intentions as the dependent variable, the VIF was 1.843 for attitudes, 1.686 for perceived behavioral control, and 1.123 for perceived norms. For other vegetable scales using intentions as the dependent variable, the VIF was 1.939 for attitudes, 1.910 for perceived behavioral control, and 1.025 for perceived norms.

Demographic Data for Sample

Tables 4.7 and 4.8 describe the demographic variables collected from the participants. Table 4.7 shows the continuous demographics data of age, as well as number of people participants live with others, and the nature of those relationships. Table 4.8 summarizes categorical demographics, and shows the frequency of gender, race, class standing, and number of subgroup recommendations met per week. The majority of the sample was White/Caucasian (73.3%), female (75.4%), lived with at least one roommate (83.4%), does not live with a significant other or spouse (81.6%), and met two or fewer vegetable subgroup recommendations (78.5%).

Table 4.9 further describes the vegetable consumption data of the participants. Consumption medians are reported as well as means and standard deviations of consumption since the data was slightly skewed even after truncation of outliers, so median is a more appropriate representation of typical scores within the group (Vincent & Weir, 2012). One-way ANOVAs were used to detect differences between males and females. There were significant differences of the mean cups consumed between males and females for the subgroups beans and peas ($p=0.020$), and starchy ($p=0.009$). There were significant differences between percent meeting subgroup recommendations between males and females for the subgroups dark green ($p=0.027$) and other ($p=0.025$).

The median cups of dark green vegetables consumed each week was 2.5, with a mean of 4.18 (SD= 4.47). Of the participants, 240 (62.2%) consumed the recommended amount of dark green vegetables, defined as consuming 1 ½ cups for women and 2 cups for men, and 126 (37.8%) did not meet subgroup recommendations. The median cups of red and orange vegetables consumed each week was 1.5, with a mean of 2.83 (SD= 3.46). Of the participants, 54 (14.0%) consumed the recommended amount of red and orange vegetables, defined as consuming 5 ½ cups for women and 6 cups for men, and 332 (86.0%) did not meet subgroup recommendations. The median cups of beans and peas consumed each week was 1.0, with a mean of 2.21 (SD= 3.09). Of the participants, 145 (37.6%) consumed the recommended amount of beans and peas, defined as consuming 1 ½ cups for women and 2 cups for men, and 241 (62.4%) did not meet subgroup recommendations. The median cups of starchy vegetables consumed each week was 3.0, with a mean of 3.86 (SD= 4.00). Of the participants, 72 (18.7%) consumed the recommended amount of starchy vegetables defined as consuming 5 cups for women and 6 cups for men, and 314 (81.3%) did not meet subgroup recommendations. The median cups of other vegetables consumed each week was 2.5, with a mean of 3.69 (SD= 4.00). Of the participants, 94 (24.4%) consumed the recommended amount of other vegetables, defined as consuming 5 cups for women and 6 cups for men, and 292 (75.6%) did not meet subgroup recommendations.

Table 4.7. Demographics (continuous)

	n	Observed Minimum-Maximum	Mean (SD)
Age (years)	381	18-30	21.64 (3.05)
Of participants who live with friends, how many friends do you live with? (8 or less)	281	1-8	2.10 (1.20)
Of participants who live with friends, how many friends do you live with? (households > 39)	5	40-85	72.8 (18.89)
Of participants who live with family, how many family members do you live with?	68	1-10	2.46 (1.61)

Table 4.8 Demographics (Categorical)

Gender (n=386)	
Female	291 (75.4%)
Male	95 (24.6%)
Missing	0 (0.0%)
Race (n=386)	
White/Caucasian	283 (73.3%)
African American	10 (2.6%)
Asian	36 (9.3%)
Native American	19 (4.9%)
Hispanic	21 (5.4%)
Other	13 (3.4%)
Missing	4 (1.0%)
Class Standing (n=386)	
Freshman	72 (18.7%)
Sophomore	65 (16.8%)
Junior	66 (17.1%)
Senior	98 (25.4%)
Graduate	77 (19.9%)
Other	4 (1.0%)
Missing	4 (1.0%)
Do you live alone? (n=386)	
Yes	60 (15.5%)
No	322 (83.4%)
Missing	4 (1.0%)
Do you live with a significant other/spouse? (n=386)	
Yes	67 (17.4%)
No	315 (81.6%)
Missing	4 (1.0%)
Where do you live? (n=386)	
On campus run by OU	111 (28.8%)
Off campus in a fraternity or sorority	7 (1.8%)
Off campus less than 5 miles from campus	204 (52.8%)
Off campus greater than 5 miles from campus	56 (14.5%)
Other	4 (1.0%)
Missing	4 (1.0%)
Met subgroup recommendations (n=386)	
0 recommendations	87 (22.5%)
1 recommendations	111 (28.8%)
2 recommendations	105 (27.2%)
3 recommendations	57 (14.8%)
4 recommendations	17 (4.4%)
5 recommendations	9 (2.3%)

Table 4.9 Consumption Means, SD, and % Meeting Subgroup Recommendations

Vegetable	n	Observed Min-Max (cups)	Median (cups)	Mean (SD) (cups)	% Meeting Recs
Dark green	386	0-19.85	2.50	4.18 (4.47)	62.2%
Male	95	0-19.85	2.50	4.33 (5.20)	52.6%
Female	291	0-19.85	2.85	4.13 (4.21)	65.3%
Red and Orange	386	0-14.91	1.50	2.83 (3.46)	14.0%
Male	95	0-14.91	2.00	3.32 (3.70)	16.8%
Female	291	0-14.91	1.50	2.67 (3.37)	13.1%
Beans and Peas	386	0-14.98	1.00	2.21 (3.09)	37.6%
Male	95	0-14.98	1.50	2.85 (3.80)*	41.1%
Female	291	0-14.98	1.00	2.00 (2.80)*	36.4%
Starchy	386	0-17.41	3.00	3.86 (4.00)	18.7%
Male	95	0-17.41	3.00	3.99 (4.84) *	23.2%
Female	291	0-17.41	2.50	3.43 (3.59)*	17.2%
Other	386	0-16.94	2.50	3.69 (4.00)	24.4%
Male	95	0-16.94	1.75	2.70 (4.05)	15.8%*
Female	291	0-16.94	3.00	3.62 (3.90)	27.1%*
Vegetables	386	0-81.14	13.25	16.78 (12.96)	32.9%
Male	95	0-79.12	14.50	18.49 (15.15)	33.7%
Female	291	0-81.14	13.00	16.22 (12.13)	32.6%

Correlations of Constructs of IM for each Vegetable Subgroup

Correlation matrices are provided to see the correlations between all the constructs of the IM per subgroup. Table 4.10 shows that all of the dark green subgroup constructs (attitudes, perceived norms, PBC, skills, and environment) were significantly correlated to all other dark green subgroup constructs with the exception of perceived norms. Perceived norms were only significantly correlated to intentions. Table 4.11 shows that all of the red and orange subgroup constructs (attitudes, perceived norms, PBC, skills, and environment) were significantly correlated to all other red and orange subgroup constructs with the exception of perceived norms. Perceived norms were only significantly correlated to intentions. Table 4.12 shows that all of the beans and peas subgroup constructs (attitudes, perceived norms, PBC, skills, and environment) were significantly correlated to all other beans and peas subgroup constructs with the exception that perceived norms and environment were not significantly correlated. Table 4.13 shows that all of the starchy subgroup constructs (attitudes, perceived norms, PBC, skills, and environment) were significantly correlated to all other starchy subgroup constructs with the exceptions that PBC and perceived norms were not significantly correlated, and skills and perceived norms were not significantly correlated. Finally Table 4.14 shows that all of the other subgroup constructs (attitudes, perceived norms, PBC, skills, and environment) were significantly correlated to all of the other other subgroup constructs with the exceptions that PBC and perceived norms were not significantly correlated, and environment and perceived norms were not significantly correlated. From these correlations, it can be concluded that of the constructs of each vegetable subgroup, perceived norms has the weakest correlations and relationships to the other constructs in each subgroup.

Table 4.10 Correlations All Constructs Dark Green Subgroup

	DG Att	DG Norms	DG PBC	DG Int	DG Skills	DG Env
DG Attitudes	1					
DG Norms	.086	1				
DG PBC	.631**	.029	1			
DG Intentions	.658**	.116*	.618**	1		
DG Skills	.445*	.080	.478**	.567**	1	
DG Environment	.421**	.042	473**	.594**	.574**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 4.11 Correlations All Constructs Red and Orange

	RO Att	RO Norms	RO PBC	RO Int	RO Skills	RO Env
RO Attitudes	1					
RO Norms	.191**	1				
RO PBC	.611**	.092	1			
RO Intentions	.661**	.275**	.580**	1		
RO Skills	.405**	.047	.474**	.479**	1	
RO Environment	.382**	.080	.488**	.532**	.528**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 4.12 Correlations All Constructs Beans and Peas

	BP Att	BP Norms	BP PBC	BP Int	BP Skills	BP Env
BP Attitudes	1					
BP Norms	.278**	1				
BP PBC	.727**	.134**	1			
BP Intentions	.732**	.268**	.593**	1		
BP Skills	.600**	.152**	.575**	.605**	1	
BP Environment	.541**	.089	.503**	.575**	.628**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 4.13 Correlations All Constructs Starchy

	S Att	S Norms	S PBC	S Int	S Skills	S Env
S Attitudes	1					
S Norms	.307**	1				
S PBC	.630**	.097	1			
S Intentions	.603**	.385**	.401**	1		
S Skills	.283**	.089	.406**	.330**	1	
S Environment	.345**	.156**	.364**	.392**	.487**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 4.14 Correlations All Constructs Other

	O Att	O Norms	O PBC	O Int	O Skills	O Env
O Attitudes	1					
O Norms	.156**	1				
O PBC	.690**	.098	1			
O Intentions	.638**	.232**	.606**	1		
O Skills	.411**	.117*	.537**	.535**	1	
O Environment	.449**	.099	.544**	.558**	.579**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Correlations of Constructs of IM Between Vegetable Subgroups

Correlation matrices are provided to examine the correlations of the constructs between vegetable subgroups. Table 4.15 shows that across the vegetable subgroups, all of the attitudes scales are significantly correlated to each of the other attitudes scales of all other vegetable subgroups. Table 4.16 shows that across the vegetable subgroups, all of the perceived norms scales are significantly correlated to each of the other perceived norms scales of all other vegetable subgroups. Table 4.17 shows that across the vegetable subgroups, all of the PBC scales are significantly correlated to each of the other PBC scales of all other vegetable subgroups. Table 4.16 shows that across the vegetable subgroups, all of the intentions scales are significantly correlated to each of the other intentions scales of all other vegetable subgroups. These correlations suggest that the scales for each of the constructs are highly related across behaviors.

Table 4.15 Correlations Attitudes DG, RO, BP, S, O

	DGAtt	ROAtt	BPAtt	SAtt	OAtt
DGAtt	1				
ROAtt	.550**	1			
BPAtt	.393**	.443**	1		
SAtt	.442**	.494**	.358**	1	
OAtt	.692**	.651**	.448**	.527**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 4.16 Correlations Norms DG, RO, BP, S, O

	DGNorm	RONorm	BPNorm	SNorm	ONorm
DGNorm	1				
RONorm	.710**	1			
BPNorm	.617**	.683**	1		
SNorm	.584**	.651**	.625**	1	
ONorm	.652**	.756**	.677**	.760**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 4.17 Correlations PBC DG, RO, BP, S, O

	DG PBC	RO PBC	BP PBC	SPBC	OPBC
DG PBC	1				
RO PBC	.636**	1			
BP PBC	.530**	.596**	1		
S PBC	.552**	.576**	.510**	1	
O PBC	.761**	.660**	.512**	.690**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 4.18 Correlations Intentions DG, RO, BP, S, O

	DGInt	ROInt	BPInt	SInt	OInt
DGInt	1				
ROInt	.710**	1			
BPInt	.617**	.683**	1		
SInt	.584**	.651**	.625**	1	
OInt	.652**	.756**	.677**	.760**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Correlations of Vegetable Subgroup Consumption Between Vegetable Subgroups

Finally, a correlation matrix is provided to examine the correlations between vegetable consumption for each subgroup and for total vegetable consumption. Table 4.19 shows that across the vegetable subgroups, consumption is significantly correlated between all groups, but differences exist in the strength of those correlations. The strongest correlations exist between each vegetable subgroup and total vegetable consumption. These correlations suggest that vegetable subgroups are more closely related to total vegetable consumption than they are to each other. Total vegetables consumption is correlated most highly with other vegetables, but have high correlations for all subgroups. Between subgroups, dark green is correlated most highly with other vegetables, red and orange is correlated most highly with other vegetables, beans and peas are correlated most highly with red and orange, starchy are correlated most highly with red and orange, and other are correlated most highly with dark green.

Table 4.19 Correlations of consumption for all subgroups and vegetable total

	Dark Green	Red and Orange	Beans and Peas	Starchy	Other	Vegetables Total
Dark Green	1					
Red and Orange	.334*	1				
Beans and Peas	.297**	.332**	1			
Starchy	.236**	.395**	.270**	1		
Other	.446**	.407**	.296**	.261**	1	
Vegetables Total	.715**	.709**	.604**	.640**	.722**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Stepwise Multiple Regression

Stepwise multiple regression was used to determine the extent to which of the constructs of attitudes, perceived norms, and perceived behavioral control are significant in predicting intentions. The results of this analysis can be seen in Table 4.20.

Dark green vegetables. The regression model showed that a significant model was found (F = 192.188, p = 0.001), in which attitudes (p<0.001) and perceived behavioral control (p<0.001) accounted for 49.8% of the variance of intentions to consume the weekly recommended amount of dark green vegetables. Standardized coefficients Beta values for attitudes was 0.445 and for PBC was 0.337.

Red and orange vegetables. The regression model showed that a significant model was found (F = 133.884, p = 0.001), in which attitudes (p<0.001), perceived norms (p<0.001), and perceived behavioral control (p<0.001) accounted for 51.3% of the variance of intentions to consume the weekly recommended amount of red and orange vegetables. Standardized coefficients Beta values for attitudes was 0.439, PBC was 0.308, and norms was 0.161.

Beans and peas vegetables. The regression model showed that a significant model was found (F = 152.422, p = 0.001), in which attitudes (p<0.001), perceived norms (p=0.029), and perceived behavioral control (p=0.009) accounted for 54.3% of the variance intentions to consume the weekly recommended amount of beans and peas vegetables. Standardized coefficients Beta values for attitudes was 0.614, PBC was 0.133, and norms was 0.079.

Starchy vegetables. The regression model showed that a significant model was found ($F = 132.067$, $p = 0.001$), in which attitudes ($p<0.001$) and perceived norms ($p<0.001$) accounted for 40.5% of the variance of intentions to consume the weekly recommended amount of starchy vegetables. Standardized coefficients Beta values for attitudes was 0.536 and norms was 0.221.

Other vegetables. The regression model showed that a significant model was found ($F = 116.840$, $p = 0.001$), in which attitudes ($p<0.001$), perceived norms ($p<0.001$), and perceived behavioral control ($p<0.001$) predicted 47.4% of the variance of intentions to consume the weekly recommended amount of other vegetables. Standardized coefficients Beta values for attitudes was 0.396, PBC was 0.319, and norms was 0.139.

For every vegetable subgroup, the construct of attitudes was the strongest predictor of intentions in each model. Attitudes was a significant predictor for all five subgroups, while PBC was only significant in four subgroups (dark green, red and orange, beans and peas, and other), and norms was only significant in four subgroups (red and orange, beans and peas, starchy, and other).

Table 4.20 Stepwise Regression Model for Intentions as predicted by Attitudes, Perceived Norms, and Perceived Behavioral Control (n=386)

Subgroup	(Adjusted R^2)	Unstandardized Coefficients B	Std. error	Standardized coefficients Beta	t	p-value
Dark green	0.498					
Constant		-0.140	0.090			
Attitudes		0.539	0.056	0.445	9.561	0.001
PBC		0.421	0.058	0.337	7.239	0.001
Red and Orange	0.513					
Constant		-0.482	0.088			
Attitudes		0.526	0.055	0.439	9.499	0.001
PBC		0.375	0.056	0.308	6.748	0.001
Norms		0.228	0.052	0.161	4.406	0.001
Beans and Peas	0.546					
Constant		-0.373	0.099			
Attitudes		0.704	0.060	0.614	11.726	0.001
PBC		0.181	0.069	0.133	2.625	0.009
Norms		0.122	0.056	0.079	2.187	0.029
Starchy	0.405					
Constant		-0.121	0.106			
Attitudes		0.706	0.054	0.536	12.968	0.001
Norms		0.282	0.053	0.221	5.344	0.001
Other	0.474					
Constant		-0.386	0.106			
Attitudes		0.475	0.062	0.396	7.703	0.001
PBC		0.407	0.065	0.319	6.247	0.001
Norms		0.190	0.051	0.139	3.721	0.001
Total Veg	0.477					
Constant		-0.351	0.093			
Attitudes		0.609	0.067	0.492	9.111	0.001
PBC		0.266	0.066	0.213	4.009	0.001
Norms		0.172	0.049	0.133	3.490	0.001

Logistic Regression

Logistic regression models were used to predict the likelihood of participants meeting each subgroup recommendation. Meeting subgroup recommendations was defined as the participant consuming at least the weekly recommended amount of each subgroup. Weekly recommendations for males and females are different, so total consumption of vegetables for each subgroup was calculated for all participants, and then divided into male and female groups to account for the differences in gender in subgroup recommendations. These gendered groups were recoded into their appropriate binary variables (not meeting recommendations = 1, meeting recommendations = 2) then recombined as a single variable of participants meeting or not meeting subgroup recommendations for modeling purposes. The results of the logistic regression model can be seen in Table 4.21.

The direct entry method was used to model intentions, perceived behavioral control (PBC), skills, and environment on meeting subgroup recommendations for all five vegetable subgroups. The Wald Chi-square test determined the significance of intention, PBC, skills, and environment as predictors of meeting subgroup recommendations. For both models the *a priori* criteria of probability X^2 was less than or equal to 0.05 to retain a predictor in the model.

Predicting Meeting Subgroup Recommendations with Logistic Regression

Dark green. The regression model showed that intentions (*B*=1.043, Wald X^2 (1) = 51.752, $p < 0.001$) were significant in predicting meeting subgroup recommendations for dark green vegetables. An Omnibus test which compared a model with all three predictors against a constant-only model was statistically significant, ($X^2(4) = 144.720$,

$p < 0.001$) which indicates that the predictors can be used to reliably differentiate between not meeting recommendations (n=146) and meeting recommendations (n=240) for dark green vegetables. The Hosmer and Lemeshow test confirmed goodness of fit for the model (X^2 (*df*=8, n=386) =8.046, $p = 0.429$) because p has to be less than or equal to 0.05 to reject the goodness of fit. The model correctly predicted 60.3% of the sample not meeting recommendations and 87.1% of the sample meeting recommendations, which gave a satisfactory overall success rate of 76.9%.

Red and orange. The regression model showed that intentions (*B*=0.768, Wald X^2 (1) = 14.126, p < 0.001) and environment (*B*=0.252, Wald X^2 (1) = 4.243, p = 0.039) were significant in predicting meeting subgroup recommendations for red and orange vegetables. An Omnibus test which compared a model with all four predictors against a constant-only model was statistically significant, ($X^2(4) = 57.603$, $p < 0.001$) which indicates that the predictors can be used to reliably differentiate between not meeting recommendations (n=332) and meeting recommendations (n=54) for red and orange vegetables. The Hosmer and Lemeshow test confirmed goodness of fit for the model (X^2 (*df*=8, n=386) =6.422, $p = 0.600$) because p has to be less than or equal to 0.05 to reject the goodness of fit. The model correctly predicted 100.0% of the sample not meeting recommendations and 0.0% of the sample meeting recommendations, which gave a satisfactory overall success rate of 86.0%.

Beans and peas. The regression model showed that intentions (*B*=0.698, Wald X^2 (1) = 30.277, p < 0.001) PBC (*B*=0.378, Wald X^2 (1) = 5.700, p = 0.017) and environment (*B*=0.176, Wald X^2 (1) = 4.045, p = 0.044) were significant in predicting meeting subgroup recommendations for beans and peas vegetables. An Omnibus test which compared a model with all four predictors against a constant-only model was statistically significant, ($X^2(4) = 158.770$, $p < 0.001$) which indicates that the predictors can be used to reliably differentiate between not meeting recommendations (n=241) and meeting recommendations (n=145) for beans and peas. The Hosmer and Lemeshow test confirmed goodness of fit for the model (X^2 (df=8, n=386) =7.787, $p = 0.455$) because p has to be less than or equal to 0.05 to reject the goodness of fit. The model correctly predicted 85.9% of the sample not meeting recommendations and 71.7% of the sample meeting recommendations, which gave a satisfactory overall success rate of 80.6%.

Starchy. The regression model showed that environment (B=0.504, Wald X^2 (1) = 15.523, p < 0.001) skills (B=-0.464, Wald X^2 (1) = 9.795, p = 0.002) intentions (B=0.310, Wald X^2 (1) = 6.428, p = 0.011) and PBC (B=0.531, Wald X^2 (1) = 6.093, p = 0.014) were significant in predicting meeting subgroup recommendations for starchy vegetables. An Omnibus test which compared a model with all four predictors against a constant-only model was statistically significant, ($X^2(4) = 58.043$, $p < 0.001$) which indicates that the predictors can be used to reliably differentiate between not meeting recommendations (n=314) and meeting recommendations (n=72) for starchy vegetables. The Hosmer and Lemeshow test confirmed goodness of fit for the model (X^2 (df=8, n=386) =13.850, $p = 0.086$) because p has to be less than or equal to 0.05 to reject the goodness of fit. The model correctly predicted 99.4% of the sample not meeting recommendations and 5.6% of the sample meeting recommendations, which gave a satisfactory overall success rate of 81.9%.

Other. The regression model showed that intentions (*B*=0.883, Wald X^2 (1) = 21.974, p < 0.001) and environment (*B*=0.245, Wald X^2 (1) = 4.594 p = 0.032) were significant in predicting meeting subgroup recommendations for other vegetables. An Omnibus test which compared a model with all four predictors against a constant-only model was statistically significant, (X^2(4) = 106.037, $p < 0.001$) which indicates that the predictors can be used to reliably differentiate between not meeting recommendations (n=292) and meeting recommendations (n=94) for other vegetables. The Hosmer and Lemeshow test confirmed goodness of fit for the model (X^2 (*df*=8, n=386) =8.156, $p = 0.418$) because p has to be less than or equal to 0.05 to reject the goodness of fit. The model correctly predicted 88.4% of the sample not meeting recommendations and 46.8% of the sample meeting recommendations, which gave a satisfactory overall success rate of 78.2%.

Table 4.21 Parameter Estimates from the Final Logistic Regression Model for Meets Subgroup Recommendations as Predicted by Intentions, PBC, Skills, and Environment (n=386)

Subgroup (Model)	Omnibus Model	-2 L-L	H-L Test	%	N-R^2	B	SE	Wald	Sig	Exp(B)	95% CI
Dark green	144.720	367.267	8.046	76.9	0.426						
Intentions						1.043	0.145	51.752	0.001*	2.837	[2.135, 3.768]
Skills						0.166	0.097	2.931	0.087	1.180	[0.976, 1.427]
PBC						-0.132	0.136	0.938	0.333	0.876	[0.671, 1.145]
Environment						-0.040	0.089	0.209	0.648	0.960	[0.807, 1.143]
Constant						-0.718	0.239	9.012			
Red and Orange	57.603	254.857	6.422	86.0	0.250						
Intentions						0.768	0.204	14.126	0.001*	2.154	[1.444, 3.215]
Skills						-0.050	0.170	0.087	0.768	0.951	[0.681, 1.327]
PBC						0.072	0.225	0.104	0.747	1.075	[0.692, 1.670]
Environment						0.252	0.122	4.243	0.039*	1.287	[1.012, 1.635]
Constant						-3.194	0.456	48.990			
Beans and Peas	158.770	352.212	7.787	80.6	0.460						
Intentions						0.698	0.127	30.277	0.001*	2.010	[1.567, 2.578]
PBC						0.378	0.158	5.700	0.017*	1.459	[1.070, 1.990]
Environment						0.176	0.087	4.045	0.044*	1.192	[1.004, 1.415]
Skills						0.098	0.119	0.670	0.413	1.103	[0.873, 1.394]
Constant						-2.374	0.352	45.407			
Starchy	58.043	313.405	13.850	81.9	0.226						
Intentions						0.310	0.122	6.428	0.011*	1.364	[1.073, 1.734]
PBC						0.531	0.215	6.093	0.014*	1.700	[1.116, 2.591]
Skills						-0.464	0.148	9.795	0.002*	0.629	[0.471, 0.841]
Environment						0.504	0.128	15.523	0.001*	1.655	[1.288, 2.127]
Constant						-2.799	0.505	30.765			
Other	106.037	322.506	8.156	78.2	0.358						
Intentions						0.883	0.188	21.974	0.001*	2.418	[1.672, 3.498]
PBC						0.237	0.207	1.314	0.252	1.267	[0.845, 1.901]
Skills						0.098	0.179	0.300	0.584	1.103	[0.777, 1.566]
Environment						0.245	0.114	4.594	0.032*	1.278	[1.021, 1.599]
Constant						-3.847	0.520	54.704			

Omnibus Model = Omnibus test of model coefficients; -2 L-L = -2 Log Likelihood; H-L = Hosmer and Lemeshow Test; % = classification table overall percentage; N-R^2 = Nagelkerke's R^2; CI = confidence interval for Exp(B)

Summary

The results of the regression models are summarized in Table 4.21. Results from this study show that the subscales of attitudes, perceived behavioral control, and intentions are reliable and valid for all vegetable subgroups and for total vegetables. However, perceived norms scales were consistently invalid and problematic at the subgroup level. When subscales only have three or four items, it is essential that the items are cohesive and clear. One possibility from the factor analysis is that the items used to assess perceived norms may not represent a single construct, but two separate constructs. This concept should be explored further with more items in the subscale, and all subscales should be tested further to confirm their validity and reliability since the instrument was newly developed.

The multiple regression models show that intentions was the most important predictor of meeting or not meeting subgroup recommendations for all five subgroups, and attitudes was the most important predictor of intentions to meet weekly recommendations for all five subgroups. The logistic regression models show that intentions was the most important predictor of meeting subgroup recommendations.

Table 4.22. Summary

Vegetable Subgroup	DG	RO	BP	S	O
% of variance of behavior predicted	42.6%	25.0%	46.0%	22.6%	35.8%
Significant predictors of behavior	Intentions (p<0.001)	Intentions(p<0.001) Environment (p=0.039)	Intentions (p<0.001) PBC (p=0.017) Environment (p=0.044)	Environment (p<0.001) Skills (p=0.002) Intentions (p=0.011) PBC (p=0.014)	Intentions (p<0.001) Environment (p=0.032)
% of variance of intentions predicted	49.8%	51.3%	54.6%	40.5%	47.4%
Significant predictors of intentions	Attitudes (p<0.001) PBC (p<0.001)	Attitudes (p<0.001) PBC (p<0.001) Norms (p<0.001)	Attitudes (p<0.001) PBC (p=0.009) Norms (p=0.029)	Attitudes (p<0.001) Norms(p<0.001)	Attitudes (p<0.001) PBC (p<0.001) Norms (p<0.001)

Chapter 5

Discussion

Although college students have low total vegetable consumption, and subgroup vegetable consumption, there is limited research exploring the determinants of vegetable consumption with this population (Adams, & Colner, 2008). This study was the first to investigate vegetable subgroup consumption of college students using the framework of the Integrative Model (IM). In addition, this was the first study to examine all five of the United States Department of Agriculture's (USDA) subgroups of vegetables (dark green, red and orange, beans and peas, starchy, and other) with the IM in any population. The purpose of this study was to investigate the use of the IM as a theoretical framework in order to predict intentions and behaviors of consuming the recommended amounts of five vegetable subgroups each week among college students. No existing instruments have operationalized the IM with vegetable subgroup consumption, therefore a new instrument was developed. This chapter includes evaluation of the hypotheses of the study, discussion of results, study limitations, implications and recommendations for future research and practice in health education and health promotion, and conclusions.

Evaluation of Instrument Reliability & Validity

No instruments existed that examined vegetable subgroup consumption using the Integrative Model (IM), therefore an instrument was created for this study using the IM survey development procedures established by Martin Fishbeina and Icek Ajzen (2010). All of the scales were experimental, and had to be reviewed for validity and reliability. The instrument was determined to have a Flesch-Kincaid Reading Ease of

57.8 & Flesch-Kincaid Grade level of 8.4, which was acceptable readability for college students. A panel of six experts reviewed the instrument in two rounds to evaluate face and content validity, and a pilot test was performed using thirty undergraduate students. Once the instrument was revised and approved, students at the University of Oklahoma were invited to participate in this study through the mass email system. Data collection continued until the desired sample size was reached, using the minimum number of participants needed for confirmatory factor analysis (n=300). Of the 624 participants who began the survey, only 386 met the criteria for inclusion (participant must be between the ages of 18 and 30, and have completed at least 85% of the survey) in data analysis. Due to the order of questions so that demographics were at the end of the survey, it could not be determined whether participants who started, but did not complete, the survey were significantly different than participants who completed the survey.

Confirmatory factor analysis using the maximum likelihood method established that all of the attitudes, perceived behavioral control, and intentions scales for all of the vegetables subgroups met the standard for construct validity, in that they each had scale had one Eigenvalue greater than one and loaded onto a single factor. However, none of the perceived norms scales met the standard for construct validity because there were two Eigenvalues great than one, and one of the items had too low of a factor loading (<0.269). After removing the problematic item, all perceived norms scales corrected to having one Eigenvalue greater than one except for the dark green perceived norms scale, which could not be corrected further. All of the scales for attitudes, perceived behavioral control, and intentions were established as reliable for all five vegetable subgroups based on the Cronbach's alpha values that were greater than 0.7. Perceived norms scales were consistently less than 0.7, even after removing the one problematic item. Normality was established for most of the variables, and when variables had excessive skewness and kurtosis outliers were identified and transformed into the mean plus three standard deviations, which corrected the normality to a more reasonable level (Perez 2002). Several kurtosis measures were above the cutoffs for normality even after transformation, however they are still useful in that F-statistics can be robust even when there are violations of skewness and kurtosis (Kirk 1995). Many of the outliers were so extreme as to have likely been related to data entry error, although they could also have been a result of students' overestimation of behaviors.

Test-retest reliability was assessed using both correlations and t-tests between time point one and time point two for ten participants who took the survey twice, at least one week apart. While correlations between time points is a standard way to establish test-retest reliability, t-tests were used give the small sample size and low variability (Vincent & Weir, 2012). Results found that the all but one of the scales were not significantly different across time, with the exception of dark green perceived behavioral control ($p=0.017$), of which only one item [For me eating the recommended amount of dark green vegetables each week is difficult::easy] was significantly different ($p=0.003$). While this shows that the scales had some stability between time points, the instrument may be modified in future research.

Perceived Norms

Perceived norms scales in this study were operationalized using the definitions of perceived norms established by Martin Fishbein and Icek Ajzen, therefore it was important to include to include items that measured both injunctive and descriptive norms in order to have the most representational scale of perceived norms (2010). Two items were created for each of these dimensions; however, data analysis revealed that one of the descriptive norms items did not meet standards for inclusion in the scale. Even with the removal of that item, the perceived norms scales never reached an acceptable Cronbach's alpha. The factor analyses also only loaded correctly when that item was excluded. This problem prompted the researcher to investigate whether the poor fit could be attributed to the way the question was written, or with its interactions with other items in the scale. The item was written exactly as specified in the guidelines for how to write perceived norms questions, therefore it is unlikely that the question was an inaccurate representation of the descriptive norms dimension (Ajzen, 2010). Perceived norms may be better operationalized when more items are included in the scale. When more items cannot be included, it may be beneficial to examine only these dimension (injunctive or descriptive) as a unique scales separate analyses. Finally, elicitation research should be used to evaluate important determinants for perceived norms for this behavior, in this population. Open ended questions could ask, "Who are important people in your life?", "Describe how your vegetable consumption would compare against other people's vegetable consumption", or "Tell me about how your peers eat vegetables each week".

Results of Hypotheses Testing

Research questions were developed using the IM as a framework for investigating vegetable subgroup consumption. These research questions were then used to create two sets of research hypotheses sets consisting of hypothesis, alternative hypothesis, and null hypothesis to examine the IM construct predictors of intentions, and IM construct predictors of meeting subgroup recommendations for each of the five vegetable subgroups. Intentions was operationalized as a continuous variable. The independent variables associated with intentions included attitudes, perceived norms, and perceived behavioral control.

Hypothesis set 1: Examines relationships among predictor constructs of attitudes, perceived norms, and perceived behavioral control on behavioral intention. The first research question asked: To what extent are the IM constructs of attitudes, perceived norms, and perceived behavioral control associated with intentions to meet subgroup recommendations among college students? Three hypotheses (hypothesis, alternative hypothesis, and null hypothesis) were utilized to address this research question.

Hypothesis 1: There is significant positive relationship between the constructs of attitudes, perceived norms, and perceived behavioral control to the construct of intentions for each of the five vegetable subgroups.

Alternative Hypothesis 1: There is significant negative relationship between the constructs of attitudes, perceived norms, and perceived behavioral control to the construct of intentions for each of the five vegetable subgroups.

Null Hypothesis 1: There is no significant relationship between the constructs of attitudes, perceived norms, and perceived behavioral control to the construct of intentions for each of the five vegetable subgroups.

Meeting subgroup recommendations was operationalized as a dichotomous variable of meeting subgroup recommendations or not meeting subgroup recommendations for each vegetable subgroup. The independent variables associated with meeting subgroup recommendations included intentions, perceived behavioral control, skills, and environment. . The results of the binary logistic regression models used to explore hypothesis set 2 showed that intentions was the strongest predictor of meeting subgroup recommendations for all subgroups except starchy vegetables, of which environment was the strongest predictor of meeting subgroup recommendations. Each hypothesis was explored individually, with significance levels for rejecting null hypotheses set a priori at $p < 0.05$. Three hypotheses (hypothesis, alternative hypothesis, and null hypothesis) were utilized to address each research question.

Hypothesis Set 1 for Five Vegetable Subgroups

Each of the five vegetable subgroups were analyzed using a separate stepwise multiple regression model with intentions as the dependent variable, and attitudes, perceived norms, and perceived behavioral control as the independent variables. The results of the stepwise multiple regression models used to explore hypothesis set 1 showed that attitudes towards the behavior was the strongest predictor of intentions towards the behavior for all five vegetable subgroups.

Dark green vegetables. The significant predictors of attitudes ($p<0.001$) and perceived behavioral control ($p<0.001$) produced an R^2 adjusted value of 0.498 ($F = 192.188$, $p = 0.001$), which indicates that they predict 49.8% of the variance in intentions to eat the recommended amount each week of dark green vegetables. Therefore the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted for dark green vegetables.

Red and orange vegetables. The significant predictors of attitudes ($p<0.001$), perceived norms ($p<0.001$), and perceived behavioral control ($p<0.001$) produced an R^2 adjusted value of 0.513 ($F = 133.884$, $p = 0.001$), which indicates that they predict 51.3% of the variance in intentions to eat the recommended amount each week of red and orange vegetables. Therefore the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted for red and orange vegetables.

Beans and peas. The significant predictors of attitudes ($p<0.001$), perceived norms ($p=0.029$), and perceived behavioral control ($p=0.009$) produced an R^2 adjusted value of 0.546 ($F = 152.422$, $p = 0.001$), which indicates that they predict 54.6% of the variance in intentions to eat the recommended amount each week of beans and peas. Therefore the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted for beans and peas.

Starchy vegetables. The significant predictors of attitudes ($p<0.001$) and perceived norms ($p<0.001$) produced an R^2 adjusted value of 0.405 ($F = 132.067$, $p = 0.001$), which indicates that they predict 40.5% of the variance in intentions to eat the recommended amount each week of starchy vegetables. Therefore the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted for starchy vegetables.

Other vegetables. The significant predictors of attitudes ($p<0.001$), perceived norms ($p<0.001$), and perceived behavioral control ($p<0.001$) produced an R^2 adjusted value of 0.474 ($F =116.840$, $p = 0.001$), which indicates that they predict 47.4% of the variance in intentions to eat the recommended amount each week of other vegetables. Therefore the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted for other vegetables.

Total vegetables. There were no hypotheses regarding total vegetable consumption, but a model was used to determine if combining the scales of all five subgroups into composite total vegetable scales could yield a significant model for total vegetables. When all of the attitudes, perceived norms, perceived behavioral control, and intentions were pooled from the five vegetable subgroups into composite constructs representing attitudes, perceived norms, perceived behavioral control, and intentions towards total vegetable consumption, the model explained 47.7% of the variance in intentions to eat total vegetables.

Hypothesis Set 2 for Five Vegetable Subgroups

Each of the five vegetable subgroups were analyzed using a separate binary logistic regression model with meeting subgroup recommendations as the dependent variable, and intentions, perceived behavioral control, skills, and environment as the independent variables. The results of the logistic regression models used to explore hypothesis set 2 showed that intentions towards the behavior was the strongest predictor of meeting vegetable subgroups for all five vegetable subgroups. Odds ratios are used to explore the extent to which each construct contributes to the odds of meeting subgroup recommendations, and constructs are presented in order of significance as predictors of meeting subgroup recommendations.

Hypothesis 2: There is significant positive relationship between the constructs of intentions, perceived behavioral control, skills, and environment to the behavior of meeting subgroup recommendations for each of the five vegetable subgroups.

Alternative Hypothesis 2: There is significant negative relationship between the constructs of intentions, perceived behavioral control, skills, and environment to the behavior of meeting subgroup recommendations for each of the five vegetable subgroups.

Null Hypothesis 2: There is no significant negative relationship between the constructs of intentions, perceived behavioral control, skills, and environment to the behavior of meeting subgroup recommendations for each of the five vegetable subgroups.

Dark green vegetables. One significant predictor produced a Nagelkerke's *R*2 effect size of 0.426 for dark green vegetables. Intentions was found to be a significant predictor of meeting dark green vegetable subgroup recommendations each week ($p<0.001$, Exp(B)=2.837, 95% CI= [2.135, 3.768]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 1.043, and the odds of meeting subgroup recommendations increased by a factor of 2.837, or 183.7% (2.837-1.000=1.837) when all other independent variables are held constant. Based on these findings, the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted.

Red and orange vegetables. Two significant predictors produced a Nagelkerke's R^2 effect size of 0.250 for red and orange vegetables. Intentions was found to be a significant predictor of meeting red and orange vegetable subgroup recommendations each week ($p<0.001$, Exp(B)=2.154, 95% CI= [1.444, 3.215]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.768, and the odds of meeting subgroup recommendations increased by a factor of 2.154, or 115.4% (2.154-1.000=1.154) when all other independent variables are held constant.

Environment was also found to be a significant predictor of meeting red and orange vegetable subgroup recommendations each week (p=0.039, Exp(B)=1.287, 95% CI= [1.012, 1.635]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.252, and the odds of meeting subgroup recommendations increased by a factor of 1.287, or 28.7% (1.287-1.000=0.287) when all other independent variables are held constant. Based on these findings, the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted.

Beans and peas vegetables. Three significant predictors produced a Nagelkerke's R^2 effect size of 0.460 for beans and peas vegetables. Intentions was found to be a significant predictor of meeting beans and peas vegetable subgroup recommendations each week (p<0.001, Exp(B)=2.010, 95% CI= [1.567, 2.578]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.698, and the odds of meeting subgroup recommendations increased by a factor of 2.010, or 101.0% (2.010-1.000=1.010) when all other independent variables are held constant.

Perceived behavioral control was also found to be a significant predictor of meeting beans and peas vegetable subgroup recommendations each week (p=0.017, Exp(B)=1.459, 95% CI= [1.070, 1.990]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.378, and the odds of meeting subgroup recommendations increased by a factor of 1.459, or 45.9% (1.459-1.000=0.459) when all other independent variables are held constant.

Environment was found to be a significant predictor of meeting beans and peas vegetable subgroup recommendations each week (p=0.044, Exp(B)=1.192, 95% CI= [1.004, 1.415]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.176, and the odds of meeting subgroup recommendations increased by a factor of 1.192, or 19.2% (1.192-1.000=0.192) when all other independent variables are held constant. Based on these findings, the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted.

Starchy vegetables. Four significant predictors produced a Nagelkerke's R^2 effect size of 0.226 for starchy vegetables. Environment was found to be a significant predictor of meeting starchy vegetable subgroup recommendations each week (p=0.001, Exp(B)=1.655, 95% CI= [1.288, 2.127]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.504, and the odds of meeting subgroup recommendations increased by a factor of 1.655, or 65.5% (1.655-1.000=0.655) when all other independent variables are held constant.

Skills was found to be a significant predictor of meeting starchy vegetable subgroup recommendations each week (p=0.002, Exp(B)=0.629, 95% CI= [0.471, 0.841]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations decreased by 0.464, and the odds of meeting subgroup recommendations decreased by a factor of 0.629, or 59.0% ((1/0.629)-1.000=0.590) when all other independent variables are held constant. Intentions was found to be a significant predictor of meeting starchy vegetable subgroup recommendations each week (p=0.011, Exp(B)=1.364, 95% CI= [1.073, 1.734]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.310, and the odds of meeting subgroup recommendations increased by a factor of 1.364, or 36.4% (1.364-1.000=0.364) when all other independent variables are held constant.

Perceived behavioral control was also found to be a significant predictor of meeting starchy vegetable subgroup recommendations each week (p=0.014, Exp(B)=1.700, 95% CI= [1.116, 2.591]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.531, and the odds of meeting subgroup recommendations increased by a factor of 1.700, or 70.0% (1.700-1.000=0.700) when all other independent variables are held constant. Based on these findings, the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted.

Other vegetables. Two significant predictors produced a Nagelkerke's R^2 effect size of 0.358 for other vegetables. Intentions was found to be a significant predictor of meeting other vegetable subgroup recommendations each week (p=0.001, Exp(B)=2.418, 95% CI= [1.672, 3.498]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.883, and the odds of meeting subgroup recommendations increased by a factor of

2.418, or 141.8% (2.418-1.000=1.418) when all other independent variables are held constant.

Environment was found to be a significant predictor of meeting other vegetable subgroup recommendations each week (p=0.032, Exp(B)=1.278, 95% CI= [1.021, 1.599]). Exp(B) is an odds ratio, that indicates that for every one unit increase in intentions, the logit (B) of meeting subgroup recommendations increased by 0.245, and the odds of meeting subgroup recommendations increased by a factor of 1.278, or 27.8% (1.278-1.000=0.278) when all other independent variables are held constant. Based on these findings, the null hypothesis was rejected, the alternative hypothesis was rejected, and the hypothesis was accepted.

Conclusions for Hypotheses Sets for Five Vegetable Subgroups

While no studies have used the IM with vegetable subgroup consumption among college students, there have been studies that use constructs similar to attitudes, norms, and perceived behavioral control to predict behavioral intentions. In addition, theory based research has investigated similarities and differences between both related and non-related behaviors. The results of this study will be discussed in relation to the IM and vegetable consumption, the TPB and nutrition behaviors, and finally the TPB and nutrition behaviors compared to non-nutrition behaviors in order to contribute to the different approaches of existing literature.

One study examined the IM and six behaviors related to cancer prevention, one of which was fruit and vegetable consumption (Smith-McLallen & Fishbein, 2008). The study population was 1743 adults over the age of 40. The researchers used a survey to examine participants' beliefs towards the behavior of "Eating five or more servings of fruits and vegetables most days in the next year". This behavior is not clearly defined, in that "most days" is abstract and open to interpretation, and there are many different ways people can consume fruits and vegetables in how the foods are selected and prepared. The way the researchers measured constructs was limited, in that each scale only had one or two items (two attitudes, one PBC, one intentions, one injunctive norms, and one descriptive norms). This shows the difficulty in measuring six different behaviors adequately, with multiple items per scale to have the best chance of representing the construct, without making the survey too long or cumbersome (participants took more than 20 minutes on average to complete this questionnaire).

The first model investigated found that attitudes, PBC, and injunctive norms were significant predictors of intentions, with attitudes as the strongest predictor, and predicted 39.7% of the variance of intentions. In the second model with attitudes, injunctive norms, descriptive norms, and PBC, all constructs were significant, with attitudes as the most important predictor, and the model predicted an increased 44.3% which was a statistically meaningful difference. Finally the last model used attitudes, PBC, and combined injunctive norms and descriptive norms into one construct in the model as perceived normative pressure (what the IM today describes as perceived norms). Unexpectedly, this caused perceived normative pressure to become the strongest predictor, but lowered the variance in intentions of the model to 41.3%. Using limited items for perceived norms and changing the items and scales used in the prediction model had unexpected effects, such that while norms may be highly correlated with intentions, it does not necessarily lead to greater variance of intentions in the model when used with the other constructs.

The results of this study are consistent with the results of the Fishbein and Smith-McLallen study, in that across the five vegetable subgroups the constructs in the models accounted for 40.5% - 55.6% of the variance in intentions compared to their 39.7%-44.3%. Since the aforementioned study by Fishbein and Smith-McLallen used fewer items to measure the constructs and achieved similar results, more items in the scales may not necessarily account for greater variance. However, one item is likely not representative of an entire construct, and the way the items were combined or used independently affected model results.

Vegetable consumption can also be compared to other nutrition behaviors. A recent meta-analysis examined thirty-four studies regarding youth nutrition behaviors using the Theory of Planned Behavior (TPB) (Riebl et al., 2015). The findings of this study about order of importance of predictor constructs are consistent with the findings of the meta-analysis, in that attitudes was determined to be the most important predictor of intentions, followed by perceived behavioral control, and perceived norms (subjective norms). While the population is different (youth instead of college students), and the behaviors in the meta-analysis were not limited to vegetable consumption, the similarity of the order of the important constructs indicates that different nutrition behaviors show some relatedness when using TPB and IM.

Finally, a meta-analysis of 206 papers (237 tests) examined the efficacy of the TPB to predict various behaviors (McEachan et. al., 2009). It found that the model was more suitable for some behaviors than others, and some populations than others. For example diet behaviors were better predicted by the models than safe sex (21.2% of variance for dietary compared to 13.8%), and prediction of adult dietary behaviors was higher than adolescent dietary behaviors (26.7% for adults compared to 9.6% for adolescents). While attitudes was the most important predictor of adult dietary intentions, PBC is the most important predictor of adult dietary behaviors, even more so than intentions. This is likely due to differences in adult dietary behaviors and behaviors specific to vegetable consumption. Overall, these comparisons of different theories and behaviors show that the same behavior studied in different populations, or similar populations studying different behaviors, can result in different outcomes. Understanding these differences when examining behavioral categories, how behaviors are related to other, and how separate behaviors produce different results when using the same theoretical model can be used to determine appropriate approaches for both research and practice.

The differences in order of significance of constructs within the prediction models, as well as the differences in amount of variances predicted using the same constructs for different interrelated behaviors, indicates that there is evidence to 1) support the use of the IM as a theoretical framework with constructs that predict a large percentage of variance for intentions and behavior, and 2) support investigating the behavioral category of meeting recommendations for consuming vegetables as a variety of interrelated vegetable consumption behaviors. While the IM is predicated on defining specific behaviors in specific populations, it can be relevant to investigating behavioral categories, or health outcomes that require multiple behavior changes, if an appropriate approach is used. Different approaches that may be appropriate for using the IM when one or more of the following conditions are met include: adoption of one behavior might lead to adoption of other behaviors if the beliefs towards outcome expectancies are related, a general attitude towards a behavioral category may influence behaviors within that category, a campaign to change a value related to many behaviors may affect them all, and interventions that promote a source of normative values may affect all behaviors related to that source (Ajzen, Albarracin, & Hornik, 2007). Investigating behaviors within a category and comparing them to the behavioral category itself can reveal the degree to which behaviors are interrelated and in what ways they are interrelated. Most studies do not examine vegetable subgroups when assessing vegetable consumption, which may affect the applicability of their findings. This can influence the approaches chosen to modify the behaviors or achieve behavioral outcomes.

Discussion

The results of this study are consistent with the literature that college students, as a population, do not meet weekly vegetable subgroup recommendations (Adams & Colner, 2008). One possible explanation as to why dark green vegetables had such a higher rate of consumption is that participants misunderstood the directions of how to estimate dark green vegetables. Dark green is the only subgroup that defines 2 cups of raw vegetables as 1 cup of dark green vegetables, where all other categories consider 1 cup of vegetables (cooked or raw) equal to 1 cup of vegetables, so participants may be overestimating their dark green vegetable consumption.

The IM posits that the most important determinants of intentions are attitudes, perceived norms, and perceived behavioral control, and that intentions is the most important predictor of behavior. Skills, environment, and perceived behavioral control can also be highly influential on behavior, such that insufficient skills, an unconducive environment, or low perceived behavioral control can moderate the effects of intentions. However, it is important to note that the influence of these determinants varies across behaviors and populations, and that not all determinants are appropriate or necessary for all situations. This study found that in general attitudes and perceived behavioral control accounted for the majority of variance of intentions to meet the recommended amount of vegetable subgroups each week, with perceived norms playing a less influential role. This suggests that adding more constructs into a model does not necessarily increase the predictive power of that model, and sometimes a few constructs are sufficient. In addition, even small scales with few items can be found to be valid and reliable, so adding more items to a construct scale may not increase the variance found in the models. It is also plausible that constructs outside of the IM could be added to the model which would improve the predictive capacity. Future research could examine other potential constructs that could fit into the model of prediction intentions to meet the weekly recommended amount of vegetables.

Limitations

Several limitations should be considered when interpreting the results of this study. The study design is cross-sectional, therefore the associations found between variables cannot be assumed to be causal relationships. Participants were recruited from a convenience sample of students at the University of Oklahoma, therefore the results cannot be generalized to other populations. Self-reported data is inherently vulnerable to potential bias, lack of honesty, or inaccuracy. To assess vegetable consumption, participants were asked "On average, how many **times per week** do you eat **[vegetable subgroup]?"** and "On average, how many **cups [of vegetable**

subgroup] per week do you eat **per occasion**?", which may not have been representative of the weekly total of vegetables actually consumed. This method of defining weekly consumption as a product of times per week and cups per week was chosen over having participants estimate their total weekly consumption in order to simplify estimates for the participant. A single, typical portion of vegetables and an estimate how many times they eat vegetables in a week involves less calculation for the participant, and therefore minimizes recall error potential, than estimating the more complex conception of having to add up all of the vegetables the participant consumes in a week. The sample population was largely homogenous in race, gender, and living situations, therefore there was not sufficient power to determine significant differences in these demographic groups.

Another limitation of this study was the length of the instrument. The scales were designed to have as few items as possible while still accurately representing the constructs, but the instrument was still long with 111 total items. Although the instrument was divided into manageable sections and had a completion bar available to encourage participants to continue, more than one third of participants (n=238, 38.1%) who started the study dropped out or did not complete enough of the survey for inclusion in data analysis. Of participants who complete the whole survey, there is a possibility that response accuracy may have been affected over time as the items in the different vegetable subgroup sections were similar and may have seemed repetitive. Future research could create shorter instruments by selecting only one or two subgroups to study, rather than all five.

Recommendations for Future Practice

First, vegetable interventions should use a theory-based approach, and target attitudes and perceived behavioral control more than perceived norms when attempting to change intentions, and intentions more than skills, perceived behavioral control, and environment when attempting to change behavior. One recent meta-analysis has found that theory can improve intervention effectiveness for vegetable consumption among children (Diep et al., 2014). Interventions had a small but significant impact on vegetable consumption compared to control conditions ($p=0.001$), and theory use was a significant predictor for vegetable changes in diet after controlling for study quality ($p<0.001$). More research needs to be done with college students to determine the effect of theory on intervention effectiveness.

A healthy diet with a variety of vegetables can improve the health and academic performance of college students, therefore colleges and universities should improve access to nutrition education and make efforts to overcome environmental barriers that may prevent students from eating the recommended amounts of vegetables. Nutrition information can be made available to students through formal classes, as well as in informal contexts such as cafeterias, health centers, and in-person or online orientations. Nutrition education should include the daily total vegetable recommendations, weekly vegetable subgroup recommendations, potential health benefits, and strategies that students can use to improve the variety and quantity of their vegetable consumption. Students who live on campus can also benefit from increased availability of vegetables in campus dining establishments and stores, increased flexibility in how students can use food plans to purchase vegetables whether independently or as accompaniments to entrées, healthier options in vending machines, and access to transportation to local stores that sell vegetables.

Recommendations for Future Research

This study is the first identified to use the IM with vegetable consumption in college students, and there is potential in many areas for future research. First, perceived norms scales need to be modified to improve reliability. Next, the scales of environment and skills are proxy measures of how participants perceive their environment and skills, rather than actual measurements of environment and skills. Furthermore, there was only one item assessing each construct, which is likely insufficient for measuring the total construct. Therefore environment and skills scales should be expanded with more questions, and those questions should be relevant to concrete environment and skills, rather than just general perceptions. From a theoretical perspective, while the IM fully develops intentions in the model and the determinants of intentions through attitudes, perceived norms, and PBC, and provides guidance for how to measure those constructs, there is limited development and guidance for investigating environment and skills. Therefore future research should expand skills and environment within the model for more clear and consistent measurement processes.

Due to the homogeneity of the sample, this study was unable to explore background factors such as race, gender, and living conditions. Future research should account for background factors in their analyses. Statistical analyses that could also be employed include structural equation modelling to determine how each variable influences intentions and behavior, and interacts with other variables in the model.

An additional expansion on this type of research could be to investigate how participant perceptions of their vegetable intake compare to the participant's actual vegetable intake. This could be accomplished by having participants maintain a food journal and record their vegetable consumption for a week, as well as asking them to recall from memory and report their vegetable consumption for that week and seeing how consistent these two reporting methods are. An even more accurate assessment would be to have a researcher or research tool record the vegetables taken and consumed by the participants in certain contexts. For example, card based systems have been used with elementary school children to monitor and analyze students' dietary selections (Lambert et al., 2005). However, these systems cannot monitor how much of the vegetables purchased are actually consumed. Researchers evaluating food waste in a University dining facility were able to record what foods college students selected, as well as recorded edible food waste once the students were done eating, from which they were able to determine how much of the food that student's selected was actually eaten and how much resulted in food waste (Whitehair, Shanklin, & Brannon 2013).

Finally, research can be done to investigate the cost-benefit ratios of modifiability of constructs and effectiveness of theory-based interventions to change vegetable consumption. While researchers understand the relative importance of the constructs in predicting behavior, it is unclear what investments are needed in both time and resources to change each of the constructs. Furthermore, it is unclear which constructs, once modified, produce the greatest immediate and lasting changes in behaviors. Therefore targeting a construct that is more modifiable with fewer resources invested may have more of an impact in an intervention than targeting a construct that has greater relative importance in the model, but is more difficult or costly to modify through intervention. These recommendations would contribute to the existing body of literature regarding vegetable consumption, research, and theory-based intervention development.

Conclusion

In conclusion, vegetable consumption is low throughout the country across all age groups, and college students are especially at risk. Improving consumption of vegetable subgroups will lead to improved nutrition and lower the risks of chronic disease. In order to improve vegetable subgroup consumption, theory-based interventions are needed that target the most important determinants of intentions and behavior. In order to use theory to understand and predict behaviors, those behaviors must be defined. Vegetable consumption is often studied as a single behavior, when in actuality it is a behavioral category, with different interrelated behaviors. This study has demonstrated that dividing vegetables into subgroups produces different prediction models. Future research can investigate how the constructs of one behavior affect the constructs of another when those behaviors are interrelated. In addition, this study has demonstrated that environment can be an important predictor of vegetable consumption, which would require a multi-level approach rather than just behavior modification. While colleges and universities cannot change vegetable consumption directly, they have the potential to create programs, implement policy changes, and modify environments in order to promote vegetable consumption among their students. When health educators, practitioners, and researchers understand the most important influences of vegetable consumption, they can develop and implement effective interventions that are grounded in theory.

References

Adams, T. B., & Colner, W. (2008). The association of multiple risk factors with fruit and vegetable intake among a nationwide sample of college students. *Journal of American College Health*, 56(4), 455-461.

Ajzen, Icek. (2002) Constructing A Tpb Questionnaire: Conceptual And Methodological Considerations. Web. 3 Apr. 2015.

Ajzen, Albarracin, & Hornik, R. C. (2007). *Prediction and change of health behavior: Applying the reasoned action approach*. Psychology Press.

Bertoia, M. L., Mukamal, K. J., Cahill, L. E., Hou, T., Ludwig, D. S., Mozaffarian, D., Willett, W.C., Hu, F.B. & Rimm, E. B. (2015). Changes in Intake of Fruits and Vegetables and Weight Change in United States Men and Women Followed for Up to 24 Years: Analysis from Three Prospective Cohort Studies. *PLoS Med*, 12(9), e1001878.

Blanchard, C. M., Fisher, J., Sparling, P. B., Shanks, T. H., Nehl, E., Rhodes, R. E., Courneya, K.S. & Baker, F. (2009). Understanding adherence to 5 servings of fruits and vegetables per day: A theory of planned behavior perspective. *Journal of Nutrition Education and Behavior*, 41(1), 3- 10.

Blanchard, C. M., Kupperman, J., Sparling, P. B., Nehl, E., Rhodes, R. E., Courneya, K. S., & Baker, F. (2009). Do ethnicity and gender matter when using the theory of planned behavior to understand fruit and vegetable consumption? *Appetite*, 52(1), 15-20.

Branscum, P., & Sharma, M. (2014). DEFINING A HEALTHY DIET: CHALLENGES AND CONUNDRUMS. *American Journal of Health Studies*, 29(4).

Centers for Disease control (CDC). (2013, May 1). State Indicator Report on Fruits and Vegetables 2013. Retrieved March 28, 2015, from http://www.cdc.gov/nutrition/downloads/State-Indicator-ReportFruits-Vegetables-2013.pdf

Diep, C. S., Chen, T. A., Davies, V. F., Baranowski, J. C., & Baranowski, T. (2014). Influence of behavioral theory on fruit and vegetable intervention effectiveness among children: a meta-analysis. *Journal of Nutrition Education and Behavior,* 46(6), 506-546.

Emanuel A.S., Mccully S.N., Gallagher K.M., Updegraff J.A. (2012). Theory of Planned Behavior explains gender difference in fruit and vegetable consumption. *Appetite*, 59(3):693-7.

Fishbein, M., & Ajzen, I. (2011). Predicting and changing behavior: The reasoned action approach. Taylor & Francis.

Institute of Medicine, Food and Nutrition Board (2004). Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate. Washington, DC: National Academies Press. Retrieved November 7, 2015 from http://www.nap.edu/read/10925/chapter/1.

Institute of Medicine, Food and Nutrition Board (2005). Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington, DC: National Academies Press. Retrieved on November 7, 2015 from http://www.nap.edu/read/10490/chapter/1#iii

Jansen M.C., Bueno-de-mesquita H.B., Feskens E.J., Streppel M.T., Kok F.J., Kromhout D. (2004). Quantity and variety of fruit and vegetable consumption and cancer risk. *Nutr Cancer.* 48(2):142-8.

Kirk, R. (1995). Experimental design: procedures for the behavioral sciences (3rd ed). Pacific Grove, CA: Brooks/Cole Publishing Company.

Kothe E.J., Mullan B.A. (2014). A randomised controlled trial of a theory of planned behaviour to increase fruit and vegetable consumption. Fresh Facts. *Appetite.* 78:68-75.

Kothe, E. J., Mullan, B. A., & Butow, P. (2012). Promoting fruit and vegetable consumption. Testing an intervention based on the theory of planned behaviour. *Appetite*, 58(3), 997- 1004.

Kreausukon, P., Gellert, P., Lippke, S., & Schwarzer, R. (2012). Planning and self-efficacy can increase fruit and vegetable consumption: a randomized controlled trial. *Journal of behavioral medicine*, *35*(4), 443-451.

Lambert, N., Plumb, J., Looise, B., Johnson, I. T., Harvey, I., Wheeler, C., Robinson, M. & Rolfe, P. (2005). Using smart card technology to monitor the eating habits of children in a school cafeteria: 3. The nutritional significance of beverage and dessert choices. *Journal of Human Nutrition and Dietetics*, 18(4), 271-279.

Larson N, Laska MN, Story M, Neumark-sztainer D. Predictors of fruit and vegetable intake in young adulthood. J Acad Nutr Diet. 2012;112(8):1216-22.

Larson N.I., Neumark-sztainer D.R., Harnack L.J., Wall M.M., Story M.T., Eisenberg M.E. (2008). Fruit and vegetable intake correlates during the transition to young adulthood. *Am J Prev Med*. 35(1):33-37.

McCrory M.A., Fuss P.J., Saltzman E., Roberts S.B.(February, 2000) Dietary Determinants of Energy Intake and Weight Regulation in Healthy Adults. *J. of Nutrition* 130:276–79.

McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health Psychology Review*, *5*(2), 97-144.

Middlestadt, S. E. (2012). Beliefs underlying eating better and moving more lessons learned from comparative salient belief elicitations with adults and youths. *The Annals of the American Academy of Political and Social Science*,640(1), 81-100.

Mytton, O., Nnoaham, K., Eyles, H., Scarborough, P., & Mhurchu, C. (2014). Systematic review and meta-analysis of the effect of increased vegetable and fruit consumption on body weight and energy intake. *BMC Public Health*, 14(886), 886-886.

Nederhof, A. J. (1985), Methods of coping with social desirability bias: A review. Eur. J. Soc. Psychol., 15: 263–280. doi: 10.1002/ejsp.2420150303

Pomerleau J., Lock K., Knai C., Mckee M. (2005) Interventions designed to increase adult fruit and vegetable intake can be effective: a systematic review of the literature. *J Nutr.* 135(10):2486-95.

Riebl, S. K., Estabrooks, P. A., Dunsmore, J. C., Savla, J., Frisard, M. I., Dietrich, A. M., ... & Davy, B. M. (2015). A systematic literature review and meta-analysis: The Theory of Planned Behavior's application to understand and predict nutrition-related behaviors in youth. *Eating Behaviors*, 18, 160-178.

Sheats, J. L., & Middlestadt, S. E. (2013). Salient beliefs about eating and buying dark green vegetables as told by Mid-western African–American women. *Appetite*, 65, 205-209.

Sheats, J. L., Middlestadt, S. E., Ona, F. F., Juarez, P. D., & Kolbe, L. J. (2013). Understanding African American Women's Decisions to Buy and Eat Dark Green Leafy Vegetables: An Application of the Reasoned Action Approach. *Journal of Nutrition Education and Behavior*, 45(6), 676-682.

Smith-McLallen, A., & Fishbein, M. (2008). Predictors of intentions to perform six cancer-related behaviours: roles for injunctive and descriptive norms. *Psychology, Health and Medicine*, *13*(4), 389-401.

Spiliotopoulou, G. (2009). Reliability reconsidered: Cronbach's alpha and paediatric assessment in occupational therapy. *Australian Occupational Therapy Journal*, 56(3), 150-155.

Stevens, J. (2009). Applied multivariate statistics for the social sciences (5th ed). New York, NY, Taylor and Francis Group.

Stok F.M., Verkooijen K.T., De ridder D.T., De wit J.B., De vet E. (2014). How norms work: self-identification, attitude, and self-efficacy mediate the relation between descriptive social norms and vegetable intake. *Appl Psychol Health Well Being*, 6(2):230-50.

Thomson C.A., Ravia J., (2011). A systematic review of behavioral interventions to promote intake of fruit and vegetables. *J Am Diet Assoc.* 2011;111(10):1523-35.

United States Department of Agriculture, Human Nutrition Information Service. (September 1993). USDA's Food Guide Background and Development.

Miscellaneous Publication number 1514. Retrieved from http://www.cnpp.usda.gov/sites/default/files/archived_projects/FGPBackgroundAndDevelopment.pdf

USDA (n.d.). MyPlate Vegetable Group -- Food gallery. Retrieved March 28, 2015, from http://www.choosemyplate.gov/food-groups/vegetables-foodgallery.html

USDA (2005). Dietary Guidelines for Americans 2005. Retrieved November 3, 2015 from http://health.gov/dietaryguidelines/dga2005/document/pdf/DGA2005.pdf

USDA. (2010, December 1). Dietary Guidelines for Americans 2010. Retrieved March 28, 2015, from http://www.health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf

USDA. (2015, February) Scientific Report of the 2015 Dietary Guidelines Advisory Committee. Retrieved November 7, 2015 from http://health.gov/dietaryguidelines/2015-scientific-report/PDFs/Scientific-Report-of-the-2015-Dietary-Guidelines-Advisory-Committee.pdf

USDA. (2015, June 12) Tips to help you eat vegetables. Retrieved September 12, 2015, from http://www.choosemyplate.gov/vegetables-tips

USDA. (2015, June 16) Why is it important to eat vegetables? Retrieved September 12, 2015, from http://www.choosemyplate.gov/vegetables-nutrients-health

U.S. Department of Health and Human Services and U.S. Department of Agriculture. Dietary Guidelines for Americans, 2010. 7. Washington, DC: U.S. Government Printing, Office; Jan. 2010

U.S. Department of Health and Human Services and U.S. Department of Agriculture. (December 2015) *2015 – 2020 Dietary Guidelines for Americans*. 8th Edition. Retrieved from http://health.gov/dietaryguidelines/2015/guidelines/.

Vincent, W., & Weir, J. (2012). Multiple Correlation and Multiple Regression. In Statistics in kinesiology (4th ed., pp. 137-146). Champaign, IL: Human Kinetics.

Wald, A., Muennig, P. A., O'Connell, K. A., & Garber, C. E. (2014). Associations between healthy lifestyle behaviors and academic performance in US undergraduates: a secondary analysis of the American College Health Association's National College Health Assessment II. *American Journal of Health Promotion*, 28(5), 298-305.

Whitehair, K. J., Shanklin, C. W., & Brannon, L. A. (2013). Written messages improve edible food waste behaviors in a university dining facility. *Journal of the Academy of Nutrition and Dietetics*, 113(1), 63-69.

Appendix A

Thank you for agreeing to take part in this survey. The purpose of this survey is to explore how college students view eating different subgroups, or categories, of vegetables. Please remember that no identifying information will be kept and all responses will be confidential.

According to the United States Department of Agriculture, there are five subgroups of vegetables:
Dark green vegetables - Including broccoli, collard greens, dark green leafy lettuce, and spinach.
Red and orange vegetables - Including carrots, red peppers (sweet, bell), sweet potatoes and tomatoes.
Beans and peas vegetables - Including black beans, chickpeas (garbanzo beans), pinto beans and soy beans.
Starchy vegetables – Including corn, potatoes, green lima beans, peas, and plantains.
Other vegetables - Including all other types that do not fit in the existing categories, such as artichokes, asparagus, avocado, brussels sprouts, cabbage, cauliflower, celery, cucumbers, onions and zucchini.

While there are daily recommendations for consuming total vegetables [based on your gender and age (example - a 25 year old, female should consume 2 ½ cups of vegetables every day)], for each vegetable subgroup there are WEEKLY recommendations.

· Weekly recommendations tell us how many cups of that vegetable subgroup we should eat every week.

· It is not necessary to eat vegetables from each subgroup every day.

· However, to meet overall nutrient recommendations, people should try to consume the amounts for each subgroup every week.

Please carefully read each question and answer it to the best of your ability. There are no right or wrong answers, we are simply looking for personal views about eating each subgroup of vegetables each week.

For each question, please select the number that best describes how you feel about eating the recommended amount of vegetables from each subgroup each week.

Most of the questions are on a scale from 1 to 7
For example,

I enjoy eating vegetables

Strongly agree 1 2 3 4 5 6 7 Strongly Disagree

The scale corresponds to

1	2	3	4	5	6	7
strongly	quite	slightly	neither	slightly	quite	strongly

Some questions may seem repetitive or similar. If you are unsure about an answer please use your best estimate, and answer every question. Please select only one item on each scale

What is your gender?

- ❍ Male
- ❍ Female

The first part of this survey will ask you about your intake of dark green vegetables. Some examples of dark green vegetables include: arugula, bok choy, broccoli, collard greens, dark green leafy lettuce, endive, escarole, kale, leeks, mesclun, mixed greens, mustard greens, romaine lettuce, spinach, swiss chard, turnip greens, and watercress.

1 cup of dark green vegetables is equal to 1 cup of cooked greens (like cooked spinach), or 2 cups of raw greens (like salad). 1 cup of broccoli is 1 cup whether raw or cooked.

Greens, Cooked (kale, chard, etc.): 1 cup

Greens, Raw (lettuce, spinach, etc.): 2 cups (about two large leaves of chopped romaine)

Broccoli: A generous fistful (tennis ball size) of florets or about 16 small florets

On average, how many times per week do you eat dark green vegetables? (no matter what the serving size) ___________________________

*including any kind of fresh, frozen, canned, or juiced

*If you eat dark green vegetables on average less than 1 time per week, put 0

On average, how many cups of dark green vegetables do you eat per occasion? ___________

*to the nearest 0.25 (1/4) cup

This part of the survey will ask you about eating the recommended amount of dark green vegetables each week.

The weekly recommendation for dark green vegetables is 1 ½ cups for women.

The weekly recommendation for dark green vegetables is 2 cups each week for men.

For me eating the recommended amount of dark green vegetables each week is

	1	2	3	4	5	6	7	
worthless	❍	❍	❍	❍	❍	❍	❍	valuable
unnecessary	❍	❍	❍	❍	❍	❍	❍	necessary
unpleasant	❍	❍	❍	❍	❍	❍	❍	pleasant
unappetizing	❍	❍	❍	❍	❍	❍	❍	tasty
difficult	❍	❍	❍	❍	❍	❍	❍	easy
impossible	❍	❍	❍	❍	❍	❍	❍	possible
out of my control	❍	❍	❍	❍	❍	❍	❍	within my control

The weekly recommendation for dark green vegetables is 1 ½ cups each week for women.
The weekly recommendation for dark green vegetables is 2 cups each week for men.

Most of the people who are important to me think that ___________ eat the recommended amount of dark green vegetables each week

	1	2	3	4	5	6	7	
I should not	❍	❍	❍	❍	❍	❍	❍	I should

I want to do what people who are important to me think I should do when it comes to eating the recommended amount of dark green vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Most college students like me eat the recommended amount of dark green vegetables each week

	1	2	3	4	5	6	7	
Definitely false	❍	❍	❍	❍	❍	❍	❍	Definitely true

When it comes to my eating the recommended amount of dark green vegetables each week, I want to do what others like me are doing

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Eating the recommended amount of dark green vegetables each week is completely up to me

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I will eat the recommended amount of dark green vegetables each week

	1	2	3	4	5	6	7	
Extremely unlikely	❍	❍	❍	❍	❍	❍	❍	Extremely likely

I will try to eat the recommended amount of dark green vegetables each week

	1	2	3	4	5	6	7	
I definitely will not	❍	❍	❍	❍	❍	❍	❍	I definitely will

I intend to eat the recommended amount of dark green vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I usually eat the recommended amount of dark green vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

This part of the survey will ask about your intake of red and orange vegetables. Some examples of red and orange vegetables include acorn squash, butternut squash, carrot juice, carrots, chili peppers, pattypan squash, pumpkin, red peppers (sweet, bell), sweet potatoes, tomato juice, tomatoes, 100% vegetable juice, and yams.

1 cup of vegetables = 1 cup of raw or cooked vegetables or vegetable juice

On average, how many times per week do you eat red and orange vegetables? (no matter what the serving size) ______________________
*including any kind of fresh, frozen, canned, or juiced
*If you eat red and orange vegetables on average less than 1 time per week, put 0
On average, how many cups of red and orange vegetables do you eat per occasion? ________
*to the nearest 0.25 (1/4) cup

This part of the survey will ask you about eating the recommended amount of red and orange vegetables each week.

The weekly recommendation for red and orange vegetables is 5 1/2 cups each week for women.

The weekly recommendation for red and orange vegetables is 6 cups each week for men.

For me eating the recommended amount of red and orange vegetables each week is

	1	2	3	4	5	6	7	
worthless	❍	❍	❍	❍	❍	❍	❍	valuable
unnecessary	❍	❍	❍	❍	❍	❍	❍	necessary
unpleasant	❍	❍	❍	❍	❍	❍	❍	pleasant
unappetizing	❍	❍	❍	❍	❍	❍	❍	tasty
difficult	❍	❍	❍	❍	❍	❍	❍	easy
impossible	❍	❍	❍	❍	❍	❍	❍	possible
out of my control	❍	❍	❍	❍	❍	❍	❍	within my control

The weekly recommendation for red and orange vegetables is 5 1/2 cups each week for women.

The weekly recommendation for red and orange vegetables is 6 cups each week for men.

Most of the people who are important to me think that ___________ eat the recommended amount of red and orange vegetables each week

	1	2	3	4	5	6	7	
I should not	❍	❍	❍	❍	❍	❍	❍	I should

I want to do what people who are important to me think I should do when it comes to eating the recommended amount of red and orange vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Most college students like me eat the recommended amount of red and orange vegetables each week

	1	2	3	4	5	6	7	
Definitely false	❍	❍	❍	❍	❍	❍	❍	Definitely true

When it comes to my eating the recommended amount of red and orange vegetables each week, I want to do what others like me are doing

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Eating the recommended amount of red and orange vegetables each week is completely up to me

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I will eat the recommended amount of red and orange vegetables each week

	1	2	3	4	5	6	7	
Extremely unlikely	❍	❍	❍	❍	❍	❍	❍	Extremely likely

I will try to eat the recommended amount of red and orange vegetables each week

	1	2	3	4	5	6	7	
I definitely will not	❍	❍	❍	❍	❍	❍	❍	I definitely will

I intend to eat the recommended amount of red and orange vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I usually eat the recommended amount of red and orange vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

This part of the survey will ask about your intake of beans and peas. Some examples of beans and peas include black beans, black-eyed peas, chickpeas (garbanzo beans), kidney beans, lentils, navy beans, pinto beans, soy beans, and white beans. It does not include green peas.

1 cup of vegetables = 1 cup of cooked beans or peas

On average, how many times per week do you eat beans and peas? (no matter what the serving size) ________________________
*including any kind of fresh, frozen, canned, or juiced
*If you eat beans and peas on average less than 1 time per week, put 0

On average, how many cups of beans and peas do you eat per occasion? _________________
*to the nearest 0.25 (1/4) cup

This part of the survey will ask you about eating the recommended amount of beans and peas each week.

The weekly recommendation for beans and peas each week is: Women: 1 ½ cups per week

The weekly recommendation for beans and peas each week is: Men: 2 cups per week

For me eating the recommended amount of beans and peas each week is

	1	2	3	4	5	6	7	
worthless	❍	❍	❍	❍	❍	❍	❍	valuable
unnecessary	❍	❍	❍	❍	❍	❍	❍	necessary
unpleasant	❍	❍	❍	❍	❍	❍	❍	pleasant
unappetizing	❍	❍	❍	❍	❍	❍	❍	tasty
difficult	❍	❍	❍	❍	❍	❍	❍	easy
impossible	❍	❍	❍	❍	❍	❍	❍	possible
out of my control	❍	❍	❍	❍	❍	❍	❍	within my control

The weekly recommendation for beans and peas each week is: Women: 1 ½ cups per week

The weekly recommendation for beans and peas each week is: Men: 2 cups per week

Most of the people who are important to me think that __________ eat the recommended amount of beans and peas each week

	1	2	3	4	5	6	7	
I should not	❍	❍	❍	❍	❍	❍	❍	I should

I want to do what people who are important to me think I should do when it comes to eating the recommended amount of beans and peas each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Most college students like me eat the recommended amount of beans and peas each week

	1	2	3	4	5	6	7	
Definitely false	❍	❍	❍	❍	❍	❍	❍	Definitely true

When it comes to my eating the recommended amount of beans and peas each week, I want to do what others like me are doing

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Eating the recommended amount of beans and peas each week is completely up to me

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I will eat the recommended amount of beans and peas each week

	1	2	3	4	5	6	7	
Extremely unlikely	❍	❍	❍	❍	❍	❍	❍	Extremely likely

I will try to eat the recommended amount of beans and peas each week

	1	2	3	4	5	6	7	
I definitely will not	❍	❍	❍	❍	❍	❍	❍	I definitely will

I intend to eat the recommended amount of beans and peas each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I usually eat the recommended amount of beans and peas each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

This part of the survey will ask about your intake of starchy vegetables. Some examples of starchy vegetables include cassava, corn, green bananas, green lima beans, green peas, jicama, plantains, potatoes, taro, and water chestnuts.

1 cup of vegetables = 1 cup of raw or cooked vegetables

Corn: 1 cup of kernels or 1 large ear (8 to 9 inches long)

On average, how many times per week do you eat starchy vegetables? (no matter what the serving size) ____________________
*including any kind of fresh, frozen, canned, or juiced
*If you eat starchy vegetables on average less than 1 time per week, put 0

On average, how many cups of starchy vegetables do you eat per occasion? _____________
*to the nearest 0.25 (1/4) cup

This part of the survey will ask you about eating the recommended amount of starchy vegetables each week.

The weekly recommendation for starchy vegetables each week is: Women: 5 cups per week

The weekly recommendation for starchy vegetables each week is: Men: 6 cups per week

For me eating the recommended amount of starchy vegetables each week is

	1	2	3	4	5	6	7	
worthless	❍	❍	❍	❍	❍	❍	❍	valuable
unnecessary	❍	❍	❍	❍	❍	❍	❍	necessary
unpleasant	❍	❍	❍	❍	❍	❍	❍	pleasant
unappetizing	❍	❍	❍	❍	❍	❍	❍	tasty
difficult	❍	❍	❍	❍	❍	❍	❍	easy
impossible	❍	❍	❍	❍	❍	❍	❍	possible
out of my control	❍	❍	❍	❍	❍	❍	❍	within my control

The weekly recommendation for starchy vegetables each week is: Women: 5 cups per week

The weekly recommendation for starchy vegetables each week is: Men: 6 cups per week

Most of the people who are important to me think that __________ eat the recommended amount of starchy vegetables each week

	1	2	3	4	5	6	7	
I should not	❍	❍	❍	❍	❍	❍	❍	I should

I want to do what people who are important to me think I should do when it comes to eating the recommended amount of starchy vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Most college students like me eat the recommended amount of starchy vegetables each week

	1	2	3	4	5	6	7	
Definitely false	❍	❍	❍	❍	❍	❍	❍	Definitely true

When it comes to my eating the recommended amount of starchy vegetables each week, I want to do what others like me are doing

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Eating the recommended amount of starchy vegetables each week is completely up to me

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I will eat the recommended amount of starchy vegetables each week

	1	2	3	4	5	6	7	
Extremely unlikely	❍	❍	❍	❍	❍	❍	❍	Extremely likely

I will try to eat the recommended amount of starchy vegetables each week

	1	2	3	4	5	6	7	
I definitely will not	❍	❍	❍	❍	❍	❍	❍	I definitely will

I intend to eat the recommended amount of starchy vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I usually eat the recommended amount of starchy vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

This part of the survey will ask about your intake of other vegetables. Some examples of other vegetables includes alfalfa sprouts, artichokes, asparagus, avocado, bamboo shoots, bean sprouts, beets, brussels sprouts, cabbage, cauliflower, celery, cucumbers, eggplant, garlic, green beans, green peppers, iceberg lettuce, mungbean sprouts, mushrooms, okra, onions, radishes, red cabbage, scallions, tomatillos, turnips, wax beans, yellow squash, and zucchini.

1 cup of vegetables = 1 cup of raw or cooked vegetables

On average, how many times per week do you eat other vegetables? (no matter what the serving size) ___________________

*including any kind of fresh, frozen, canned, or juiced

*If you eat other vegetables on average less than 1 time per week, put 0

On average, how many cups of other vegetables do you eat per occasion? ________________

*to the nearest 0.25 (1/4) cup

This part of the survey will ask you about eating the recommended amount of other vegetables each week.

The weekly recommendation for other vegetables each week is: Women: 4 cups per week

The weekly recommendation for other vegetables each week is: Men: 5 cups per week

For me eating the recommended amount of other vegetables each week is

	1	2	3	4	5	6	7	
worthless	❍	❍	❍	❍	❍	❍	❍	valuable
unnecessary	❍	❍	❍	❍	❍	❍	❍	necessary
unpleasant	❍	❍	❍	❍	❍	❍	❍	pleasant
unappetizing	❍	❍	❍	❍	❍	❍	❍	tasty
difficult	❍	❍	❍	❍	❍	❍	❍	easy
impossible	❍	❍	❍	❍	❍	❍	❍	possible
out of my control	❍	❍	❍	❍	❍	❍	❍	within my control

The weekly recommendation for other vegetables each week is: Women: 4 cups per week

The weekly recommendation for other vegetables each week is: Men: 5 cups per week

Most of the people who are important to me think that __________ eat the recommended amount of other vegetables each week

	1	2	3	4	5	6	7	
I should not	❍	❍	❍	❍	❍	❍	❍	I should

I want to do what people who are important to me think I should do when it comes to eating the recommended amount of other vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Most college students like me eat the recommended amount of other vegetables each week

	1	2	3	4	5	6	7	
Definitely false	❍	❍	❍	❍	❍	❍	❍	Definitely true

When it comes to my eating the recommended amount of other each week, I want to do what others like me are doing

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Eating the recommended amount of other vegetables each week is completely up to me

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I will eat the recommended amount of other vegetables each week

	1	2	3	4	5	6	7	
Extremely unlikely	❍	❍	❍	❍	❍	❍	❍	Extremely likely

I will try to eat the recommended amount of other vegetables each week

	1	2	3	4	5	6	7	
I definitely will not	❍	❍	❍	❍	❍	❍	❍	I definitely will

I intend to eat the recommended amount of other vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I usually eat the recommended amount of other vegetables each week

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

This part of the survey will ask you about preparing the five subgroups of vegetables.

I can prepare foods that include dark green vegetables

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I can prepare foods that include red and orange vegetables

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I can prepare foods that include beans and peas vegetables

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I can prepare foods that include starchy vegetables

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

I can prepare foods that include other vegetables

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

There are always dark green vegetables available for me to eat in my home

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

There are always red and orange vegetables available for me to eat in my home

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

There are always beans and peas available for me to eat in my home

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

There are always starchy vegetables available for me to eat in my home

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

There are always other vegetables available for me to eat in my home

	1	2	3	4	5	6	7	
Strongly disagree	❍	❍	❍	❍	❍	❍	❍	Strongly agree

Which of the following describes you best?

	1	2	3	4	5	6	7	
I primarily prepare my own food	❍	❍	❍	❍	❍	❍	❍	I primarily eat food that other people have prepared (dining hall, restaurant, home meals where I was not the one to prepare the food)

What is your age today in years?__________

What is your major? (state if undecided)___________________

What is your class standing?

- ❍ Freshman
- ❍ Sophomore
- ❍ Junior
- ❍ Senior
- ❍ Graduate
- ❍ Other/Unclassified (please explain) ______________________

What is your race?

- ❍ White/Caucasian
- ❍ African American
- ❍ Hispanic
- ❍ Asian
- ❍ Native American
- ❍ Pacific Islander
- ❍ Other ______________________

Where do you live?

- ❍ On campus in a dorm or apartment run by OU
- ❍ Off campus in a fraternity or sorority
- ❍ Off campus in an apartment or house that is less than 5 miles from campus
- ❍ Off campus in an apartment or house that is greater than 5 miles from campus
- ❍ Other (please explain) ______________________

Do you live alone?

- ❍ Yes
- ❍ No

How many friends do you live with? (including fraternity/sorority members)?__________

How many family members do you live with? (not including spouse/significant other?)_________

Do you live with a significant other/spouse?

- ❍ Yes
- ❍ No

Appendix B: Panel of Experts

Paul Branscum, Ph.D., RD
Assistant Professor and Graduate Liason
Department of Health and Exercise Science
The University of Oklahoma

Megan Denney, M.Ed.
Academic Advisor
Department of Health and Exercise Science
University of Oklahoma

Allen Knehans, Ph.D.
David Ross Boyd Professor and Chairman
OUHSC Department of Nutritional Sciences

Daniel Larson, Ph.D.
Assistant Professor
Department of Health and Exercise Science
University of Oklahoma

Sarah Maness, Ph.D.
Assistant Professor
Department of Health and Exercise Science
University of Oklahoma

Christopher Wheldon, Ph.D.
Cancer Prevention Fellow at National Cancer Institute
National Institute of Health