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Using Social Cues to Influence Fruit and Vegetable Intake in College Students

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USING SOCIAL CUES TO INFLUENCE FRUIT AND VEGETABLE INTAKE IN COLLEGE STUDENTS

by

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ABSTRACT

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by

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College students eat less than the recommended amount of fruits and vegetables (FV). Using social cues, such as normative messages regarding the intake of peers or modeling of FV intake may influence college students to eat more FV. The following studies evaluated various ways to influence FV using social cues.

Students from all studies were asked to take a survey at baseline and after each intervention with information regarding demographics, FV intake, and perception of peers' intake. Studies 1 and 4 also included the collection of skin carotenoid concentrations—a biomarker of FV intake. We hypothesized that a descriptive normative message regarding average FV intake and skin carotenoids would increase these values in Utah State University (USU) students more than those receiving no message or a message regarding intakes, specifically for those who identified strongly with other USU students (chapter II). However, neither the normative message group, nor any other group reported increases in either self-reported FV or carotenoids over a 5-week period. We hypothesized that adding an approval/disapproval message would increase effects of descriptive messages over a descriptive message only (chapter V). We did observe

significant changes. However, these changes occurred in both groups and the effects were quite small. We hypothesized that self-reported FV intake might be influenced by normative messages when little time was available to change behavior (chapter III). We asked students to take a monthly FV survey immediately after receiving no message, FV recommendations, or a manipulated high or low normative message. Those receiving a message that they were in the lowest quartile of intake reported a half-cup increase in self-reported intake, while no other group reported change. Finally, we utilized repeated peer modeling of eating vegetables to influence FV intake (chapter IV). We observed no effect on FV intake for those in the peer-modeling group over those in the control group. Overall, we found small or no effects of social cues on FV intake or carotenoids measures. Future research might utilize social norms as part of a larger intervention targeting other factors that might influence college FV intake such as cost, time, or skills.

(278 pages)

PUBLIC ABSTRACT

Using Social Cues to Encourage College Students to Eat More Fruits and Vegetables

Elizabeth Nix

People often base their behaviors on social norms—what they think others do or approve of. This is likely true of fruit and vegetable (FV) intake as well. College students typically don't get enough FV. We attempted to encourage FV eating by providing students with messages or demonstrations that eating FV is normal. First, we tried to encourage FV intake by providing students with messages regarding the average skin carotenoid concentration and where they fit within their peers (Chapter II). Carotenoids are compounds found in FV that cannot be made by the body, making them an estimate of FV intake. We found that students did not increase their self-reported FV intake or skin carotenoids as a result of these social norms messages, messages about the recommendation for FV or no message at all. We then added an approval/disapproval message (as ☺, 😐 or ☹) to the average carotenoid scores and where a student fit within their peers' scores (Chapter V). This resulted in small increases in self-reported FV intake and skin carotenoids for those receiving the approval/disapproval message and those who only got information about the average score of their peers and where they fit within the average. To test whether self-report was influenced by messages regarding social norms, we sent out messages telling students they were lower than average—whether this was true or not, higher than average, providing the recommendation for FV, no message. Those told they were lower than their peers reported a half-cup increase in FV intake

immediately after receiving the message. Finally, we attempted to influence student's FV intake by having other students come into a weekly class, pose as students in the class and eat vegetables (Chapter III). We found that those exposed to these vegetable-eating students were no more likely to increase FV than those not exposed to it. Overall, we found very small or no effects from any of the included studies and that self-reported FV intake should be interpreted with caution. Interventions that include other factors, such as time, cost, availability or knowledge/skills, might increase FV more than social norms alone.

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Elizabeth Nix

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CHAPTER I

INTRODUCTION

Overview

As adolescents transition into adulthood, they began to have control over more aspects of their life and are likely to develop many new lifestyle habits. One of these important lifestyle changes may include changes in dietary behavior (Brunt & Rhee, 2008; Butler, Black, Blue, & Gretebeck, 2004; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). While the "freshmen fifteen" is likely an exaggeration of the weight gain observed in college students as they move from the home of their parents to life on their own or with roommates, there is no doubt that dietary behaviors in young adults do not reflect USDA recommendations for a healthy diet (Davy, Benes, & Driskell, 2006; Huang et al., 2003; Vella-Zarb & Elgar, 2009). Adolescents are known to have lower than optimal intakes of healthful foods such as FV, and in many cases this behavior extends into young adulthood and college (Powell, Zhao, & Wang, 2009; "Youth Risk Behavior Surveillance: National College Health Risk Behavior Survey -- United States, 1995," n.d.). High FV intake, as part of a healthy overall diet, can reduce the risk of many chronic diseases, including type II diabetes, cardiovascular disease, some cancers, stroke, and even Alzheimer's disease (Carter, Gray, Troughton, Khunti, & Davies, 2010; Loef & Walach, 2012; Micha et al., 2017; Pierce et al., 2007; Wang et al., 2014). For this reason, interventions that target this behavior in early adulthood may help to reduce the risk of these chronic diseases as these dietary behaviors become habitual.

People likely base many of their behaviors, including FV intake, on the behavior of others (Emanuel, McCully, Gallagher, & Updegraff, 2012; Jung, Shin, Kim, Hermann, & Bice, 2017; Kothe, Mullan, & Butow, 2012). Researchers have successfully utilized social cues, such as messages regarding the typical behavior of a population, to influence behaviors such as college drinking and environmental behaviors (Baumann et al., 2017; Borsari & Carey, 2003; Lee, Geisner, Lewis, Neighbors, & Larimer, 2007; Schultz et al., 2016; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). The positive effect of these interventions has led to expanding this type of research into other health behaviors such as dietary intake (Robinson, Thomas, Aveyard, & Higgs, 2014). There is epidemiological evidence that shows a positive association between a person's perceptions of what others eat and what they eat (Ball, Jeffery, Abbott, McNaughton, & Crawford, 2010; Jones & Robinson, 2017; Louis, Davies, Smith, & Terry, 2007; Pelletier, Graham, & Laska, 2014). There have also been intervention studies that demonstrate that certain cues can influence dietary behaviors. This can be done through peer modeling—a designated person demonstrating the desired behavior—or social norms messaging—a description on the typical behavior of a group of peers (Cruwys et al., 2012; Hermans, Larsen, Herman, & Engels, 2009; Prinsen, de Ridder, & de Vet, 2013; Robinson, Fleming, & Higgs, 2014; Robinson, Harris, Thomas, Aveyard, & Higgs, 2013; Robinson & Higgs, 2013). Either of these methods may be helpful in influencing young adults to alter their consumption of healthful foods such as FV. However, there is still much to be understood in this area of research.

Peer Modeling

Meals are commonly shared with family, friends and even strangers. There is an extensive amount of research that indicates that serving sizes are often matched to a dining partner (Cruwys et al., 2012; Greenhalgh et al., 2009; Hermans et al., 2009; Robinson, Benwell, & Higgs, 2013; Salmon, Fennis, de Ridder, Adriaanse, & de Vet, 2014). Many studies have demonstrated that when a person is in the presence of a peer model—a person given instructions to behave in a certain way—eating either a high or low amount of food, that person will also eat higher or lower in order to match the intake behavior of the peer model. This matching of intake with dining companions does not appear to be moderated by other factors such as hunger level (Goldman, Herman, & Polivy, 1991), dieting status (Rosenthal & Marx, 1979), live or remote models (Feeney, Polivy, Pliner, & Sullivan, 2011) or weight of model (Hermans et al., 2009) . However, most of these studies evaluate the intake of snack foods such as crackers, cookies, candies or popcorn (Feeney et al., 2011; Howland, Hunger, & Mann, 2012; Leone, Pliner, & Peter Herman, 2007; Robinson, Benwell, et al., 2013; Robinson, Tobias, Shaw, Freeman, & Higgs, 2011; Rosenthal & Marx, 1979; Roth, Herman, Polivy, & Pliner, 2001). While these studies may give helpful insight into the reasons that many in our population consume excessive amounts of 'junk' and snack food, this information does little to improve the overall dietary behavior of the population. Another important aspect of how social modeling and norms may influence diet is in the choice and intake of low-energy, healthful foods. Yet few studies have evaluated how a dining companion or model may influence the intake of FV.

Peer modeling may influence the amount of a nutrient dense food presented. Hermans et al. (2009) found participants who were paired with a model eating a higher amount of carrots and cucumbers ate significantly more carrots than participants who were matched with those eating a small amount or no carrots and cucumbers (Hermans et al., 2009). However, when presented with the choice between a healthy food and an unhealthy food, research is less conclusive. Participants were more likely to choose a healthy snack bar or biscuit over a less healthy one led to believe that other participants ate either healthy or less healthy choices (Burger et al., 2010). However, Robinson and Higgs (2013) found little difference between healthy and unhealthy choices in when paired with a model choosing either high energy or low energy snacks from a buffet, with the exception of carrot intake. Those in the "unhealthy" model group chose fewer carrots than those in the control or "healthy" intake group ((Robinson & Higgs, 2013).

Familiarity or identity with the peer model may increase the efficacy of social modeling on dietary behavior (Cruwys et al., 2012). Peers likely influence elementary school children's eating behaviors more than teachers or adult strangers (Hendy & Raudenbush, 2000). Similarly, young adults might be more influenced by in-group peers rather than out-group peers. Cruwys et al. (2012) determined that in-group peers—those attending the same university—had a positive peer modeling effect, while those attending a different university had no peer modeling effect.

Another important aspect of social influence on eating behavior is the use of multiple exposures to a peer model. Most studies done in young adult populations evaluate how a one-time exposure to social modeling may influence choice or intake in

one sitting (Burger et al., 2010; Cruwys et al., 2012; Feeney et al., 2011; Goldman et al., 1991; Robinson, Benwell, et al., 2013; Robinson & Higgs, 2013; Robinson et al., 2011). This may be effective in changing behavior for that moment, but fails to shed light on the effect that multiple exposures of modeling may have on habitual food intake. While some preschool studies have utilized multiple exposure and measured several meal-time choices, these are often limited to 4-5 meal observations (Greenhalgh et al., 2009; Hendy, 2002; Hendy & Raudenbush, 2000).

One exception is the Food Dudes program, which evaluated the effect a "heroic" peer model had on intake for meals, snacks, and home FV intake (Horne et al., 2004, 2008). Even after a four-month follow-up intakes of home FV remained higher than at baseline. It is unknown if a similar study in other populations, such as young adults, would have similar results. Additionally, this program is a comprehensive program that includes other nutrition intervention aspects including increased availability to fresh FV and positive reinforcement, through small rewards such as pencils, toys or special privileges. Therefore, these results should be interpreted with caution in regards to the effect of peer modeling.

It is apparent however that perception of a social norm may be correlated with long-term health behaviors (Ball et al., 2010; Jones & Robinson, 2017; Louis et al., 2007; Pelletier et al., 2014). Researchers Ball et al. found that Australian women who observed neighbors eating higher amounts of FV were 19% more likely to eat high amounts of FV (Ball et al., 2010). Young adults might be more influenced by the eating behaviors of friends and significant others than with neighbors (Pelletier et al., 2014). This further

emphasizes the importance of having a strong identification with the peer model or group.

Normative Messages

The theory behind social norms is very similar to that of modeling. Both describe the influence that social cues may have on eating behavior. While modeling often involves the physical presence of a dining companion or model, social norms more often give a description of how the general population feels about or participates in a behavior. Social norms can be classified as either injunctive or descriptive. An injunctive norm is a behavior that most of the referent group thinks *should be done*, while a descriptive norm is what the population is *actually doing* (Reno, Cialdini, & Kallgren, 1993). Several studies have shown that injunctive norms may not be quite as effective in making healthy changes (Borsari & Carey, 2003; Robinson, Fleming, et al., 2014). Thus, descriptive norms are more often used in intervention strategies. However, many recent studies have shown a positive effect when combining both descriptive and injunctive norms (Costa & Kahn, 2013; Schultz et al., 2016, 2007). These have been limited to studies regarding energy/water usage and binge drinking behaviors(Borsari & Carey, 2003; Lewis & Neighbors, 2006).

Combining injunctive and descriptive may be beneficial for FV intake as the average FV intake in college students is lower than the recommendation. Those that are already above the average FV intake may feel justified in maintaining their behavior even if it is less than recommendations (Stok, Ridder, Vet, & Wit, 2012). Messages that include both descriptive normative feedback and injunctive (in the form of emoticons) to

depict whether most people approve ☺ or disapprove ☹ of a person's behavior, as seen energy usage studies, might be effective at changing dietary behaviors (Schultz et al., 2007).

Another way to increase the effectiveness of a social norms approach is to identify the best referent group. The referent group refers to the population whose statistics or perceptions are presented in the normative information (Hogg & Reid, 2006; Louis et al., 2007). This referent group may be very large, such as the US population, or very small, such as other members of a sports team. If an individual does not have a strong identification the referent group used in an intervention, they may be less inclined to change their behavior (Hogg & Reid, 2006).

The self-categorization theory suggests that as an individual strengthens their identity with a group, they begin to see themselves less as an individual and more as part of the referent group (Hogg & Reid, 2006). Stok et al evaluated this concept of identification with the referent group and it's effect on vegetable intake after the presentation of a normative message depicting either that other university students ate a high amount or low amount of vegetables (Stok, Verkooijen, de Ridder, de Wit, & de Vet, 2014). Stok et al. (2014) found that only those university students that had a strong identification with others from this university showed significant differences in vegetable intake. These students with high identification with this referent group reported that they ate sufficient vegetables close to 6 days out of the week when provided a message that most university students ate sufficient vegetables; when given a message that few university students ate vegetables, their vegetable intake was sufficient only 3.5 days out

of the week. Little difference was observed in those reporting a moderate or weak identification with the referent group (Stok, Verkooijen, et al., 2014).

In a second study, Stok *et al.* hypothesized 3 possible mediators that may be influenced by normative information regarding FV: identification as someone who eats FV, attitude toward FV and self-efficacy to prepare and eat FV. Among those who identified highly with other university students and received a message that most students ate sufficient vegetables they observed increase self-identification as a vegetable eater, self-efficacy and attitude (4.28 of 5, 4.26 of 5, and 6.15 of 7 respectively) compared to those who received information that few students ate enough vegetables (3.39 of 5, 3.48 of 5 and 5.21 of 7).

Issues with self-reported dietary intake

A limitation that exists in current social norms research related to diet is the use of self-reported intake as an outcome measure. Self-reported intake of FV may not always be accurate (Freedman et al., 2014; J. R. Hebert, Clemow, Pbert, Ockene, & Ockene, 1995; James R Hebert et al., 2002). Self-reported dietary intakes may be subject to recall bias or social desirability (Di Noia, Cullen, & Monica, 2016; Hébert, 2016; J. R. Hebert et al., 1995).

Ideally, studies using social norms of FV intake would have an objective outcome measure, such as carotenoid concentrations. Carotenoids are compounds found in FV that cannot be synthesized in the body. Therefore, any carotenoids found in the body must come from the diet. Serum carotenoids have often been used in validation studies and are known to be a biomarker of FV intake (Greene et al., 2008; Resnicow et al., 2000).

However, serum carotenoids are costly and invasive for the participant. New technology has been developed to measure concentrations of carotenoids in the skin.

The Pharmanex biophotonic scanner uses the science of resonant Raman spectroscopy to emit a low-level of blue light into the skin to detect levels of carotenoids (Aguilar, Wengreen, Lefevre, Madden, & Gast, 2014). An excitation of these molecules results in a peak in the Raman absorbance signal. These levels of skin-carotenoids (or Raman intensity counts) have been highly correlated ($r=0.74$, P-value=0.0001) with serum levels of carotenoids and are significantly cheaper and less invasive to measure (Mayne et al., 2010). Skin carotenoids have also, through controlled feeding trials, been shown to change in response to high-carotenoid juice consumption (Aguilar, Wengreen, & Dew, 2015; Jahns et al., 2014)

A recent study of social norms conducted at Utah State University utilized this method to measures skin carotenoid levels after an intervention providing normative messages (Wengreen, Nix, & Madden, 2017). Those told they were in the lowest 20 percentile of skin carotenoid scores demonstrated an increase in total carotenoid concentrations of 5,000 Raman intensity counts, while those in the control or actual descriptive norm group showed no increase.

Conclusion

As adolescents transition into adulthood, the development of long-term healthy dietary patterns becomes increasingly important. The effect of social influences on long-term dietary intake continues to be under-researched. The use of peer modeling to influence nutrient dense foods in young adults has been limited to single-session events

(Cruwys et al., 2012; Feeney et al., 2011; Goldman et al., 1991; Hermans et al., 2009; Robinson & Higgs, 2013). Repeated exposure to peer models has been shown to be successful at increasing FV in children. However, these often measure intakes after the presentation of food options rather than long-term intakes (Greenhalgh et al., 2009; Horne et al., 2004). Nutrition interventions that utilize social normative information have shown some promise (Robinson, Fleming, et al., 2014; Robinson, Harris, et al., 2013; Stok, de Ridder, de Vet, & de Wit, 2014; Stok, Verkooijen, et al., 2014). However, there is still much research to be done and problems to be solved in this area. Issues regarding self-report in FV intake as well as the low average intake of these foods in the US population hinder the effectiveness of these interventions (Di Noia et al., 2016; J. R. Hebert et al., 1995; James R Hebert et al., 2002; Powell et al., 2009). However, by determining the effect social norms have on self-report and using alternate, more objective outcome measures, researchers may be able to distinguish between social desirability effects and actual changes in FV intakes.

Purpose and Objectives

- To determine the effect of descriptive social normative information on vegetable and fruit intake as measured by a biophotonic carotenoid scanner.
    - To determine if identification with the norm referent group increases the likelihood that normative information will improve carotenoid scores.
    - To determine the effect of normative information on self-identification, self-efficacy, and attitude as possible moderators of behavior change.
    - To determine if stage of change relates to change in carotenoid scan scores when normative information is provided.
    - To determine if social normative data increases carotenoid scores more than information based on recommendations.
    - To determine if a combination of injunctive and descriptive norm alleviates a migration toward the average in those higher than average.
- To determine the effect social norm and recommendation information may have on self-reported fruit and vegetable intake, when actual intake is unlikely to have changed.
- To determine the effect that multiple-exposure, peer-modeling (demonstrated norm) has on habitual dietary intake among students enrolled in NDFS1020.

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CHAPTER II

THE EFFECT OF DESCRIPTIVE SOCIAL NORMATIVE MESSAGES ON FRUIT AND VEGETABLE INTAKE AND SKIN CAROTENOID CONCENTRATIONS IN COLLEGE STUDENTS: A RANDOMIZED CONTROLLED TRIAL

Abstract

Objective: The objective of the current study was to determine how descriptive normative messages regarding skin carotenoid scores, a biomarker of fruit and vegetable intake, influences FV intake.

Design: Participants were recruited from an introductory nutrition course at US University in 2015. Participants (n=214) were randomly assigned to three groups and asked to complete carotenoid scans and report how frequently they consumed FV over the past week at baseline and 1 month after receiving the normative information. The control group received no information; the recommendation group received their skin carotenoid score and was informed that those meeting recommendations for FV had skin carotenoid scores of approximately 40,000; the social norms group received their skin carotenoid score and how their score compared to their peers.

Results: Baseline averages for FV intake and skin carotenoid scores were 2.5 half-cup servings and 26,885, respectively, and did not differ by group. Baseline FV intake was correlated to baseline skin carotenoid score ($r = .611$, $p = .000$). A repeated-measures general linear model was used to determine change over time. No significant time by group interaction was observed for either carotenoid concentrations or total self-reported FV intake ($p=0.49$ and $p=0.71$, respectively).

Conclusion: Presentation of actual DSN information had no effect on either FV intake or skin carotenoid score in this study. Future studies may evaluate longer time periods for change, or inclusion of an approval/disapproval (injunctive norm) message with DSN.

Introduction

College is, for many, a time of great change in health habits and lifestyle(1). The "freshmen fifteen"—the idea that many freshmen gain a significant amount of weight during their first year away at college—may be an exaggeration (2) but there is little doubt that college students do not always make the healthiest lifestyle choices as they move away from home and begin to develop independence (1–3). Eating too few fruits and vegetables (FV) is one way that college students are not quite meeting recommendations (4,5). Eating FV, as part of a healthy dietary pattern, has been correlated with lower risks of obesity, cardiovascular disease, diabetes, and some cancers (6–8).

There is epidemiologic evidence that young adults may base some of their dietary behaviors on what they perceive others to be doing (9–12). While it is true that many college students do not meet the recommendation of 4-5 cups per day—with average intakes of approximately 1.5 cups/day—many adolescents and young adults underestimate the intake of their peers (4,13,14). It may be that, although these populations don't get enough, they believe they are at least doing better than average. It is possible, therefore, that changing the perception of peer intake may result in increases in FV intake.

There is some evidence to support this hypothesis. New research has emerged on the effectiveness of how a normative message—a message describing the behavior of a certain population—may positively influence FV eating behavior (15–19). These experimental studies have demonstrated that providing a message stating that the average

peer (i.e. other college students) eats a high amount of healthy foods, such as fruits or vegetables, typically increases the chances that a participant will choose a healthy food presented to the participant in the lab setting (20,21) or increase intakes of fruits or vegetables within the next few days (17–19). However these studies evaluate only short-term changes in behavior. Less is known about how normative messages may affect habitual intakes of FV.

Only one recently published study, by our research group, has evaluated changes in habitual intake when students were presented with a normative message (22). In this study, students were presented with a manipulated normative message regarding their skin carotenoid concentrations, a biomarker of carotenoid containing fruits and vegetable intake. Students receiving the manipulated message that their skin carotenoid score was in the lowest 20th percentile of the distribution of scores from their peer group (regardless of whether or not this information represented the truth) had an increase in carotenoid scores after 6 weeks. However, using this manipulated message is not an ethical solution to promote long-term behavior change. It is therefore important to determine if actual descriptive normative messages about skin carotenoid concentrations may have a beneficial effect on the behavior of eating more fruits and vegetables among college students.

Many researchers use self-reported measures of FV intake. However, these self-reported measures may be subject to social desirability bias (23–26). This may be especially true for social normative research, as these interventions typically make an actual norm salient and participants may have an increased desire to model their own

behavior after that of their peers. In a research study we recently published, we found that those being told that their intake was in the lowest 20th percentile—regardless of actual self-reported intake—reported a half-cup increase in FV intake as measured by a validated FV screener developed by the National Cancer Institute (14). We suspect that this was not due to actual change as these participants had only 2-3 days after receiving the normative message to retake the survey and the measure used was a frequency-based questionnaire, which measures intakes over the previous month. It is unlikely that these students would have been able to alter their diet enough within the short amount of time to result in such a substantial change.

It is, therefore, advisable to use an objective form of measurement, such as carotenoid concentrations, as a measure of FV intake in normative research about dietary behaviors. Carotenoids are organic compounds found in darkly pigmented FV (27). Carotenoids are not produced in the human body. Therefore, levels of carotenoids in blood or skin must come from an outside source. Serum carotenoids are often used in validation studies (28). However, collecting blood samples to measure serum carotenoids can increase the cost of research and are an invasive procedure for participants. New technology has been developed to scan the skin for carotenoids using resonance Raman spectroscopy to decrease burden and cost in collecting information regarding carotenoids (29–31). Skin carotenoids have been significantly correlated with serum carotenoids and FV intake in several studies (29–31). Additionally, through feeding trials, it has been observed that increasing carotenoid containing juice can increase the concentration of

skin carotenoids (32–34). Skin carotenoids take approximately 6 weeks to reflect change, which makes them ideal for measuring long-term changes in FV intake (27).

The purpose of this study was to determine how actual descriptive normative messages regarding carotenoid concentrations might influence FV intake of college students, as indicated by measured skin carotenoid concentrations. A secondary purpose was to determine if the degree to which participants identified with their peer group moderated the effect. We predicted that those in the descriptive normative message group would be more likely to increase FV intake and skin carotenoids than would those receiving information regarding the recommendation for FV or for those receiving no information. We also predicted that those who identified more strongly with their peer group would be more likely to change their fruit and vegetable consumption.

Methods

Participants

Students were recruited from the undergraduate Human Nutrition class during the Spring semester of 2015. The study was announced and advertised as a study evaluating factors that influence FV intake in college students in class and via the class's online classroom management system. Students were awarded 10 points extra credit—1% of total class points—for participating in all aspects of the study. Undergraduate students aged 18 years and older enrolled in the course were included in the study. We excluded graduate students or any students attending a distance campus.

Based on data from a previous study done in the course the year before, we determined that in order to see a 5,000-point increase in carotenoids with 80% power and

at a significance level of 0.05, we would need approximately 60 participants per group for a total of 180 total participants. However, all participants in the course were invited to participate in order to give everyone in the course equal opportunity to earn extra credit. Approximately 575 students were invited to participate. Of those, 350 (61%) completed the initial survey and carotenoid scan and were provided the intervention and 214 (61%) completed the survey and scan 4-6 weeks later.

Procedures

This is a randomized controlled experiment with three equal groups—Control, Recommendation and a Descriptive normative message. Each participant was asked to take a survey between the dates of February 2nd through the 9th of 2015 and have hands scanned for carotenoid concentrations at baseline (February 9th through 20th) and in 4-6 weeks time (March 30th through April 10th). We announced the study in the nutrition course and provided all students with an explanation of carotenoid values, what they represent, and how eating darkly pigmented FV can increase this value. Using a random number generator in in IBM™ SPSS statistics software (35), the primary researcher allocated each participant to one of three groups after collection of baseline data. Each participant was assigned a random number, sorted by that number and then separated into three groups based on how they were listed (i.e. the first 116 were allocated to control, 116 to the recommendation group, and 117 to the descriptive norm group). Neither the primary researcher nor participants were blinded to randomization. Students were then provided with a message via email based on group allocation.

Participants in the control group were thanked for their participation and were told that skin carotenoid levels are an objective measure of FV intake. They were informed that they were in the control group and that they would not be receiving their scores at this time. However they could find out their initial score at the end of the study.

Students in the recommendation group were also thanked for participation and told that carotenoids are an objective measure of FV intake. These students were given their score and told that those meeting the recommendation of eating 5 or more cups of FV per day usually had scores of approximately 40,000.

Students in the descriptive norm group were provided with the same message as those in control along with information regarding their own score and that of their peers. They were also told where they fit within the distribution of skin carotenoid scores of a group of their peers, students who had previously taken the class. For example a student in this group may have received the following message, "Nutirition students have an average skin carotenoid score of **25,103**. Your carotenoid score is 27,371.5. Of 100 students, 30 scored above you on the carotenoid scan and 70 scored below you."

Instruments

Survey

Participants were provided with the link to the baseline survey via the course's Canvas announcement. The baseline survey contained questions regarding demographic information such as age, race, sex, height and weight. It also included information regarding academic information such as GPA, completed semesters, major, and reasoning for taking the nutrition course. Students were then asked about factors that may influence

carotenoid scores besides diet including tobacco use, exercise patterns, sun exposure, recent illness or chronic disease status, and tanning lotion use.

The survey also included a frequency-based questionnaire regarding typical FV intake with 10 items—frozen, fresh or dried fruit, leafy greens, yams and winter squash, spaghetti sauce and tomatoes, vegetable soup, carrots, beans, and other vegetables. Each item gave a description of typical serving sizes (½ cup for most vegetables and whole fruits, ¼ cup for dried fruit and 1 cup for leafy greens). Options ranged from never to 4 or more times per day. The FV questionnaire was not validated. However, the data collected using this tool reflects similar averages seen for other studies in a similar population (4,14,22). Likewise, total FV intake as measured by this instrument had a significant correlation to skin carotenoid scores (Pearson correlation=0.52, p=<0.01), which is similar to correlation values reported in a validation study conducted by Resnicow et al. between measures of self-reported FV intake and serum carotenoids (36).

Three questions were also included to determine the participant's identification with other university students, which may be a moderating factor in normative studies (19), These questions were similar to those used by Stok et al with answers ranging from 1 (very much disagree) to 7 (very much agree). However, these researchers conducted their study in Dutch, therefore, there may be translational differences (19).

Skin Carotenoid concentrations

Carotenoids were measured using the Pharmanex Bio Photonic scanner. Participants were asked to come to the back of the classroom to have their hand scanned. They were asked to place the thick part of the palm, about an inch under the pinky, on a

small light on the machine. This machine then emits low levels of infrared light, which are reflected by carotenoid compounds in the skin. Each student had his or her hand scanned twice. If the two scans were more than 5,000 units apart, a third scan was performed. An average of the scans were created. Two scanner machines were used to measure carotenoids. Due to minor differences between machines, each student had their hand scanned by the same scanner at baseline and at 4-6 weeks to maintain consistency. A researcher was available to determine which scanner was used for each student at baseline.

Data Analysis

After completion of all study procedures, we evaluated the data for change over time. Total FV intake was calculated into servings per day. Total perception of peers' FV intake was also calculated into half-cup servings per day. A repeated measures ANOVA in IBM™ SPSS statistics software (35) was run to examine whether FV intake and skin carotenoid scores changed by group over time. Identification with the referent group of other university students was included as a covariate in the repeated measure ANOVA for both variables.

Results

213 students (37% of students invited to participate) completed the study and are included in the analyses presented here. Participants were predominantly female (69%), between the ages of 19 and 20 (61%). We did not collect race/ethnicity data for this population. However, the average enrollment rates for this university are approximately

81% white, 6% Hispanic, with Black American, Native American, Asian American, Pacific Islander, blended race and unknown race making up less than 2% of the student population each. Student's had an average BMI of 23.5 kg/m^2, FV intake of 2.5 servings per day and skin carotenoid concentrations of 26,885.0 (see table 2-1). Baseline FV intake was significantly correlated to skin carotenoid concentrations (Pearson correlation=0.52, p=<0.01). BMI was also negatively correlated (Pearson correlation=-0.25, p<0.01) to carotenoid concentrations. No other variable, including exercise, sun exposure, tanning practices or sickness correlated with carotenoid concentrations. Groups did not differ significantly from each other at baseline.

Table 2-1. Demographics of participating University students by group allocation

N=213	Control (n=68)	SD	Recommendation (n=70)	SD	Social Norm (n=76)	SD	P-value
Female	48	-	46	-	54	-	0.75
Age range							
18-20	40		44		47		
21-22	16	-	17	-	17	-	0.89
23+	12		9		12		
BMI (kg/m^2)[ab]	23.9	4.2	23.5	4.2	23.1	3.4	0.53
Baseline FV [bc]	2.3	2.2	2.9	2.1	2.4	1.9	0.17
Perception of peer's FV intake[bc]	2.3	1.0	2.5	0.9	2.4	0.9	0.10
Carotenoid score[cb]	25,354.9	9,307.0	28,550.4	10,131.4	26,885.0	8,518.0	0.13

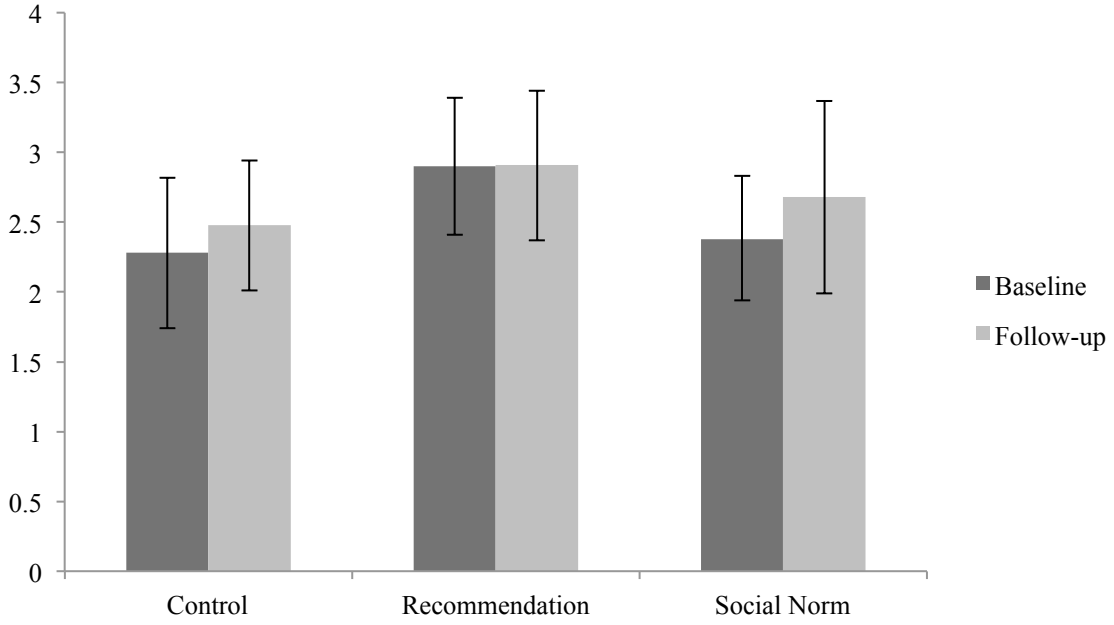
SD, standard deviation
BMI, body mass index
FV, fruit and vegetable
[a]-based on self-reported height and weight
[b]-Displayed as Mean
[c]-expressed as servings per day

Identification with the referent group was calculated by adding the responses to each of the three questions. A total score of 21 was possible. Participants had an average score of 14.09. Students were separated into tertiles of identification with students from this university; low (M=9.20, SD=2.65, n=81), medium (M=15.12, SD=1.38, n=74), and high (M=19.53, SD=1.37, n=59).

Using a repeated measures ANOVA, there was no significant change in skin carotenoid concentrations over time by group allocation (df=2, F=.72, p=.49, Partial Eta squared=.007). Means for each group remained consistent over time, with no observable change in any group (See figure 2-1). When identification with the referent group was included in the analysis, there was also no significiant interaction for group by time by identification with the referent group (df=4, F=0.75, p=0.56, Partial eta squared=0.014).

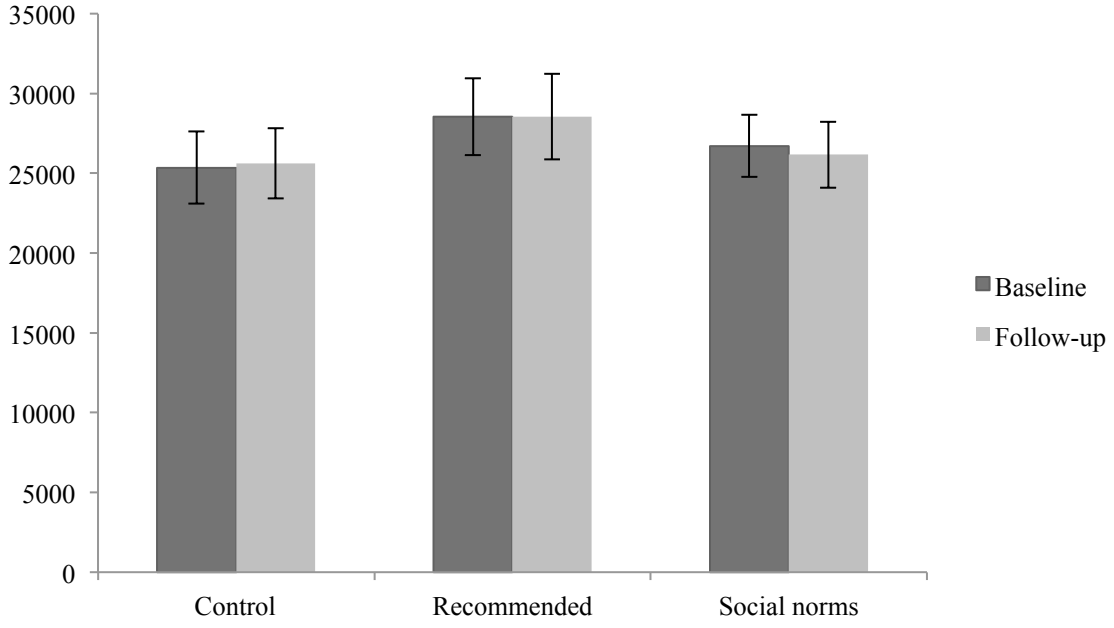
There was also no significant group by time interaction for self-reported FV intake (df=2, F=0.35, p=0.71, Partial eta squared=0.003, figure 2-2) or perception of peers' intake (df=2, F=0.40, p=0.67, Partial eta squared=0.004). These, likewise, were not moderated by identification with the referent group (df=4, F=0.68, p=0.61, Partial eta squared=0.013 and df=4, F=0.72, p=0.58, Partial eta squared=0.014, respectively).

Figure 2-1. Total Change in FV intake in servings by group over time



*No significant change over time for any group at significance level of p=0.05

Figure 2-2. Total Change in skin carotenoid concentrations by group over time



*No significant change over time for any group at significance level of p=0.05

Discussion

We did not observe any change in either skin carotenoid concentrations or self-reported FV intake for any group over time. We had expected to see increases in carotenoid concentrations for those in the descriptive normative group, as a similar effect has been seen in studies by other researchers in this field (17,19,21). However, this was not observed. We had also expected to see this effect moderated by identification with the referent group (students attending the same university). When this variable was included as a covariate in the analysis, it was also non-significant.

This effect was unexpected, although not entirely surprising. This result was similar to a result seen in our prior study, recently published, in which changes were observed for a manipulated normative message—a message informing everyone, regardless of actual score, that they were in the lowest 20th percentile, but no observed changes were observed for those given their actual score within their distribution (22).

One of the major limitations to the current study and a possible reason that we saw no significant effect is the wording of the normative message. The messages indicated that skin carotenoids were an objective measure of FV intake, but did not emphasize that carotenoids could be increased or specify which FV would best increase this score. We did discuss these factors when announcing the study to the students, but it is possible that not all participating students heard or remembered this content. Carotenoids themselves may have been too abstract a measurement for students to feel that they had control over. In our prior study in which normative messages referred to

carotenoid scores, the message clearly portrayed dietary changes that could alter skin carotenoid levels (22).

Additionally, it takes a long-term change in dietary behavior in order to see significant changes in skin carotenoid concentrations (30). Students may have changed temporarily, but not for an extended period of time. Our timing was not as ideal as hoped and time between scans was not as long as we would have liked. Optimally, scans would take place 6-8 weeks after an intervention in order to allow more time to observe changes. Due to time and labor constraints, many scans were only 4 weeks apart and none more than 6 weeks apart.

While both these limitations may have influenced the results of the study, it is also possible that actual descriptive normative messages may be less effective in increasing FV in college students. Generally, college students do not meet recommendations for FV. Messages that include information that the reference population consumes less than the recommended amount may reinforce the idea that college students do not consume the appropriate amount of FV and therefore justify this behavior in the individual (4,18). Additionally, those above the average may be more motivated to fit with what is "normal" and may therefore be at a risk of decreasing intake to fit within the average. Similar issues were seen in an energy usage study when participants received a personalized descriptive normative message regarding energy intake—those above the average energy usage decreased to a more desirable amount, while those with low energy usage increased to a less desirable amount. These issues were alleviated when researchers added in an approval/disapproval message—injunctive

norm—along with the personalized descriptive norm. This approach is promising, but has not been tested in dietary behaviors.

More research is needed to determine the best method of delivering a truthful and effective message to increase FV intake in college students. It is difficult to determine if the lack of effects seen in this study were due to limitations in the study design or simply that delivery of an actual descriptive normative message is insufficient to produce increases in FV intake in college students. It's possible that the same study with stronger emphasis on how students can increase carotenoid scores, might lead to increases in FV intake and thus carotenoid scores. Further research may also evaluate the effect of how an injunctive, combined with a descriptive, norm may lead students to make healthier choices in regards to FV over that of a descriptive normative message only. More research is needed in the field of social normative messaging to determine if this approach is an effective way to improve health and increase FV intake in college students.

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CHAPTER III

SOCIAL APPROVAL BIAS IN SELF-REPORTED FRUIT AND VEGETABLE INTAKE AFTER PRESENTATION OF A NORMATIVE MESSAGE IN COLLEGE STUDENTS[1]

Abstract

Objective: To determine the accuracy of self-reported data regarding Fruit and Vegetable (FV) intake in college students at Utah State University after being presented with a descriptive normative message.

Intervention: Participants (N=167) were recruited from general education courses and asked to complete a baseline survey containing a FV screener from the National Cancer Institute. They were then randomized to receive one of four messages one week after the initial survey and asked to immediately complete the same FV screener. The Control group received no FV message. The Recommendation group received a message that the recommendation for FV is 4-5 cups per day. The two normative groups received a message that either 80% of students ate more (Low) or less (High) FV than they did, regardless of actual intake, in addition to the recommended intake.

Analysis: Repeated measures ANOVA was used to assess differences in reported FV intake and perceived FV intake of peers between the first and second assessment. Results and Conclusions: Those receiving the message that they were in the lowest 20th percentile of intake reported a half-cup increase in self-reported FV intake and a one-cup increase in perception of peers' intake ($p=0.037$ and $p=<0.001$, respectively). No

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significant differences were observed in other groups. These results indicate that normative messaging may influence self-reported FV intake and perception of peer intake of college students when this message indicates that the participant is in the lowest percentile of their peers.

Introduction

College students are at an important time in their life to develop new habits, including dietary habits (Butler, Black, Blue, & Gretebeck, 2004). Many studies have shown that college students have less than optimal diets, in which they do not consume enough fruits and vegetables (FV) (Archer, Hand, & Blair, 2013; Brunt & Rhee, 2008; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). High intakes of FV, as part of a healthy dietary pattern, have been associated with reduced risk for obesity, heart disease, diabetes and some cancers (Carter, Gray, Troughton, Khunti, & Davies, 2010; Pierce et al., 2007; Wang et al., 2014). Many studies have evaluated ways to improve FV intake in college students. These studies have focused primarily on addressing barriers to consumption such as cost, preparation skills and nutrition education (Kelly, Mazzeo, & Bean, 2013). A factor that has received less attention in nutrition research is social influence.

Social normative theory posits that people base some behaviors and beliefs on what they perceive others are doing or approve of (Reno, Cialdini, & Kallgren, 1993). Social normative messages have been shown to have an effect on a variety of behaviors including energy and water usage, littering, and college drinking (Borsari & Carey, 2003; Costa & Kahn, 2013; Lee, Geisner, Lewis, Neighbors, & Larimer, 2007; Reno et al., 1993; Schultz et al., 2016; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007; Wechsler et al., 2003). A growing body of evidence suggests that normative messages may also have an impact on the dietary behaviors of young adults (Robinson, 2015; Robinson, Thomas, et al., 2014). Normative messages may be either injunctive —

reflecting what the group thinks should be done, or descriptive— reflecting what the group is actually doing (Chung & Rimal, 2016; Rimal & Lapinski, 2015). Descriptive normative messages have been shown to have a more substantial effect on FV intake than injunctive normative messages and, therefore, are more often used (Robinson, 2015).

Objective outcomes are the preferred measure of interest in normative research. When measuring outcomes such as incidence of littering or energy usage, these objective outcomes are easily obtained. Many researchers of dietary-related social norms have also been able to objectively measure what foods participants select and consume after they are presented with a normative message by providing controlled food options and observing the eating behavior of participants over a short period of time (Cruwys, Bevelander, & Hermans, 2015). For example, Robinson et al. (2013, 2014) measured intakes of healthy and unhealthy snack food items after participants received either a health or social norm based message (Robinson, Fleming, & Higgs, 2014; Robinson, Harris, Thomas, Aveyard, & Higgs, 2013). These single-setting studies have provided invaluable evidence of the effect of normative messages on immediate food choices in a controlled environment, but not habitual dietary intake.

Indisputably, objective measures of long-term dietary behavior change are more difficult to obtain. Nutrition research has been limited to relying largely on self-report data when evaluating habitual dietary patterns (Archer et al., 2013). Commonly used self-reported dietary assessments include multiple 24-hour recalls and food frequency questionnaires (FFQ); each can be used to provide an estimate of usual dietary intake over a defined period of time. Many short assessment tools have been created specifically

to measure frequency of FV intakes. These have been shown to be reliable and valid when compared to either multiple 24-hour recalls or serum carotenoids, a biomarker of carotenoid-containing FV (Greene et al., 2008; Peterson et al., 2008; Resnicow et al., 2000; Thompson et al., 2000).

However, self-reported measures of dietary behavior may be subject to bias based on perceptions of what is socially acceptable (Di Noia, Cullen, & Monica, 2016; Hébert, 2016; Hebert, Clemow, Pbert, Ockene, & Ockene, 1995; Miller, Abdel-Maksoud, Crane, Marcus, & Byers, 2008; Schoeller, 1995). Participants may report higher intakes of healthful foods, such as FV and lower intakes of junk foods (Di Noia et al., 2016; Miller et al., 2008; Schoeller, 1995). Researchers Herbert et al. (2001) found that self-reported FV intake was not correlated with scores of social desirability, as measured by the Marlowe-Crowne Social Desirability Scale (Hébert et al., 2001; Loo & Thorpe, 2000). However, the social desirability scale is also a self-reported measure and may therefore be subject to bias. In addition, specific populations may be more susceptible to this bias than others. For example, college students may be more likely to desire approval from their peers than other adult populations (Crocker, Luhtanen, Cooper, & Bouvrette, 2003)

Furthermore, the degree of bias in self-reporting dietary behaviors may change after information is given to describe what the norm is for the behavior being targeted (Ball, Jeffery, Abbott, McNaughton, & Crawford, 2010; Pelletier, Graham, & Laska, 2014). Normative research often makes an actual norm salient, which may differ from what was previously perceived as a norm. This problem has been observed in self-reported alcohol consumption behavior after the presentation of normative messages and

may be similar in dietary interventions (Cunningham & Wong, 2013). Changing the perception of what is considered normal FV intake could alter a participant's responses to a survey asking participants to report how frequently they consume FV. Researchers Miller et al. (2008) found that when provided with a health message, considered an injunctive normative message, regarding FV intake, participants reported higher amounts of FV after ten days than did those receiving no injunctive normative message.. These researchers attribute this difference to approval bias rather than actual change due to "the minimal nature of the intervention and the large size of the difference" between groups (Miller et al., 2008).

As more researchers look into the use of social normative messages and their effect on dietary behaviors, it becomes crucial to determine how significantly social approval bias may influence self-reports of long-term dietary behavior change. The purpose of our study is to determine if the presentation of social normative messages to college students regarding FV intake of their peers affects self-reported FV intake over the past month using a previously validated 19-item FFQ.

Methods

Participants

Participants were sampled from four undergraduate courses (Behavioral Psychology, 2 sections of The Science and Application of Nutrition, and a general Biology course) at Utah State University (USU) in the Spring Semester of 2016. Participants were undergraduate students between the ages of 18 and 24 and attended the Logan main campus at USU. Students were invited to participate through a class

announcement. They were informed that as part of their participation, their email address would be entered into a lottery drawing for a $100 gift card or one of 20 coupons for a local ice cream establishment. We conducted a power analysis based on prior information in a similar population, which had baseline intakes of 3.14 (SD=2.35) servings or approximately 1.57 cups. In order to detect a 1 serving (approximately ½ cup) increase in intake, with 80% power and a significance level of 0.05, we would need 87 participants per group or 348 total participants. Of the 700 students invited to participate, 222 (32%) completed the first survey. Of those that completed the first survey, 167 (75%) completed the second survey.

Instruments

Participants were asked to complete a survey and the 19-item National Cancer Institute (NCI) FV screener at baseline and again in one week. The NCI screener is a validated instrument that measures estimated FV intake over the previous month (Freedman, Choi, Hurley, Anadu, & Hébert, 2013; Peterson et al., 2008; Thompson et al., 2000; Yaroch et al., 2012). There are 10 items asking about the frequency of certain FV items, with 9 questions regarding portion sizes. For example, "Over the last month, how many times did you drink 100% juice such as orange, apple, grape or grapefruit juice?" with answers ranging from never to 5 or more times per day. The baseline survey included a consent form and questions to determine eligibility for the study (undergraduate and main campus student). It also included demographic information such as age, sex, race/ethnicity, and height/weight as well as questions from the NCI screener. The final questions asked participants to estimate how many servings (half-cup portions)

they think the average USU student consumes. Students were asked to enter their email to be sent the intervention and entered into the drawing. One week after baseline, participants were emailed the intervention message (see details below) and a link to the second and final survey with the instructions to complete the survey within two days of receiving the email, thus limiting exposure time to the normative message. The second survey included only the FV screener and questions regarding the participant's perception of their peers' intake of FV.

Procedures

This study was reviewed and approved by the Institutional Review Board (IRB) at USU. Students were informed that the nature of the study was to evaluate factors that influence fruit and vegetable intake in college students, and were asked to provide consent before participating. Students were invited to participate via an announcement that was sent to them through USU's online learning management system. This announcement included a link to the letter of consent and the online survey. After participants completed the first survey, they were randomized into one of four groups using a random number generator in SPSS software. The four groups were sent the intervention email one week after the initial survey. The email received by participants differed by group allocation as follows.

Control (n=40): This group received an email thanking them for their participation and asking them to please verify the data given by completing a second survey. They were given no information regarding their own responses or their peers' FV intake.

Recommendation group (n=41): Participants in this group were sent an email thanking them for their participation and informing them that the USDA recommendation for FV intake is 4-5 cups per day. They were then asked to compete the second survey.

High Norm message- (n=44): Participants of this group were thanked for participating and provided the USDA recommendation as well as a manipulated normative message. Regardless of actual intake, these participants received a message that stated, "You are in the 74^{th} -82^{nd} percentile (each individual got a specific number within this range) of intake. This means that only 26-18% (again each individual received a specific number that corresponding to the percentile range of intake) of students eat more fruits and vegetables than you do." Percentiles were altered within these eight units in order to decrease suspicion about the normative message in case students shared information, but all were given a percentile within this range. A similar method was used in the Low Norm message group described below. .

Low Norm message- (n=42): Participants in this group were also provided with a nearly identical message to those in the High Norm group. However, this group was informed that they were in the 19^{th}-25^{th} percentile of intake, regardless of actual intake.

At the end of the second survey, those in the High and Low Norm groups were informed of the deceptive nature of the study. These participants were informed that

regardless of actual intake, they were told that they were higher/lower than their peers. All participants were also reminded that participation is voluntary and provided a link to the researcher's email if they wished to have their data removed. No participant asked to have his or her data removed.

Data Analysis

All data was evaluated using SPSS software. An average total daily FV intake, in cups, for baseline and 1 week were created based on calculation instructions from the NCI. Perception of FV, also in cups, was calculated by adding the perception of fruit intake to the perception of intake of vegetables. Total daily FV as well as total perceived FV were evaluated using repeated measures ANOVA in SPSS.

Results

Participants were directed to the end of the survey if they did not meet criteria. Therefore, all participants that completed the initial survey met inclusion criteria. Participants had a mean age of 19.8 years. Our sample was predominately female (76%). 157 of the 167 participants identified as European American, 6 as Hispanic/Latino, 1 as Pacific Islander, 3 as multiracial. Mean BMI using self-reported height and weight was approximately 23.6kg/m^2 (Table 3-1). There were no significant between-group differences at baseline. Baseline FV intake was significantly correlated to baseline perception of peers' FV intake (Pearson Correlation 0.22, p=0.004). The message including the link to the survey was sent out on March 22nd, 2016 at approximately 10:30pm and all participants included in the analyses finished the second survey by

March 25th, 2016, within 72 hours of receiving the message. Of the 167 participants, 43 (25%) of the participants took the survey within 2 hours of receiving the link, 83 (50%) participants took the survey the following day, and 42 (25%) completed it on the third and fourth day.

Table 3-1. Baseline demographics of Participants Completing Both Surveys

N=167	Control (n=40)	Recommendation (n=41)	High Norm[a] (n=44)	Low Norm[a] (n=42)	P-value
Female (%)	77	85	70	71	.36
Mean age (SD)	20.2 (1.8)	19.8 (1.5)	19.6 (2.2)	19.8 (1.4)	.57
Race					
White	36	41	41	49	
Latino	3	0	2	1	
Pacific Islander	0	0	1	0	.37
Other	1	0	0	2	
BMI (kg/m^2)[b]	24.2 (5.3)	23.6 (5.2)	23.5 (3.7)	23.0 (3.8)	.73
Baseline FV (cups)	1.7 (1.4)	1.6 (1.5)	1.5 (1.2)	1.7 (1.3)	.82
Perception of peer's FV intake (cups)	0.8 (0.5)	0.8 (0.8)	0.8 (0.7)	0.7 (0.6)	.66
Referent group ID (Out of 21)	14.7 (3.9)	15.3 (3.6)	15.2 (3.3)	15.3 (4.0)	.88

[a]- The terms High and Low Norm refer to the manipulated message that participants received and not actual intakes.

[b]- Calculated based on self-reported height and weight

Repeated measures ANOVA was used to examine difference in self-reported FV intake by group from baseline to one week. The group by time interaction was statistically significant indicating that mean self-reported FV intake differed by group assignment over time (df=3, F=2.89, p=0.037, partial η^2=0.049). Those in the Low Norm group reported a half-cup increase in FV after they were provided with the email message (df=1, F=4.95, p=0.032, η^2=0.11). However, the only significant mean difference in reported FV intake between groups was between the Low and High Norm groups (p=0.035). The mean difference in reported FV intake between the Low and control or recommendation group was not significant, although the mean difference was borderline significant between Low Norm and Recommendation (p=0.086). Using a repeated measures test, no significant differences were reported over time and by group for all fruits (df=3, F= 1.46, p=0.23, partial η^2=0.026) or all vegetables (df=3, F=1.99, p=0.12, partial η^2=0.034).

Repeated measures ANOVA was also used to examine changes in participant's perception of peers' intake by group over time (df=3, F=12.32, p=<0.001, partial η^2=0.19, figure 3-1). There was a significant change over time for participants in the Low Norm group and the control group, with those in the Low Norm reporting a 1-cup increase in their perception of their peer's intake over time (df=1, F=44.38, p=<0.001, η^2=0.52, figure 3-2) and those in the control group reporting a 0.3-cup increase over time (df=1, F=7.392, p=0.010, η^2=0.16). There was no significant change in perceived peer FV intake for participants in the Recommendation and High Norm groups after receiving the intervention message. The only significant mean difference in reported perception of FV

between groups was between the Low and Recommendation groups (p=0.032). The mean differences between the Low Norm group and Control and High Norm were both borderline significant (p=0.061 and 0.84). The group by time interaction was also significant for fruit and vegetable intake when examined independently of the other (df=3, F=9.12 and 9.89 respectively, p=<0.001, partial η^2=0.14 and 0.015 respectively). Participants in the Low Norm group reported a half-cup increase in perception of peers' fruit intake and vegetable intake.

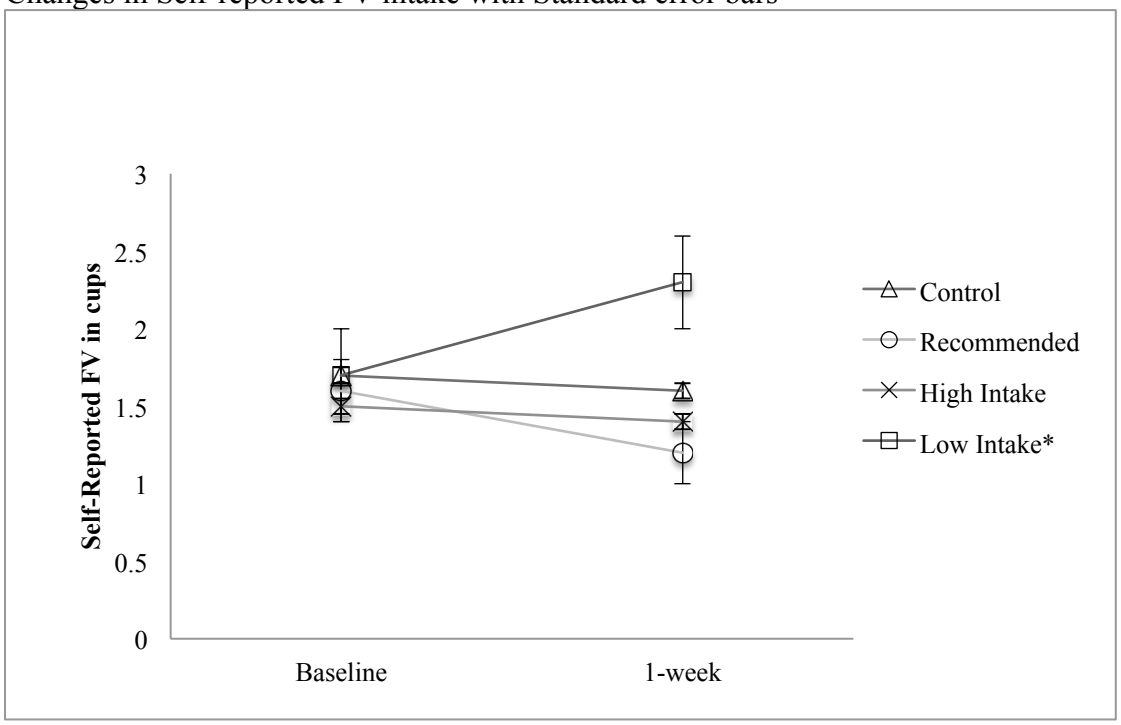
Table 3-2. Changes in Self-report and Perception of Participants Completing Both Surveys

N=167	Control		Recommendation		High Norm[a]		Low Norm[a]	
In cups (SD)	Baseline	1-week	Baseline	1-week	Baseline	1-week	Baseline	1-week
Self-report F/V intake	1.7 (1.4)	1.6 (1.3)	1.6 (1.5)	1.5 (1.2)	1.5(1.2)	1.4 (1.0)	1.7 (1.3)	2.3 (2.1)*
Self-report Fruit intake	0.8 (1.0)	0.7 (1.0)	0.8 (1.2)	0.7 (0.8)	0.7 (1.0)	0.6 (0.6)	0.8 (1.0)	1.1 (1.4)
Self-report Vegetable intake	0.8 (0.7)	0.8 (0.7)	0.7 (0.6)	0.7 (0.6)	0.7 (0.7)	0.7 (0.6)	0.8 (0.7)	1.1 (1.5)
Perception of peers' F/V intake	0.8 (0.5)	1.0 (0.8)	0.8 (0.8)	0.9 (0.7)	0.8 (0.7)	1.0 (0.8)	0.7 (0.6)	1.6 (1.0)**
Perception of peers' fruit intake	0.5 (0.3)	0.6 (0.4)	0.5 (0.4)	0.6 (0.4)	0.5 (0.4)	0.6 (0.5)	0.4 (0.3)	0.9 (0.5)**
Perception of peers' vegetable intake	0.3 (0.3)	0.4 (0.5)	0.4 (0.5)	0.3 (0.4)	0.4 (0.4)	0.4 (0.5)	0.3 (0.3)	0.7 (0.5)**

*Significance: p=<0.05, ** p=<0.001, ns p=>0.05

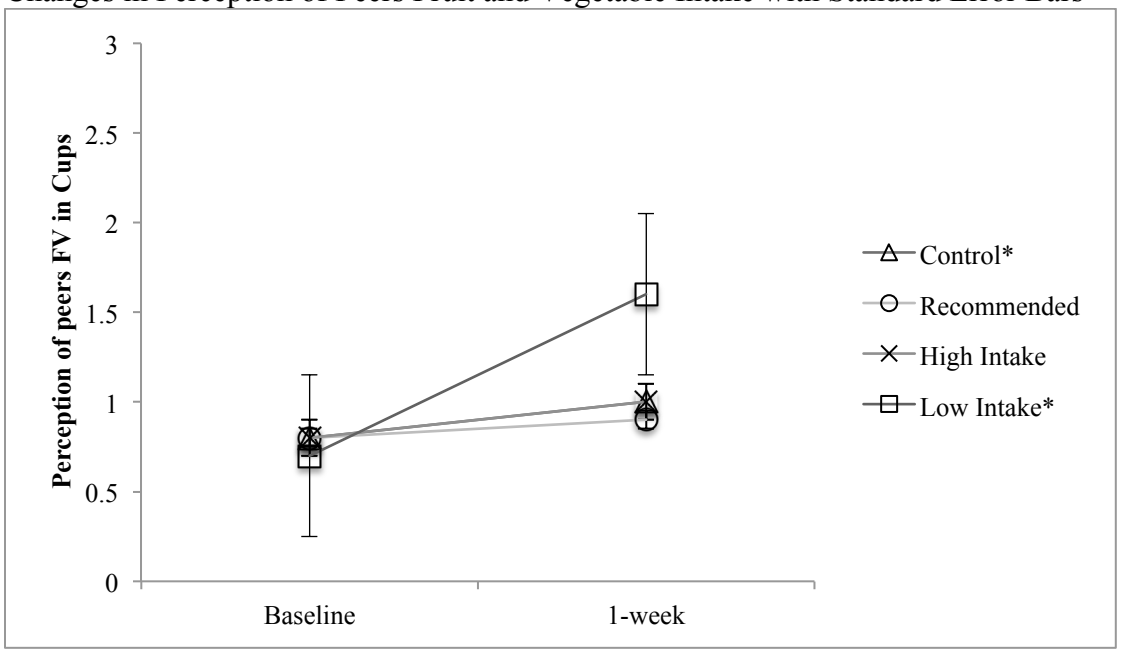
[a]- The terms High and Low Norm refer to the manipulated message that participants received and not actual intakes.

Figure 3-1.
Changes in Self-reported FV intake with Standard error bars



*Significant change over time

Figure 3-2.
Changes in Perception of Peers Fruit and Vegetable Intake with Standard Error Bars



-Estimated means for baseline and 1-week were the same for the control and High Intake groups
*Significant change over time

Discussion

As predicted, those in the Low Norm group were significantly more likely to report higher FV consumption and higher perceived FV intake of their peers on the second survey compared to the first. The effect size for changes in self-reported intake was quite small (partial η^2=0.046). Because of the short time between measures, the observed difference in intake was likely due to social approval bias rather than actual change in behavior. No significant changes in intake or perceived intake of their peers were observed for other groups.

This is the first study to evaluate how normative messages may alter responses on long-term FV measures when actual change is unlikely to have occurred. Few studies have evaluated the effects of social norms on long-term intake of FV (Robinson, 2015). Of these studies, many were over the course of only a week and some used self-report as a measurement of FV intake. For example, Stok et al. (2014a) used a simple, one-item collection method regarding how many days of the prior week participants ate adequate vegetables after receiving a normative message. In another study, Stok et al. (2014b; 2012) used a food journal to measure changes within a week of hearing the message, which may reduce recall bias, but may still be subject to social approval (Schoeller, 1995). Another limitation to these studies is that the length of time measured was only the week or 2 days after receiving a message, so it is difficult to determine if these food behaviors continued over a longer period of time. Some studies have also used intention to eat FV as an outcome measure (Croker, Whitaker, Cooke, & Wardle, 2009; Stok et al., 2012). It is difficult determine what effect intention might have on habitual intake. Only

one social normative message intervention has evaluated long-term change in FV intake using the NCI 19-item FV screener (Wengreen, Nix, & Madden, 2017). However these researchers also used a skin carotenoid score—which is correlated to serum carotenoids and can be used as a biomarker for intake of darkly pigmented FV—as the normative value of interest and to measure approximate changes in intake. Surprisingly, no change was seen on the self-reported measure of FV intake, but a significant increase in skin carotenoids was seen for those told that their carotenoid score was lower than that of their peers.

Miller et al. (2008) delivered just a recommendation FV message, which coincided with significantly higher self –reported FV intakes than those in a control group. The authors speculate that this difference between groups is due to social approval bias as the intervention period was short and the intervention itself minimal. However, participants in our study that were provided with information regarding the recommendation of FV were no more likely to alter self-reported intake than those in the control. More research is needed to determine if a message about recommended intake of FV or similar health prompts may alter self-report.

Likewise, there is concern that social normative messages might have a negative effect on those that meet or are above the average of a desirable behavior. This is of great concern when portraying national statistics of dietary patterns. In reporting health statistics, low descriptive norms are frequently used, such as “Only 5% of Americans get the recommended amount of FV.” This may have a negative effect on the populations’ intake, as observed in a study conducted by Stok et al. (Stok et al., 2012). Stok et al.

observed that those receiving a message indicating that the average consumption of fruit among their peers was relatively low reported lower intentions to eat fruit and lower reported intakes over the next week than those given no message or a message that the average students ate higher amounts of fruit.

We did not observe this effect in our results. Those receiving a message stating that their intake was higher than average did not report higher or lower intakes after receiving the message than those in the control. This may be due to the type of message delivered. Stok et al. (2014a; 2014b; 2012;) delivered a message regarding the overall intake of the population whereas those in our study were provided a personalized message of where they fit within the norm. Schultz et al. (2007) used a similar type of personalized descriptive message for energy use and did observe an increase in energy usage for those below the average to fit more within what is considered normal. This effect disappeared, however, when participants were provided with a combined descriptive and injunctive message.

In this study, we used descriptive normative messages only. Likewise, In other social normative studies, researchers have used primarily descriptive norms when referring to the intake of FV (Croker et al., 2009; Robinson, Fleming, et al., 2014; Robinson et al., 2013; Stok, de Ridder, et al., 2014; Stok et al., 2012; Stok, Verkooijen, et al., 2014). It would be interesting to know how a message that combines descriptive with injunctive norms may alter this effect.

An interesting discovery of the current study is the very low reported perception of peers' intake. Overall, participants underestimated their peers' intake by approximately

one cup. So, although the average participant intake was still well below the recommendations for FV intake, it appears most participants still felt that they consumed more than their peers. This is similar to the findings of Lally at el. (2011) and gives us insight into the perceptions of adolescent and young adults FV intake. This may also explain why students in the High Norm group did not alter their self-reported intake in this study. They received a message that was in line with their perception—that most students ate fewer FV than they did. After receiving the message, those in the Low Norm group reported approximately 1 cup higher in their perception of their peers' intake. This new perception is more in line with the average intake of USU students.

Perhaps one of the reasons that average intake of FV is low among college students is this skewed perspective of the average college students' intake. It is hypothesized that individuals base their FV behavior on what they perceive others are doing (Ball et al., 2010; Cruwys et al., 2015; Jones & Robinson, 2017). Indeed there was a significant correlation between baseline perception and self-reported intake in our sample. Presenting normative messages correcting the perception of college students' intake may correlate to increases in self-reported or actual FV intake. The use of the manipulation message makes it impossible to determine if the presentation of actual norms for FV behavior may have an effect on perception of peers' intake.

Limitations

One of the primary limitations to this study is that the observed results may not be generalizable to different populations or different FV intake measures. Our population was predominantly European American college students. We therefore cannot make inferences regarding the same effects on communities with diverse ethnic backgrounds or young adults that are not college students. Similarly, we only used one measurement of long-term dietary intake, the 19-item NCI FV screener. This study may provide valuable information to researchers on the effects of normative messages on self-reported data, but it is unknown whether this same effect would be seen with other assessment measurements of intake. The FV screener is used to assess average estimated intakes of food and therefore may not be as precise as food diaries and 24-hour recall assessments. The screener relies on estimation skills and memory recall, which may be more susceptible to bias than other measures (Hebert et al., 1995; Kristal, Shattuck, Henry, & Fowler, 1990; Schoeller, 1995).

We did not include a scale for social approval bias or social desirability. Social approval scores were not associated with higher intakes of FV in the study conducted by Herbert et al (Hébert et al., 2001). However, it's possible that those with higher scores on the approval bias survey may be more like to report changes in self-reported FV intake after receiving a normative message.

We also did not include questions regarding the believability of the message in this study or if they had any suspicions of the true nature of the study. These factors may influence changes in perception or self-reported intake. If the participant does not believe

the message, it may be less likely that they will report any change. Future studies may include these measures as a moderating effect of normative research.

We did not achieve the amount of participants per group that we had hoped for and thus we had less power than anticipated to observe the hypothesized effects. Therefore, the results from this study should be interpreted with caution. Students were recruited on a volunteer basis and were informed that the purpose of the study was to evaluate factors that influence FV intake in college students. We may therefore have self-selection bias in our sample. Students more willing to participate in research or those more interested in improving FV behaviors may have been more likely to complete the first survey.

Lastly, it is possible, though unlikely, that the changes reported were actual changes. We suspect that this is not the case, as participants had little time for actual change after receiving the normative message. In order to see an average daily half-cup increase on the monthly FV screener, participants would have to report an increase of approximately 15 cups over the course of the month. It is unlikely that participants could have achieved this change over the course of the three days after receiving the message and taking the screener for a second time.

Implications for Research and Practice

In this study, we have determined that accuracy of self-reported FV might be influenced by normative messages informing a student that their intake is lower than that of their peers. These same participants reported a significant increase in perception of their peers' intake as well. With the emergence of social normative research on dietary

behaviors, it is important to consider what biases might influence self-reported FV intake. More research is needed in larger populations and using varying types of assessment measures in order to determine the appropriate way to measure habitual FV intake in normative interventions.

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CHAPTER IV

REPEATED PEER MODELING OF VEGETABLE EATING HAD NO EFFECT ON LONG-TERM FRUIT AND VEGETABLE INTAKE OF COLLEGE STUDENTS IN A GENERAL NUTRITION COURSE

Abstract

Objective: To determine if repeated exposure to peers eating vegetables increased long-term FV intake in college students

Methods: 4 sections of an introductory nutrition course were randomly assigned to either the control or treatment group—8 weeks of exposure to peer models eating vegetables. All participants were asked to take a survey, including demographics and FV intake at baseline and 8 weeks. Changes in FV and perception of peer FV were evaluated using a repeated-measures model.

Results: Participants (N=120) had a mean age of 20.1 years, were 90% white and 73% female. There was no change over time for total FV. Those in the treatment group demonstrated a 0.22 cup/day increase in perception of peer intake over time, possibly due to significant differences at baseline.

Conclusion and Implications: Those exposed to repeated peer models eating vegetables were no more likely to increase FV intake than those in control sections.

Introduction

College is a time for young adults to begin making their own dietary decisions and building adult eating habits[1–3]. Unfortunately, many young adults do not always use this time to develop healthy habits. Instead, many young adults participate in risky health behaviors such as eating too many foods that are high in added fat and sugar and not enough fruits and vegetables (FV)[3]. Most college students report eating about 1.5 cups of FV per day [4], which is well below the recommendation of 4-5 cups per day established by the United States Department of Agriculture (USDA)[5]. Meeting the recommendation for FV, as part of a healthy dietary pattern, has been associated with a reduced risk for all cause mortality, obesity, heart disease, type II diabetes and Alzheimer's disease[6–9]

Most people believe it is important to get enough FV[10,11]. However, that importance does not necessarily predict actual intake[12]. In addition, it appears common for young adults to perceive others to eat healthy foods including FV less frequently than they actually do[13,14]. Misperceptions of the eating behaviors of their peer's may negatively influence the eating behavior of young adults as these individuals might justify their lower-than-recommendation intakes, as long as they are still consuming more than they perceive others to be eating[15]. Correcting these misperceptions may lead to increases in individual intakes of FV.

One way to influence this perception may be to use a peer model to demonstrate a healthy behavior such as high FV intake. There is substantial evidence to suggest that participants match the amount they eat with the amount eaten by a peer model[16].

However, many of the peer model studies evaluate the intake of unhealthy snack foods, such as popcorn, candy or cookies[17–22].

Fewer peer modeling studies have evaluated how peer models influence individual's intakes of healthful foods[19,20,23–25]. A study by Hermanes et al., demonstrates that young adult women ate more carrots, when paired with a peer model who eats more of this food[24]. Some researchers have also demonstrated that peer modeling can influence an individual's choice of food, choosing healthier snack bars or veggies over more energy-dense alternatives[20,23,25] However, many of these studies focus on a single exposure of peer modeling and a staged eating occasion. Other studies in young children demonstrate that repeated exposures to peer modeling of the desired behavior is an effective way to influence dietary behaviors[26–29] , but no study has examined this effect among adults. In addition, less is known how repeated exposures to peer modeling might affect long-term intakes of FV among young adults.

No study to date has evaluated changes in long-term FV intake in college students with repeated exposure to a peer model eating vegetables. In this study, we evaluated how a peer model eating vegetables during a weekly class affected long-term FV intake in college students attending a university in the United States.

Methods

Participants

The study went through a full review and was approved by the Institutional Review Board. Participants were recruited from four sections of an in-class, undergraduate general nutrition course in the Spring 2017 semester. Participants had to

be 18 or older. Students were invited to participate through an in-class announcement as well as an announcement through the course's online classroom platform. Students were offered 10 points extra credit, which accounted for 1% of the total points of the course. Students in the class were offered other opportunities for extra credit should they decide not to participate in the study. To observe a half-cup increase in FV intake at a power of 80% and a significance level of 0.05, we determined that we would need 80 participants per group. All 455 students enrolled in the course were invited to participate. Of those, 194 participated at baseline (43%) and 120 of those participants participated post-intervention (62%).

Procedures

Participants were asked to complete a survey assessing average FV intake at baseline and in eight weeks time. At baseline, the four sections of the course were randomly assigned the treatment or the control group with two sections in each group. Over the course of the eight weeks, participants in the treatment course section were exposed to peer models eating vegetables during class time. Classes met once per week for 75 minutes.

Peer models were students in the undergraduate dietetics and psychology courses. All peer models were recruited on a volunteer basis. All models were told the purpose of the study and were provided with vegetables, such as carrots, cucumbers, bell peppers, celery and cherry tomatoes to eat each week in class. We hoped to have 10-15 peer models per treatment section leading to a 1:10 peer model to student ratio. Only 7-8 peer models went to each treatment section during the eight-week period, which is slightly less

than anticipated. However, average attendance to the course was also less than anticipated—approximately half of enrolled students attending each class period—leading to a similar peer model to student ratio.

Peer models were instructed to eat the vegetable snack in full view of other students at various time periods throughout the class. If students in the course asked about this behavior, peer models were instructed to answer without revealing the nature of the study. No peer model reported being asked about their behavior.

Instruments

The link to the consent form and baseline survey was available through the online announcement and could be taken on any computer. The post-intervention survey was emailed to students using the email provided at baseline. The baseline survey consisted of questions regarding basic demographics such as age, race, sex, height, weight and year in school. Both the baseline and post-intervention surveys contained a validated FV screener from the National Cancer Institute (NCI)[30–33]. This 19-item questionnaire asks about the frequency of 10 FV items and the amount consumed each time this FV was eaten. For example, for "In the last month, how often did you eat fruit?" with answers ranging from never to 5 or more times per day. These were followed by an amount question based on average serving sizes of that fruit or vegetable. Each survey also had two questions that asked participants to estimate the amount of FV that the average university student gets each day. On the final survey, students were asked if they noticed any unusual behavior of classmates. This was done to determine if participants were knowledgeable of the purpose of the study. No student guessed the true nature of the study.

Students were asked about their attendance to the course in order to determine exposure to the treatment. We then classified these into regular attendance, inconsistent attendance, or low/no attendance. Those in the regular attendance group responded that they missed 1-2 classes during the 12 weeks of the semester. Those in the inconsistent attendance group reported they missed 3-5 or 6-8 classes of the 12. Those in the low attendance group reported only going to class 1-3 times, stopped coming to class after the first few weeks or did not attend at all.

Data Analysis

Total FV intake was calculated into cups per day based on responses to the 19-item FV questionnaire. Frequencies were calculated from monthly frequency to daily, i.e. once a week was calculated to be a frequency of 0.14. These frequency variables were then multiplied by the amount specified, which differed by food group. Total perception of peers' intake was also calculated into cups per day by approximating each serving to be a half cup and adding the cup per day each of fruits and vegetables. Each of these values was analyzed using a general linear repeated-measures model. A significance level of $p=0.05$ was used to determine time by group interactions for FV intake and perception of peers FV intake.

Results

A total of 120 students participated in all parts of the study and were included in the final analysis. Participants were predominantly female (73%) and white (90%). Participants had a mean age of 20.1 (SD=3.2) years. Students had an average BMI of

23.3 (SD=3.9). Total FV intake was 1.9 (SD=1.8) cups per day for all participating students at baseline. The perceived FV intake of peers was 0.8 (SD=0.6) cups per day. Perception of peers' intake was significantly lower than the average FV intake (M=0.8 and 1.9 respectively, t=7.8, p=<0.001). However, total FV intake was correlated to perception of peers' intake using Pearson correlation coefficient (0.20, p=<0.007).

Participants in each of the groups did not statistically differ from each other in BMI, total FV intake, sex or race (see table 4-1). Those in the treatment group had a significantly higher age than those in the control (p=0.03). When dropouts were included in the analysis, there was no significant difference between groups for perception of peers' intake (p=0.09). However, when we excluded those who dropped out, there was a significant difference between those in the treatment and control group (0.7 and 0.9 cups respectively, df=1, F=4.56, p=0.04), with the treatment group having a slightly lower perception of peers' FV intake. Those who dropped out of the study by not completing the second survey did not differ significantly than those in the control group, but did differ in age from the treatment group.

Table 4-1. Descriptive demographics

N=190	Treatment (n=59)	Control (n=63)	Dropout (n=68)	P-value[a]
Female	45	48	45	0.33
Mean age (SD)	21.0 (5.1)	19.8 (1.9)	19.6 (1.5)	0.03*
Race				
-White	53	57	61	
-Pacific Islander	1	0	0	
-Asian	1	4	0	0.11
-Latino	2	1	4	
-Native American	0	1	1	
-African American	2	0	0	
BMI (kg/m^2)[b]	23.3 (3.8)	23.0 (3.9)	23.6 (4.0)	0.62
Baseline FV[c]	1.9 (1.7)	1.8 (1.4)	1.9 (2.1)	0.83
Perception of peer's FV intake[c]	0.7 (0.6)	0.9 (0.7)	0.8 (0.6)	0.09**

SD, standard deviation
BMI, body mass index
FV, fruit and vegetable
[a]One-way ANOVA used to determine between group differences
[b]Calculated from self-reported height and weight
[c]Expressed as cups/day
*Those in treatment group were significantly higher than those in control and those that dropped out
**Although there was no significant difference when all groups were considered, there was a significant difference between those in the treatment and control group (p=0.03), with those in the treatment group having a slightly lower perception of peers' FV.

The two variables in which the treatment and control group were statistically different from each other—age and perception of peers intake—were not correlated (Pearson correlation=-0.13, p=0.17). We do not therefore draw any conclusions that these differences somehow affected each other.

There was no significant time by group interaction for total FV intake (df=1, F=1.5, p=0.70, partial eta square=0.001), indicating that those in the treatment group

were no more likely to alter FV intake than those in the control group. There was a significant time by group interaction for perception of peers' intake of FV (df=1, F=4.29, p=0.04, partial eta square=0.034), though the effect was quite small (see table 4-2).

Table 4-2. Mean FV intake over time

	Treatment (n=59)		Control (n=63)	
	Baseline	8-week	Baseline	8-week
Total FV intake[a]	1.9 (1.7)	1.7 (1.2)	1.8 (1.4)	1.7 (1.3)
Perception of peer FV intake[a]	0.7 (0.6)	0.9 (0.7)*	0.9 (0.7)	0.9 (0.6)

FV, fruit and vegetable
[a]Expressed as cups/day
*Significant time by group interaction and change over time, using repeated measures general linear model

These effects were not moderated by attendance to class (df=2, F=0.53, p=0.59). Of the 121 students, 61 reported attending regularly, 38 reported inconsistent attendance, and 22 reported low/no attendance. These results should be interpreted with caution, as we did not calculate sample size in adequate power for this sub-analysis and the numbers in each group were inconsistent.

Discussion

To our knowledge, this is the first study to evaluate the effect of repeated peer modeling on long-term FV intake in college students. There have been several studies aimed at evaluating the effect of peer modeling on immediate food choice in college students, but none have looked at the effect of peer modeling in a naturalistic setting where food was not immediately presented. There have also been studies evaluating the

effect of repeated exposure to a peer model, but these have been done primarily in elementary aged children. Overall, we saw no change in self-reported FV intake. We saw a small, but significant increase in perception of peers' intakes for those in the treatment sections. However, we suspect this was due to a significant difference between groups at baseline. We had expected to see increases in total vegetable intake for those in the treatment group sections. However this was not the case. There are several possible explanations for this.

Firstly, students may not have noticed the behavior of their peers. Students in the class may have been focused on the course content and therefore may not have been paying attention to the peer models. Indeed, no student guessed the true purpose of the study based on our question regarding unusual class behavior leading us to believe that students may not have given other students in the class enough attention to have had an influence. Attendance was also not mandatory for the course, so it is also possible that students did not notice behavior because they weren't in class to see it. Based on our questions regarding attendance, approximately half of the participants reported attending regularly.

It is also possible that seeing other students eating vegetables does not have an impact on long-term FV intake. Those that have conducted peer-modeling studies with healthy food intake as an outcome measure have had small or inconsistent results[23,24,34,35]. Repeated exposure to peer models eating healthy foods has been done in an elementary school-based program with moderate success. Some of these programs included peer modeling as one aspect of a multi-component intervention. For example, the Food Dudes

programs typically offer small, non-food rewards for trying new FV[27–29]. It's possible that the peer modeling had less of an effect than the incentives in these programs. It is also possible that elementary students are still forming opinions regarding food likes and dislikes. College students may feel more certain in their food choices and may be less likely to be influenced by the behavior of their peers.

There was a significant difference at baseline between students' perception of their peers' intakes and report of their own intake. Students reported average intakes for their peers to be over a cup below their own intake. This is consistent with other studies conducted in this population[14]. Correcting this misperception may lead to increases in individual FV intake. However, it is difficult to know how to correct this misperception. Students in our treatment group did report an increase in perception. However, means for the treatment group at 8 weeks were no different from those in the control group and were unlikely to be due to the intervention. It is unknown why those in the treatment group had a statistically lower perception of peers' intake than those in the control at baseline.

Limitations

There are some limitations to the current study that should be mentioned. Firstly, as mentioned, attendance was not required. Nearly half of participants reported having inconsistent or low/no attendance. It is difficult to determine whether attendance and exposure may have had an effect on the treatment, as there is not significant power for this sub-analysis. Likewise, due to the distracted nature of the classroom setting, it may have been less likely for students to notice others' behavior.

Secondly, the current study uses self-reported data to measure the success of the intervention. Although the NCI FV screener has been previously validated, it is unknown if this screener adequately measures change in an individual. It's possible that the FV screener is not sensitive enough to pick up changes in an individual. For example, researchers Peterson et al. evaluated the correlations between changes in serum carotenoid and changes in FV intake as reported by the NCI screener after a behavioral intervention. These researchers found that there was no correlation between changes in FV intake and serum carotenoids. It is possible that other factors can influence serum carotenoids. However it is also possible that the NCI screener, while useful for measuring population means, may not be able to pick up changes in individual intakes. Similarly, in a study evaluating the effects of a normative message on skin carotenoids and self-reported FV intake using the same screener[36], no change was observed in the self-reported intake when students were told they were below the average. However, there was a significant increase in skin carotenoid measures in the group told that they were lower than average. The use of 24-hour recalls or serum or skin carotenoids in this study would have aided our evaluation of changes in FV intake.

Additionally, our treatment and control group differed at baseline in two variables; age and perception of peers' intake. Our treatment group was older and had a lower perception of peers' intakes at baseline. We do not know the reason for this difference between groups. The two variables were not correlated, indicating that those of a higher age were not more likely to report lower perceptions of student FV intake.

Conclusion

The current study evaluated the effect of repeated exposure peer modeling of eating vegetable on self-reported FV intake in college students. Multiple exposures to their peer's eating vegetables in a classroom setting did not influence the self-reported intake over a 8-week period of time. It is possible that this is due to limitations in the study design. However, it is also possible that peer modeling of eating vegetables may be unlikely to affect college students' intake. The behavior of eating vegetables is complex and may have been more strongly influenced by other factors such as the cost and availability of FV, time constraints and personal preferences. Future work may evaluate how peer modeling might work best in conjunction with other intervention strategies, such as FV promotion in dining halls or educational lessons. Additionally, a study in which the behavior of the peer model is more visible to participants may lead to better increases over time. Lastly, the assessment method used may not be sensitive enough to capture long-term changes. Measures such as 24-hour recalls or skin carotenoids might be more sensitive to individual change.

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CHAPTER V

THE EFFECT OF PERSONALIZED DESCRIPTIVE AND INJUNCTIVE NORMATIVE MESSAGES REGARDING SKIN CAROTENOIDS ON FRUIT AND VEGETABLE CONSUMPTION AND SKIN CAROTENOID MEASURES

Abstract

Introduction: College students do not eat the recommended amounts of fruits and vegetables (FV) and often perceive their peers to consumer low amounts of FV. The objective of this study was to examine the influence of providing normative written messages about the average college students FV eating behaviors on perception of peer intake, self-reported FV intake, and carotenoid concentrations—a biomarker of FV—in college students.

Procedures: College students (N=248) were asked to complete a survey including a 19-item FV and a 2-item FV screener, and skin carotenoid scan and were randomly assigned to receive one of two messages. The first message (n=128) included information about carotenoids, the recommendation for FV intake, their carotenoid score and how their score compared with their peers. The second message (n=120) also included an indication of approval/disapproval in the form of ☺, 😐 or ☹, and what their score should be if they consumed the recommendation. Seven weeks after receiving the message, students completed a second survey and skin carotenoid scan.

Results: Students in both groups had a mean increase in carotenoids of 1332 Raman units and FV intake of 0.25 cups/day as measured by the 19-item screener ($p=<0.001$ and 0.03, respectively), but no change for the 2-item questionnaire ($p=0.39$). Students also reported a 0.42 cups/day increase in their perception of their peers' FV intake ($p=<0.001$, $\eta^2=0.22$). There was no time by group interaction for carotenoid concentration, self-reported FV intake, or perception of peers' intake ($p=0.63$, 0.23, 0.75, respectively).

Conclusion: Providing a normative message regarding skin carotenoid scores, with or without approval/disapproval information, was successful at improving both carotenoid concentrations and FV intake though the effects were small (η^2=0.063 and η^2=0.02). Future research may use these types of messages in conjunction with interventions that address other factors influencing FV intake in college students.

Introduction

College is a time for young adults to make their own choices and develop life-long adult habits. However, many college students do not establish healthy habits during these formative years (Butler, Black, Blue, & Gretebeck, 2004; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). For example, the average college student eats only 1.5 cups of fruits and vegetables (FV) per day falling far short of the United States Department of Agriculture (USDA) recommendation of 4-5 cups per day ("2015-2020 Dietary Guidelines for Americans | Center for Nutrition Policy and Promotion," n.d.; Powell, Zhao, & Wang, 2009).

One possible influence on college students' FV intake is their perception of their peers' intake of FV (Ball, Jeffery, Abbott, McNaughton, & Crawford, 2010; Jones & Robinson, 2017; Pelletier, Graham, & Laska, 2014). If students perceive their peers to eat few FV they may feel justified in their own behavior to eat fewer than the recommendation. Indeed, research has demonstrated that adolescents and young adults might perceive average intakes of FV in this population to be significantly lower than they actually are (Lally, Bartle, & Wardle, 2011; Nix & Wengreen, 2017).

It is possible that correcting students' perceptions about their peers' health behavior might alter their personal behavior (Borsari & Carey, 2003; Lee, Geisner, Lewis, Neighbors, & Larimer, 2007). One way to alter the perception of FV intake may be through the use of normative messages—messages that describe typical behaviors or attitudes of peers. Researchers have utilized social normative messaging to influence

college drinking (Lee et al., 2007; Lewis & Neighbors, 2006) and energy and water usage (Schultz et al., 2016; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007).

Researchers have also attempted to alter FV intake in college students by providing messages regarding the FV intake of their peers. The results of the studies that use normative messages to change FV intake in college have been inconsistent and many depend on self-reported measures that may be biased by the message provided. Stok et al. (2014) observed a short-term increase in self-reported FV intake when presenting participants with a message that most students met recommendations, specifically with those who identified highly with other students from Utrecht university, where the study took place. Robinson et al. (2014) found that low FV consumers were more likely to choose FV from a buffet selection when exposed to normative messages that college students regularly eat FV rather than a message providing information that eating more FV is good for your health.

Normative messages can be either injunctive or descriptive (Chung & Rimal, 2016; Rimal & Lapinski, 2015; Schultz et al., 2007). Injunctive messages typically state what a population approves of. Descriptive messages portray what the population is actually doing. Descriptive messages have generally been shown to be more effective than injunctive messages at altering dietary behaviors for which the average person complies with the recommended intake, but may not be effective at altering dietary behaviors for which the average person consumes less than the recommended amount; such is the case with FV intake. (Stok, de Ridder, et al., 2014). Researchers have used a false normative message to increase college student FV intake (Stok, de Ridder, et al.,

2014; Stok et al., 2012; Stok, Verkooijen, et al., 2014; Wengreen, Nix, & Madden, 2017). However, as a wider public health intervention, this may not be ethical (Thomas & Miller, 2017). Another possible way to increase FV intake while still providing a truthful normative message is to use a combination of descriptive and injunctive norms. This method exploits not only the actual norm of a group, but also whether the group feels this is good or bad. This method has not been used in any previous dietary intervention, but has been shown to be successful in both energy and water usage studies (Costa & Kahn, 2013; Schultz et al., 2016, 2007) and college drinking studies (Lee et al., 2007).

Most of the previously mentioned studies utilize a social normative message that refers to intakes of the population as a whole. Personalized normative messages have been utilized in energy and water conservation studies with great success (Schultz et al., 2016, 2007). In a previous study by our group, we used a personalized normative message that did not lead to increased FV intake in our study population (Nix & Wengreen, 2017; Wengreen et al., 2017). It is possible that including an injunctive norm as part of a personalized norm might be more successful at increasing FV intake. There have been no studies evaluating the difference between population-based or personalized normative messages in the same population with the same outcome measure.

A problem that arises when measuring changes in FV in a social norms intervention is the reliability of self-reported intakes. Self-reported intakes have been shown to be biased in many research studies. We found this to be true when delivering a social normative message about FV intake. Those that were told they were below the average FV intakes—regardless of the truth of this message—reported a half-cup per day

increase in FV intake (Nix & Wengreen, 2017). Researchers Miller et al. (2008) found a similar bias in their study. Those receiving a textual prompt regarding the health benefits of FV were more likely to report higher intakes of FV than those not given this message. Miller et al., hypothesized that the changes seen in their study were due to bias rather than actual changes due to the minimal nature of the intervention (Miller et al., 2008).

To exclude the effects of unreliable self-reporting, it is best to find an objective measure of dietary intake. Carotenoids are compounds that are not made by the body and, therefore, concentrations can only come from an exogenous source. As a result, carotenoids have become a way to objectively measure FV intake. Serum carotenoids are often used in validation studies (Greene et al., 2008; Resnicow et al., 2000). However, measuring serum carotenoids is an invasive and costly procedure. Recently developed methods use resonance Raman spectroscopy to measure carotenoids in the skin. Skin carotenoids have been shown to correlate to serum carotenoids and, through feeding trials, have been shown to effectively measure changes in FV intake (Aguilar, Wengreen, Lefevre, Madden, & Gast, 2014; Jahns et al., 2014).

Skin carotenoids deplete more slowly than serum carotenoids (Jahns et al., 2014). This indicates that skin carotenoids might be a reliable option to measure long-term intakes of FV, as temporary changes in the diet are less likely to impact skin carotenoid levels. A previous study conducted by this research team is the only study, to our knowledge, that measured changes in long-term intake in response to a normative

message (Wengreen et al., 2017). More research is needed on how normative messages influence long-term intake using objective methods.

The purpose of this study is to determine the effect of a combination of injunctive and descriptive personalized normative messages on FV intake as determined via skin carotenoids levels, a biomarker of carotenoid containing fruit and vegetables intake, in college students enrolled in an organic chemistry class.

Methods

Participants

The Institutional Review Board at Utah State University (USU) approved the study and participants were required to complete a consent form before participating in the study. Participants were recruited from an undergraduate Organic Chemistry lab. All students over the age of 18 were invited to participate in the study. Students were given 5 points extra credit for participation in all aspects of the study. No credit was given for partial participation. Students were invited to participate via an announcement on the course's learning management system (Canvas). A link to the baseline survey was available through this announcement. Students were required to complete the consent form before being directed to the survey.

Based on data from a previous study with USU students, we determined that in order to see a 5,000 unit increase in skin carotenoid levels, with 80% power and a significance level of 0.05, we would need approximately 80 participants per group in each of the two groups or 160 total participants. Each student was randomly assigned by the flip of a coin to either the descriptive only group or the combination group who

received both a descriptive and injunctive message. Of the 342 students enrolled in the course, 278 students (81%) completed the initial survey and carotenoid scan and 248 of those students completed the second survey and scan for an approximate 88% retention rate.

Procedures

Participants were asked to complete a survey and obtain a baseline carotenoid scan at the beginning of the semester and to complete a second survey and scan 7 weeks later. A link to the baseline survey was provided in the online announcement for the study. Carotenoid scans were conducted during regularly scheduled lab sections when students had spare time. Students were asked to complete the online survey, including consent, prior to getting hands scanned, as we did not want skin carotenoid measures to influence self-reported intake of FV.

The scanners were located in a room between the two teaching labs used by the course. The study was announced and explained in person at the beginning of each lab section, and students were invited to have their hand scanned at any point when they were not busy with lab work. Students had their hand scanned on one of two scanner units. Each student was scanned twice to ensure reliability. If the two scans were greater than 3,000 units apart, a third scan was taken, as errors between scans should not exceed this amount if scans are performed correctly. An average value was calculated from the two scans that were 3,000 or fewer units apart.

Before a student had his/her hand scanned, they were randomly assigned to one of two treatment groups, where treatment was determined by the message provided.

Students randomized to the descriptive message group (n=142) received a paper handout with information about what carotenoids are, how they can be improved, the student's own carotenoid score, and how that score compared to other USU students. Students randomized to the descriptive/injunctive group (n=136) received a nearly identical message to those in the descriptive message group except that their message including an approval/disapproval message in the form of smiley and frowny face emoticons and the average for students consuming the recommendation of 4-5 cups of FV per day. Full messages are included in the supplemental material.

The second set of data collection occurred 7 weeks after the first data collection and was performed following the same protocol. An email was sent to all participating students with a link to a second survey. Students were asked to take the survey before having their hand scanned for the second time. The scan was completed on the same scanner as their baseline scan to maintain consistency between baseline and post intervention scans. Participants were given their baseline and post-interventions averages as well as a debriefing statement outlining the purpose of the study, which was not fully disclosed at baseline data collection.

Instruments

Survey

The surveys completed at baseline and 7 weeks after the intervention consisted of two validated FV intake screeners. For this study, we used two FV questionnaires. This was done as each questionnaire has strengths and weakness. This was also done to compare changes of self-reported FV intake to skin carotenoids using the two self-

reported measures. The first FV intake screener was the National Cancer institute 19-item FV screener (Resnicow et al., 2000; Thompson et al., 2002). This survey has been validated to assess average FV intake. The survey contains 10 questions regarding the frequency of types of FV consumed and 9 questions regarding the amount of that item typically consumed. For example, "How often did you consume 100% juice over the prior month?" Answers ranged from never to 5 or more times per day. These were followed by a frequency question such as, "When you consumed 100% juice, how much did you typically consume?" Answers for these questions differed based on typical serving sizes of each item. The second FV questionnaire contained only 2 questions—"Approximately how many half-cup servings of fruit (vegetables) do you get each day?" with answers ranging from less than 1 serving per day to 5 servings per day in 1 serving increments (Cappuccio et al., 2003; Peterson et al., 2008; Resnicow et al., 2000). These questions were followed by a nearly identical question assessing participants' perception of their peers' FV intake.

In addition to these questions, the baseline survey also contained questions regarding basic demographic information, such as age, race/ethnicity, sex, height, and weight.

Skin carotenoid concentrations

Skin carotenoid concentrations were measured using the Pharmanex Biophotonic scanner. This scanner has been validated to measure levels of carotenoids in the palm of the hand. Participants were instructed to place the thick part of the palm, below the pinkie finger, on a sensor on the carotenoid scanner. The scanner then emitted a low level of

blue light. Carotenoid compounds absorb this light and reflect back green light that is sensed by the scanner. Each scan takes approximately 30 seconds. Results are reported in Raman units.

Data Analysis

Total FV intake from the two-item questionnaire was calculated into cups per day assuming every 2 servings per day was equivalent to 1 cup of FV. Perception of peer FV intake was calculated in the same way. Total FV intake using the NCI FV screener was calculated according to instructions from the NCI. Each frequency response was converted into daily frequency, which was then multiplied by the cup amount based on the subgroup of FV, i.e. leafy greens, fruit juices, whole fruit, tomato sauce, etc. FV intake, peer intake, and average skin carotenoid concentrations were assessed for normality. Total FV as measured by the NCI screener did not follow a normal distribution and was, therefore, log-transformed. Skin carotenoid concentrations, total FV from the 2-item questionnaire, log-transformed FV intake from the NCI screener, and perception of peer intake were compared over time and between groups using a repeated-measures general linear model. At baseline, we compared total FV intake by either of the two surveys and perception of FV intake to determine any significant difference by using a paired-sample t-test. Correlations between skin carotenoid concentrations and total FV intake—both measures—as well as BMI body mass index were evaluated using a Pearson correlation coefficient (PCC).

Results

Of the 342 students enrolled in the Organic Chemistry course, approximately 73% completed both scans and surveys and were included in the analysis. Participants completing the study were 64% male, 91% white American, and had a mean age of 21.7. At baseline, these participants had a mean BMI of 24.0 kg/m^2, carotenoid concentration of 31946 Raman units, and a mean FV intake of 1.67 cups per day using the NCI screener and 1.17 according to the two-item questionnaire. There was no between group difference on most variables (See table 5-1). There was a significant difference between the two groups on race/ethnicity. However, both groups were predominantly white. Participants reported a significantly lower perception of their peers' intake (0.69 cups/day) than the average intake as measured by either screener ($p=<0.001$, see figure 5-1). Baseline carotenoids were positively associated with FV intake as measured by the two-item and NCI screener (PCC=0.36 and 0.22, $p=<.001$, respectively, see table 5-2). Carotenoid concentrations were also negatively correlated to BMI (PCC=-0.14, $p=0.02$). Self-report FV was weakly positively correlated with perception of peers for the two-item questionnaire (PCC=0.18, $p=<0.01$), but not for the NCI screener (PCC=0.11, $p=<0.08$). Self-reported FV intake as measured by the NCI screener was statistically higher than that measured by the two-item questionnaire ($p=<0.001$).

Table 5-1. Baseline demographics of Participants by group allocation

N=248	Descriptive (n=128)	Combined (n=120)	Significance
% Male	63	65	0.52
Mean age[a]	21.5 (1.9)	21.9 (2.4)	0.146
Race -White -Pacific Islander -Asian -Latino -Native American -African American -Other	 118 1 1 1 1 2 4	 108 0 7 5 0 0 0	0.02*
BMI (kg/m^2)[ab]	24.01 (4.15)	24.02 (3.66)	0.99
Baseline FV NCI[ac]	1.63 (1.42)	1.55 (1.23)	0.64
Baseline FV 2-item[ac]	1.13 (0.87)	1.2 (0.85)	0.49
Perception of peer's FV intake[ac]	0.65 (0.66)	0.72 (0.75)	0.45
Carotenoid Score[a]	31375.00 (10895.33)	32498.62 (10896.05)	0.42

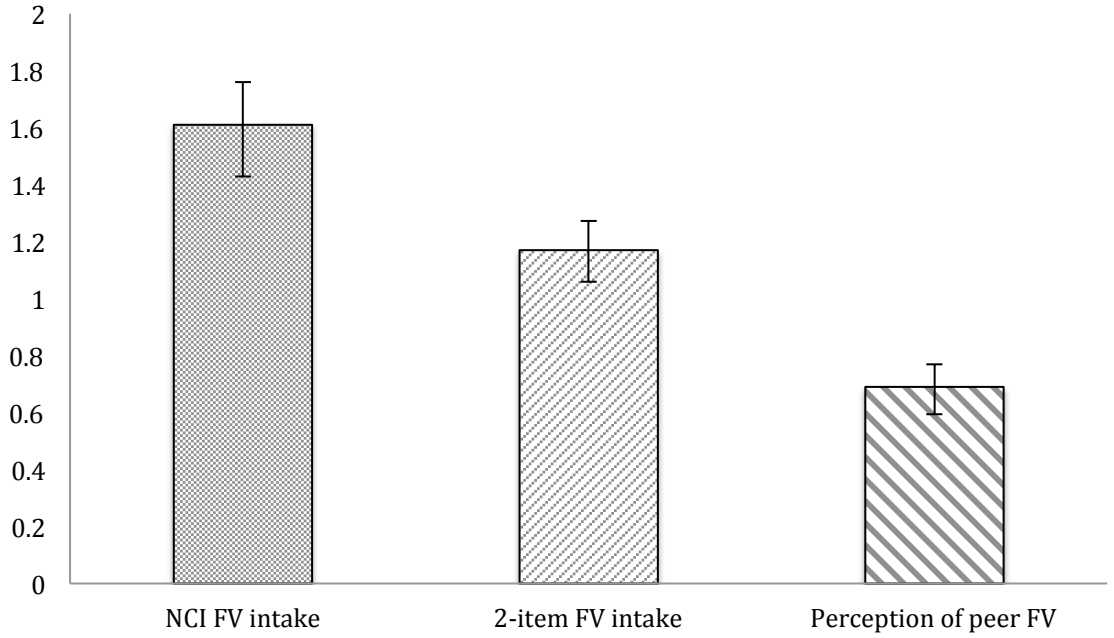
BMI, body mass index
FV, fruit and vegetable
[a-] Expressed as Mean (SD)
[b-]Based on self-reported height and weight
[c-]Expressed as cups/day
*-Significant difference at p=<0.05

Table 5-2. Correlations[a] for skin carotenoids, total FV, and perception of peer intake

	Skin Carotenoid	Total FV NCI	Total FV 2-item	Perception of peer intake
Skin carotenoid	-	0.22**	0.37**	0.07
Total FV NCI	0.22**	-	0.56**	0.11
Total FV 2-item	0.37**	0.56**	-	0.18*

FV, fruit and vegetable
NCI, National Cancer Institute
[a]Pearson correlation coefficient
*Significant, p=<0.01
**Significant, p=<0.001

Figure 5-1. Comparison of two FV screeners and perception of peer intake at baseline, in cups/day



FV, fruit and vegetable
NCI, National Cancer institute
*Each value was statistically different from the other two at baseline, p<0.001

Using a repeated-measures ANOVA, there was no significant time by group interaction for carotenoid concentrations (p=0.63), FV intake measured by NCI (p=0.27), FV intake with two-item questionnaire (p=0.75), and perception of peer intake (p=0.75), indicating that the combined descriptive and injunctive message group was no more likely to increase these variables than the descriptive message only (see table 3). There was, however, a significant change over time for both groups for skin carotenoid concentrations (df=1, F=16.52, p=<.001, η^2=0.063), log-transformed FV as measured by the NCI screener (df=1, F=4.14, p=0.04, η^2=0.02), and perception of peers' intake (df=1,

F=67.73, p=<0.001, η^2=0.22). There was no change over time in self-reported FV intake using the two-item questionnaire (df=1, F=0.73, p=0.39, η^2=0.003).

Table 5-3. Mean (SD) change over time

	Descriptive (n=128)		Combined (n=121)	
	Baseline	7-week	Baseline	7-week
Skin Carotenoid	31,375 (10,895)	32,555 (10,966)**	32,499 (10,896)	33,992 (10,925)**
Total FV NCI[a]	1.62 (1.42)	1.73 (1.98)*	1.55 (1.23)	1.98 (1.73)*
Total FV 2-item[a]	1.13 (0.87)	1.07 (0.81)	1.20 (0.85)	1.18 (0.85)
Perception of peer intake[a]	0.66 (0.66)	1.09 (0.60)**	0.72 (0.75)	1.12 (0.81)**

SD, standard deviation
FV, fruit and vegetable
NCI, National Cancer Institute
[a]Reported in cups per day
*significant, p=0.03
**Signifciant, p=<0.01

Discussion

Both descriptive alone and a combination of descriptive and injunctive normative messages resulted in increases in self-reported FV intake as measured by the NCI FV screener as well as skin carotenoid concentrations over time, though effect size for this increase was small (η^2=0.06 and 0.02, Cohen, 1988). There was no time by group interaction indicating that either message resulted in increases. This partially confirms our hypothesis that those provided with a normative message regarding skin carotenoids might increase FV intake and subsequent carotenoid scores, although we did expect to see this primarily in the combination group rather than the descriptive only group.

To our knowledge, this is the first study to use a combination of descriptive and injunctive normative messages regarding skin carotenoid concentrations to influence FV intake in college students. Many of the previous studies showed a positive effect on FV intake after the presentation of a social normative message (Robinson et al., 2013; Stok, de Ridder, et al., 2014; Stok, Verkooijen, et al., 2014). However, many of these studies evaluated only short-term or immediate food choices and intakes, or used self-reported measures. While we did observe an overall positive effect for both treatment groups, the effect was small (η^2=0.06). A controlled feeding trial conducted by Aguilar et al. (2014) revealed that a juice equivalent of 23g carrots resulted in changes of carotenoid concentrations of 10,000 units, which is much greater than the increases seen in this study. Similarly, in our previous study, a manipulated normative message was more successful at increasing skin carotenoid concentrations over time over those receiving information about the recommendation or an actual descriptive normative message. In that study, those receiving the message that they were lower than average—whether this was true or not—had an average increase of 5,000 Raman units over time (Wengreen et al., 2017). The change over time in the current study was much smaller than observed in this previous study (fewer than 2,000 units). The small magnitude of change observed in the current study may be an indicator of the participant's desire to increase FV intake. It's possible that given a longer interval between carotenoid measures may have resulted in larger increases. However, we cannot know if that is the case.

We did observe a nearly half-cup increase in both groups for perceptions of peers' FV intake. At baseline, participants perceived that their peers consumed approximately

0.7 cups, which is a half-cup (2-item) to a cup (NCI screener) less than the actual averages. This is consistent with a previous study by this group in which participants perceived their peers to eat over a half cup less than the actual average (Nix & Wengreen, 2017). Lally et al. (2011) observed a similar disconnect between actual and perceived FV intakes in adolescents. It is possible that changes in perception observed in this study may encourage students to eat more FV in the future (E. J. Kothe, Mullan, & Butow, 2012).

An interesting observation of the current study is how each of the intake methods correlated, but also differed from each other. FV intakes as measured by either survey differed significantly from each other with over a half-cup more observed on the 19-item FV screener than the 2-item questionnaire. Intakes as measured by either questionnaire were correlated to skin carotenoid measures. However, the 2-item survey had a stronger correlation to carotenoids than the NCI screener. Additionally, changes in FV intake by either screener were not correlated to changes observed in skin carotenoid measures. This is similar to results evaluated by Peterson et al. (2008) who found that changes in serum carotenoids were not correlated to changes reported by the NCI screener, while changes from a 1-item measure did correlate to serum carotenoids in men only. Interestingly, in prior validation studies, 2-item questionnaires have often had lower correlations to serum carotenoids than the NCI screener (Greene et al., 2008; Peterson et al., 2008; Resnicow et al., 2000)

Limitations

We did not have a control group for this intervention. It's possible that the novelty of the skin carotenoid measure itself was responsible for the small increases observed

rather than the normative message. We suspected that having a descriptive only group would provide a control group, as our previous studies using a descriptive only message did not result in increases in carotenoids (Nix & Wengreen, 2015; Wengreen et al., 2017). We suspect that one of the reasons we observed no significant time by group interaction was due to a contamination effect of the intervention. Due to the structure of the course and the location of the data collection, we were unable to completely separate participants. Intervention messages were delivered via paper, giving students the opportunity to compare scores and be exposed to each type of message.

Another limitation to the current study is a lack of generalizability of the population. All participants were University students and most were white American. We do not know if there would be a larger or smaller effect in different ages, socioeconomic statuses, or races and ethnicities. More research is needed in diverse populations to determine the effectiveness of social normative messaging on FV intake.

The use of self-reported FV intake may also be considered a limitation. However, we also included skin carotenoids as a measure of FV intake. The two FV questionnaires used do not specifically ask about carotenoid containing FV. It is possible that participants changed their intake of carotenoid containing FV, but not overall intake, which may explain the lack of results observed using the 2-item questionnaire.

Conclusion

Overall, there was a statistically significant, but small, change over time in skin carotenoids and FV intake as measured by the NCI FV screener for those receiving either

a descriptive only or descriptive plus injunctive normative message. Normative messages may be successful at changes over a 7-week period, though the effect of the observed increase in this study was small. There was a significant half-cup increase in perception of peers' intake. It is possible that this may lead to increases in FV intake over time, as perceived norms are often cited as a predictor of FV intake (Emanuel, McCully, Gallagher, & Updegraff, 2012; E. J. Kothe et al., 2012). It's also possible that other factors may be more influential on the typical college student's FV intake, such as cost, time, or skills. Additionally, normative messages might work well in conjunction with other interventions that address these barriers and facilitators to FV intake in college students (Emily J. Kothe & Mullan, 2014).

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CHAPTER VI

SUMMARY AND CONCLUSION

Summary

There is a significant amount of evidence that people base some of their eating and drinking behaviors on what they perceive others to be doing (Ball, Jeffery, Abbott, McNaughton, & Crawford, 2010; Pelletier, Graham, & Laska, 2014; Robinson, 2015). There is also some evidence that people perceive others to be eating fewer FV than they actually are (Lally, Bartle, & Wardle, 2011; Nix & Wengreen, 2015, 2017). Correcting that misperception may lead people to increase their own FV intake. This can be done by either peer modeling or social normative messaging.

Peer modeling studies consist of a hired peer model who demonstrates the behavior that the researchers want to influence. Peer modeling studies have consistently shown that people eat more snack foods when dining with peer models instructed to eat more of a food (Conger, Conger, Costanzo, Wright, & Matter, 1980; Feeney, Polivy, Pliner, & Sullivan, 2011; Howland, Hunger, & Mann, 2012; McFerran, Dahl, Fitzsimons, & Morales, 2010). There is also evidence that a person will eat more vegetables when paired with a model who eats more vegetables (Hermans, Larsen, Herman, & Engels, 2009). People may even choose a more healthy option when a peer has demonstrated the same healthy behavior (Burger et al., 2010; Prinsen, de Ridder, & de Vet, 2013; Robinson & Higgs, 2013). All the current studies on peer modeling in young adults have been conducted in single settings with the outcome measure of immediate food choice or amount.

Another way to influence FV intake in college students may be through the use of Social normative messages. Several researchers have seen a positive effect in immediate food choice when present students with a message portraying that most of their peers' make healthier choices, such as eating more FV (Robinson, Fleming, & Higgs, 2014; Robinson, Harris, Thomas, Aveyard, & Higgs, 2013; Stok, de Ridder, de Vet, & de Wit, 2014; Stok, Verkooijen, de Ridder, de Wit, & de Vet, 2014). All of the current studies measured intakes over the course of one event or up to a week. None of the studies mentioned above utilized skin carotenoids as an assessment measure. Each of the above studies used normative messages that describe the eating behavior of the group. Our studies (chapters II, III and V) utilized a personalized normative message describing where a person's FV intake or skin carotenoid concentration fit within the distribution of their peers. This method has been used in electricity and water usage studies with much success (Costa & Kahn, 2013; Schultz et al., 2016; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Similar to the energy usage study, we also hypothesized that a personalized normative message accompanied by an approval/disapproval message might be more successful at altering behavior.

For our social normative message studies (chapters II and V), we utilized skin carotenoid concentrations as an outcome measure. We hypothesized that exposure to a social normative message might influence self-reported FV intake regardless of actual change. We tested this hypothesis by providing students with a manipulated normative message—informing them that they were low, regardless of whether this was true or not

—and measuring monthly frequencies both at baseline and immediately after receiving the normative message.

Peer Modeling

Ours is the first study, to our knowledge, that utilizes multiple exposures of peer modeling and measures long-term intake. We hypothesized that those in the treatment sections (n=60) of the nutrition course would be more likely to increase their long-term intakes of FV or vegetables as measured by the NCI FV screener than those in the control group (n=67). This, however, was not the case. Participants in the treatment sections reported no greater change in FV intake after 8 weeks (Mean change [M_c]=-0.18 cups/day) than those in the control (M_c=-0.08 cups/day). We did observe a 0.22 cups/day increase in perception of peer intake for those in the treatment group. However, the treatment group had significantly lower perceptions at baseline. The sensitivity of the FV instrument or the awareness of participants of the modeling behavior may be part of the reason we saw no increase in FV intake. However it is also possible that other factors might be more important to college students eating behaviors such as cost, time, availability and cooking skills.

Bias in self-report

We confirmed our hypothesis that presenting students with a normative message might alter their self-reported intakes when little time was available for change. We observed that those given a manipulated low norm (n=42)—indicating that participant was lower than average, whether this was true or not—reported a 0.6 cup increase of FV

per day after immediately receiving a message, while those told they were higher than average (n=44), given the recommendation (n=41) or given no message (n=40) did not report any changes (p=0.04). Similarly, those in the manipulated low group reported an increase in perception of their peers' intake (M_c=0.98 cups/day), while those in the other groups reported no change in perception (p=0.001). This justifies the need for objective measures of FV intake, such as skin carotenoid concentrations.

Social normative messages

We found overall that personalized normative messages had either no effect or small effects in our study populations of college students. In our first study (N=213), we provided a descriptive personalized normative message such as "Your score is 24,300. This is in the 40th percentile. This means that out of 100 students, 60 scored higher than you". Although we hypothesized that providing this message to college students would result in increases in FV intake and skin carotenoid concentrations, we found this not to be true. Those receiving a personalized normative message (M_c FV=0.20 servings/day and carotenoids=273.8 Raman units) were no more likely to change their intake of FV than those receiving a message that the recommendation is 4-5 cups/day (M_c=0.02 servings/day and 6.3 Raman units), or no information regarding FV recommendations or peers' carotenoid concentrations (M_c =0.29 servings/day and 744.8 Raman units, p=0.71 and 0.83 respectively). We hypothesized that perhaps those that identified most highly with USU students (n=59) would be more likely to increase FV. However, we still found there to be no increase over time for FV or carotenoid measures for those students (p=0.47).

Initially, we aimed to observe if mediators of FV intake—identification as a vegetable eater, attitude toward veggies, and self-efficacy—increased when exposed to a descriptive normative message. However, we found that we did not have the statistical power to evaluate the various means, as we would have to adjust for multiple comparisons. Additionally, we did not observe an overall increase in FV intake, indicating that if these mediators increased, it was not reflected in actual intakes or carotenoid concentrations, thus they would not be mediating any change. There was no significant between-group difference in changes in identification as a FV eater, attitude toward FV or self-efficacy (p=0.86, 0.39 and 0.55, respectively). There was a significant increase over time for identification as a FV eater (p=0.04) for all groups. This may have been a result of the being in a basic nutrition course.

We had suspected that adding in an injunctive norm would result in higher FV intake and skin carotenoid concentrations over time, we found that those receiving a combination of injunctive and descriptive (n=120), were no more likely to change their FV intake (NCI screener p=0.63 and two-item p=0.75) or skin carotenoid scores (p=0.63) than those receiving a descriptive only (n=127). We did observe an increase in skin carotenoid concentrations (M_c=1332.0 Raman units) and FV intake as measured by the NCI screener (M_c=0.25 cups/day) over time for both groups in our final study, although these effects were small (η^2=0.063 and η^2=0.02, respectively). We did not see an increase in FV as measured by the two-item questionnaire. We did observe a significant 0.42 cups per day increase in perception of peers' intake in both groups (p=<0.001, η^2=0.22).

There are several possible factors that may have lead to increases in self-reported FV and skin carotenoids in chapter V, but not chapter II. Each of these studies was conducted in a different setting with a different student population, which can contribute to the differences in effects observed. However, one of the major differences in these two studies was the format of the message provided. In our first study, conducted in the spring semester of 2015, students were provided with an email message regarding their skin carotenoid score and how it compares to other USU students. However, these students were not provided with details of what carotenoid concentrations are, what FV contains carotenoids, and how they can be improved. The messages provided in the study conducted in the Fall 2017 semester included this additional information in order to help students relate diet with skin carotenoid concentrations.

Additionally, students in the final study received a paper copy of the message. This gave students an opportunity to see their score during the process and to compare with peers. We observed that students in the organic chemistry labs were very enthusiastic about skin carotenoids. These students also appeared to be competitive with the other students in the lab and compared results with their peers. This likely exposed them to both messages and may have been one reason that we observed modest effects in the last study, but not the first.

Comparison of USU average and perceptions

In addition to providing evidence regarding the efficacy of social normative messages as a strategy to change dietary behaviors in college students, our studies

provide information regarding perceptions of intakes as compared to average intakes. To evaluate correlations and differences as a whole, we combined all participants (N=678) where FV intake was measured by the NCI screener and perceptions were measured by the two questions of how many fruits and vegetables participants believed USU students ate, with answers in 1 serving intervals. We found that total FV intake was significantly correlated to participant's perception of peers' FV intake (correlation=0.16, p=<0.001).

Prior research in adolescents has demonstrated that students misperceive their peers to be eating less than the actual average (Lally et al., 2011). We found this to be true in our studies as well. When including all cases, we found a statistically significant difference between FV intake and perceived FV intake of their peer's (M=1.75 and 0.74 cups/day, respectively).

In two of the studies included in this dissertation, perceptions increased as a result of the intervention. The theory of planned behavior speculates that perceived norms predict FV intake (Emanuel, McCully, Gallagher, & Updegraff, 2012; Kothe & Mullan, 2014). It's possible that this change in perception may cause an increase in FV intake over the course of time, even if intakes were not changed immediately after the intervention.

Conclusion

Previous research regarding using normative messages and peer modeling have been shown to have generally positive effects (Hermans et al., 2009; Robinson et al.,

2014; Robinson & Higgs, 2013; Stok, de Ridder, et al., 2014; Stok, Verkooijen, et al., 2014). Overall, we observed no effect or small effects by using social normative messaging or peer modeling to influence FV intake in college students. These are also some of the first studies to evaluate the long-term impact of FV intake. Previous studies have evaluated immediate food choices or changes over the course of three days to a week. It's possible that, while effective at changing short-term intakes, there is less of a lasting influence of peer modeling and norms.

We are also the first to study what effect normative messages would have on skin carotenoid measures. This is specifically valuable as we observed a significant increase in self-reported FV intake immediately after receiving a normative message. This may indicate that self-reported FV intake in studies where normative messages are shared with participants should be interpreted with caution and objective measures of FV intake should be used when possible.

The evidence from all included studies suggests that more research is needed to determine if normative messaging is an effective intervention strategy. It is probable that there are many additional factors that influence college student FV intake, such as cost, availability, time, or tastes than with what is considered done by peers (Graham, Pelletier, Neumark-Sztainer, Lust, & Laska, 2013; Larson et al., 2008). It is possible that normative messages and peer modeling may be more effective when food is presented immediately after exposure than measures of long-term behavior after exposure to such norms. This may become useful in studies regarding dining hall food selections, which could be particularly helpful to those who regularly eat in dining halls. Additionally, using social

cues may be more effective when combined with interventions targeting other barriers or facilitators of dietary change, as seen in programs like Food Dudes, in which peer models are part of a multi-faceted intervention. Similarly, studies targeting predictors of FV intake in college students based on the theory of planned behavior may target perceived norms, but also address intentions, perceived control and attitudes (Kothe & Mullan, 2014).

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APPENDICES

Appendix A: SOCIAL NORMATIVE MESSAGES USED IN INTERVENTIONS

Chapter II Email Messages

Control

Dear $%anumber%

Thank you for participating in our study. Our study is evaluating factors that may influence carotenoid levels in young adults. Skin carotenoid levels are an objective measurement of vegetable and fruit intake.

You are in the control group that is not receiving scores at this time, but you will receive your score at the end of the semester when you get your hand scanned for the second time.

We again thank you for participating and hope that you will participate again in April. Without this second scan, we cannot use your information in our study.

Liz Nix BS, RD

Student researcher

Recommendation

Dear $%anumber%

Thank you for participating in our study. Our study is evaluating factors that may influence carotenoid levels in young adults. Skin carotenoid levels are an objective measurement of vegetable and fruit intake. So the more veggies and fruits you eat, the higher your score can be.

Healthy people who eat 5 cups or more of vegetables and fruits per day usually have a score of 40,000 or above. You have a score of $%carotenoidscore%.

We again thank you for participating and hope that you will participate again in April. Without that second scan, we cannot use your information in our study. Have a wonderful day

Liz Nix BS, RD

Student researcher

Descriptive Normative Message

Dear $%anumber%

Thank you for participating in our study. Our study is evaluating factors that may influence carotenoid levels in young adults. Skin carotenoid levels are an objective measurement of vegetable and fruit intake.

Nutirition 1020 students have an average score of **25103**.

Your carotenoid score is $%carotenoidscore%.

Of 100 students, $%above% scored above you on the carotenoid scan and $%below% scored below you.

We again thank you for participating and hope that you will participate again in April. Without this second scan, we cannot use your information in our study.

Liz Nix BS, RD

Student researcher

Chapter III Email Messages

Control

Dear $%anumber%

Thank you for participating in this study!

As I mentioned before this study has two parts. The link to the second survey is provided below. This survey should take less time than the first survey and is necessary if you want to be entered into the drawing. The survey will close Friday evening at 6:30pm.

https://usu.co1.qualtrics.com/SE/?SID=SV_8hVXBc1nn7XnKhT

Liz Nix BS, RD

Student researcher

Recommendation message

Dear $%anumber%

Thank you for participating in this study! Did you know that it is recommended to get at least 4-5 cups of fruits and vegetables per day?

As I mentioned before this study has two parts. The link to the second survey is provided below. This survey should take less time than the first survey and is necessary if you want to be entered into the drawing. The survey will close Friday evening at 6:30pm.

https://usu.co1.qualtrics.com/SE/?SID=SV_8hVXBc1nn7XnKhT

Liz Nix BS, RD

Student researcher

Manipulated High Normative Message

Dear $%anumber%

Thank you for participating in this study! Did you know that it is recommended to get at least 4-5 cups of fruits and vegetables per day? Most USU students seem to know that, but still don't get enough.

Your average intake is in the $%percentile%th percentile of other students at USU. This means that only $%percent above%% of students eat more fruits and vegetables than you do!

As I mentioned before this study has two parts. The link to the second survey is provided below. This survey should take less time than the first survey and is necessary if you want to be entered into the drawing. The survey will close Friday evening at 6:30pm.

https://usu.co1.qualtrics.com/SE/?SID=SV_8hVXBc1nn7XnKhT

Liz Nix BS, RD

Student researcher

Manipulated Low Normative Message

Dear Participant

Thank you for participating in this study! Did you know that it is recommended to get at least 4-5 cups of fruits and vegetables per day?

Your average intake is in the $%percentile%th percentile of other students at USU. This means that $%percent above%% of students eat more fruits and vegetables than you do!

As I mentioned before this study has two parts. The link to the second survey is provided below. This survey should take less time than the first survey and is necessary if you want to be entered into the drawing. The survey will close Friday evening at 6:30pm.

https://usu.co1.qualtrics.com/SE/?SID=SV_8hVXBc1nn7XnKhT

Liz Nix BS, RD

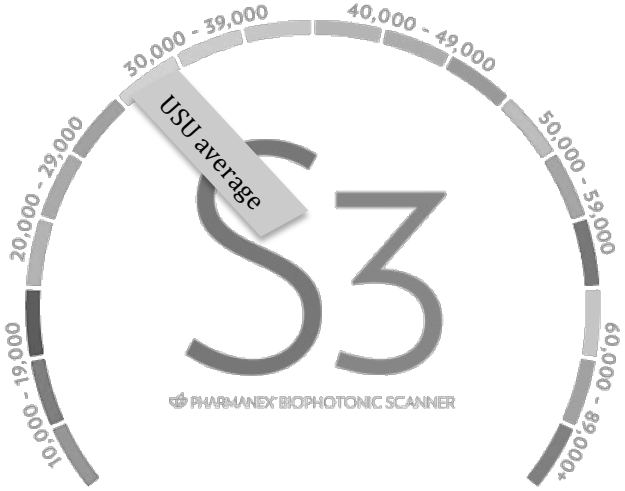
Student researcher

Chapter VI Written Messages

Descriptive Only Message

Thank you for your participation! Skin carotenoid scores are a way to objectively measure fruit and vegetable intake. These scores are affected by the way you eat. Those who eat a lot of darkly pigmented fruits and veggies tend to have higher scores. The USDA recommends eating 4-5 cups of fruits and veggies per day.

Your score is _____ and it is in the _____ percentile. This means that _____ out of 100 students had higher carotenoid scores than you.

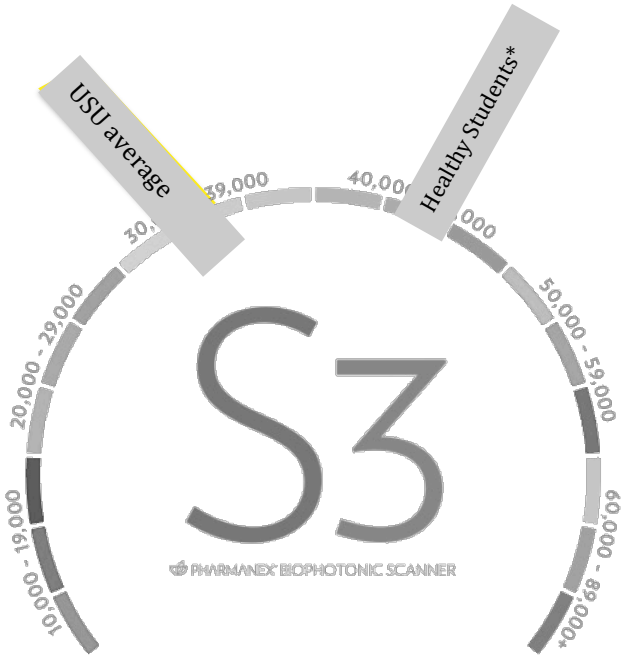


You can increase your score by eating more dark colored fruits and veggies, such as berries, kale, winter squash, tomatoes, peppers, sweet potatoes, carrots, peaches, and cantaloupe.

Combined Descriptive and Injunctive

Thank you for your participation! Skin carotenoid scores are a way to objectively measure fruit and vegetable intake. These scores are affected by the way you eat. Those who eat a lot of darkly pigmented fruits and veggies tend to have higher scores. The USDA recommends eating 4-5 cups of fruits and veggies per day.

Your score is _____ and it is in the ___ percentile. This means that ____ of 100 students had higher carotenoid scores than you.



☺-Outstanding! You're well above average
☺-Good work! You're above average.
😐-You're doing okay. Right about average
☹-Bad news, you're below average

You can increase your score by eating more dark colored fruits and veggies, such as berries, kale, winter squash, tomatoes, peppers, sweet potatoes, carrots, peaches, and cantaloupe.

*-students who get 4-5 cups of fruits and vegies per day

Appendix B: CHAPTER II BASELINE AND POST-INTERVENTION SURVEYS*

Start of Block: Consent Form

Q44 Open the attached file. This document provides information about this study. Please read this document carefully and choose an option below.
Informed consent

- ○ Agree (1)
- ○ Disagree (2)

End of Block: Consent Form

Start of Block: General information

Q1 What is your A #?

_____

Q2 What is your age?

- ○ 18-20 (1)
- ○ 21-22 (2)
- ○ 23-24 (3)
- ○ 25-26 (4)
- ○ Over 26 (5)

Q3 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to disclose (3)

Q5 What is your height?

- ○ Feet (1) _____
- ○ Inches (2) _____

Q6 What is your weight in pounds?

_____

Q7 How many semesters of college have you attended (not including this one)?

_____

Q8 What is your major/college?

- ○ Nutrition, Dietetics and Food Science (1)
- ○ English (2)
- ○ Arts (3)
- ○ Engineering (4)
- ○ Humanities and Social Sciences (5)
- ○ Education (6)
- ○ Business (7)
- ○ Natural Resources (8)
- ○ Agriculture and Applied Science (9)
- ○ Other (10) _____

Q9 What is your cumulative GPA (If you are not sure, estimate to the best of your abilities)?

_____

Q50 What is your reason for taking the Nutrition 1020 course?

- ☐ Part of major (1)
- ☐ Fulfill breadth requirement (2)
- ☐ Interested in Nutrition (3)
- ☐ It sounded like an easy class (this will not affect your grade) (4)
- ☐ Other (5) _____

End of Block: General information

Start of Block: Part 1

Q10 Do you use tobacco products?

- ○ Yes (1)
- ○ No (2)

Skip To: Q13 If Do you use tobacco products? = No

Q62 Do you smoke cigarettes?

- ○ Yes (1)
- ○ No (2)

Skip To: Q63 If Do you smoke cigarettes? = No

Q12 How many packs do you smoke in a week?

- ○ Less than 1 per week (1)
- ○ 1-3 per week (2)
- ○ 4-6 per week (3)
- ○ 1 per day (4)
- ○ More than 1 per day (5)

Q63 Do you use chewing tobacco?

- ○ Yes (1)
- ○ No (2)

Q11 Do you use nicotine-containing electronic cigarettes?

- ○ Yes (1)
- ○ No (2)

Q13 Do you live with a person who smokes?

- ○ Yes (1)
- ○ No (2)

Q14 How often do you perform moderate intensity exercise? (defined by the World Health Organization as a moderate amount of effort that noticeably accelerates the heart rate. Includes: brisk walking, dancing, housework, hunting, gardening)

- Less than once a week (1)
- Once a Week (2)
- 2-3 times a week (3)
- 4-5 times a week (4)
- Daily (5)

Q15 What is the typical duration of moderate exercise per day?

- Less than 30 minutes (1)
- 30-59 minutes (2)
- 60-90 minutes (3)
- Greater than 90 minutes (4)

Q16 How often do you perform vigorous exercise? (Defined by the World Health Organization as a large amount of effort that causes rapid breathing and substantially accelerates the heart rate. Includes: running, climbing hills, aerobics, competitive sports, fast swimming or cycling)

- ○ Less than once a week (1)
- ○ Once a Week (2)
- ○ 2-3 times a week (3)
- ○ 4-5 times a week (4)
- ○ Daily (5)

Q17 What is the typical duration of vigorous exercise per day?

- ○ Less than 30 minutes (1)
- ○ 30-59 minutes (2)
- ○ 60-90 minutes (3)
- ○ Greater than 90 minutes (4)

Q18 In the last week, approximately how much time did you spend outside per day (average)?

- 0-29 minutes (1)
- 30-59 minutes (2)
- 1-2 hours (3)
- 2 hours or more (4)

Q60 In the last week, approximately how much time of the time you spent outside was between the hours of 10am and 4pm?

- 0-29 minutes (1)
- 30-59 minutes (2)
- 1-2 hours (3)
- 2 hours or more (4)

Q19 Have you been sick with a cold, the flu or other bacteria or virus in the past 2 weeks?

- Yes (1)
- No (2)

Q20 Have you been diagnosed with any of the following chronic diseases?

- ☐ Diabetes Mellitus (1)
- ☐ Cancer (2)
- ☐ Celiac disease (3)
- ☐ Asthma (4)
- ☐ Rheumatoid arthritis (5)
- ☐ Other (6) _____
- ☐ None (7)
- ☐ Prefer not to disclose (8)

Q21 Have you used sunless tanning lotion in the past week?

- ○ Yes (1)
- ○ No (2)

Q22 Have you used a tanning bed in the past week?

- ○ Yes (1)
- ○ No (2)

End of Block: Part 1

Start of Block: Part 2

Q23 How often did you consume the following beverages in the last week?

	Never (1)	1 per week (2)	2-4 times per week (3)	5-6 times per week (4)	1 time per day (5)	2-3 Times a day (6)	4 or more times per day (7)
100% orange juice, apple juice or other 100% juice (1)	○	○	○	○	○	○	○
Vegetable juice like V8, carrot, or tomato (2)	○	○	○	○	○	○	○
Fruit flavored drinks and sports drinks like Capri Sun, Sunny Delight, or Powerade (3)	○	○	○	○	○	○	○
Regular soda pop (not diet) or energy drinks like Rockstar, Red Bull or Monster (4)	○	○	○	○	○	○	○
Plain milk (5)	○	○	○	○	○	○	○
Chocolate or other flavored milk (6)	○	○	○	○	○	○	○
Smoothie made with yogurt and fruit (7)	○	○	○	○	○	○	○
Coffee or tea (Regular or decaffeinated). (8)	○	○	○	○	○	○	○

Wine, beer or other alcoholic beverages. (9)	○	○	○	○	○	○	○

End of Block: Part 2

Start of Block: Part 3

Q24 How often did you consume the following foods in the last week?

	Never (1)	1 per week (2)	2-4 times per week (3)	5-6 times per week (4)	1 time per day (5)	2-3 Times a day (6)	4 or more times per day (7)
Potato or tortilla chips either flavored or plain (1)	○	○	○	○	○	○	○
French fries or tater tots (2)	○	○	○	○	○	○	○
Popcorn (3)	○	○	○	○	○	○	○
Pretzels or salty crackers including gold fish crackers, Ritz crackers (4)	○	○	○	○	○	○	○
Graham crackers or animal crackers (5)	○	○	○	○	○	○	○
Candy such as jelly beans, licorice, or gummy bears (6)	○	○	○	○	○	○	○
Chocolate or chocolate candy bars	○	○	○	○	○	○	○

(7)							
Cookies, brownies, pies, cake, doughnuts, or poptarts (8)	○	○	○	○	○	○	○
Popsicles, Slurpees, or shaved ice (9)	○	○	○	○	○	○	○
Ice cream or milkshakes (10)	○	○	○	○	○	○	○

End of Block: Part 3

Start of Block: Part 4

Q25 How often did you consume the following foods in the last week?

	Never (1)	1 per week (2)	2-4 times per week (3)	5-6 times per week (4)	1 time per day (5)	2-3 Times a day (6)	4 or more times per day (7)
Fresh or frozen fruit like apples, banana, orange (1/2 Cup) (1)	○	○	○	○	○	○	○
Canned fruit like peaches, pears, applesauce, or pineapple (1/2 cup) (2)	○	○	○	○	○	○	○
Dried fruit like raisins or Craisins (1/4 cup) (3)	○	○	○	○	○	○	○
Green salad, spinach, kale or other dark green leafy vegetable (1 cup raw) (4)	○	○	○	○	○	○	○
Spaghetti sauce, tomatoes or salsa (1/2 cup) (5)	○	○	○	○	○	○	○
Yams, sweet potatoes or	○	○	○	○	○	○	○

winter squash like butternut (1/2 cup) (6)							
Vegetable soup, or stew with vegetables (1 cup) (7)	○	○	○	○	○	○	○
Carrots (1/2 cup) (8)	○	○	○	○	○	○	○
Beans such as baked beans, garbonzo beans, kidney beans, or black beans (1/2 cup) (9)	○	○	○	○	○	○	○
Any other vegetables, (string beans, peas, corn, broccoli, celery, cauliflower) (1/2 cup) (10)	○	○	○	○	○	○	○

Q47 Was this a typical week?

○ Yes (1)

○ No (2)

End of Block: Part 4

Start of Block: Part 5

Q26 How long have you been eating the number of vegetables and fruits specified in the previous questions?

- A few days (1)
- 1 week (2)
- 2-3 weeks (3)
- 1 month (4)
- 2-6 months (5)
- Greater than 6 months (6)

Q27 Are you seriously thinking about increasing your vegetable and fruit intake in the next 6 months?

- Yes (1)
- No (2)

Q28 Are you seriously thinking about increasing your vegetable and fruit intake in the next month?

- Yes (1)
- No (2)

End of Block: Part 5

Start of Block: Block 12

Q52 Growing up, did your family have a food-producing garden?

- Yes (1)
- Sometimes (2)
- No (3)

Q54 How often did your family purchase foods directly from growers (ex. farmers market, CSA)

- Never (1)
- Less than Once a Month (2)
- Once a Month (3)
- 2-3 Times a Month (4)
- Once a Week or more (5)

Q53 Growing up, how many nights per week did you eat dinner with family?

- 1 or less (1)
- 2-3 (2)
- 4-5 (3)
- 6+ (4)

Q57 How often were you involved in meal preparation growing up?

- Never (1)
- Once per month (2)
- 2-3 times per month (3)
- Once per week (4)
- 2-3 times per week (5)
- 4-5 times per week (6)
- Greater than 6 times per week (7)

Q55 How much do you agree with the following statement?
Growing up, fruits and/or vegetables were readily available in my home.

- Strongly disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

Q56 How many times per week did your family "eat out" (ex. fast food, restaurants, take-out)?

- Once per week or less (1)
- 2-3 times per week (2)
- 4-5 times per week (3)
- 6-7 times per week (4)

Q48 What is your current living situation?

- Living alone (1)
- Living with parents (2)
- Living with roommate(s) (3)
- Living with spouse/partner with no children (4)
- Living with spouse/partner with children (5)

Q51 Which of these best describes your meal preparation?

- I use an on-campus meal plan (1)
- I cook for myself/others (2)
- My spouse/partner cooks for me (3)
- My parents cook for me (4)
- Someone besides myself cooks for me (5)
- I eat out (fast food/restaurant/take out) (6)

End of Block: Block 12

Start of Block: Block 13

Q49 Which of the following diets have you followed in the past or are currently following? (Mark all that apply)

- ☐ Paleo Diet (1)
- ☐ Gluten Free (2)
- ☐ Atkin's diet (very low carb) (3)
- ☐ Low carb (4)
- ☐ HCG (5)
- ☐ Weight watchers (6)
- ☐ Vegetarian (7)
- ☐ Vegan (8)
- ☐ Low fat (9)
- ☐ Low sugar (10)
- ☐ Juice/cleansing (11)
- ☐ Intermittent fasting (12)
- ☐ Other (13) _____
- ☐ None (14)

End of Block: Block 13

Start of Block: Part 6

Q29 Please rate how much you agree with the following statements (1 being very much disagree and 7 being very much agree).

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)
Eating sufficient vegetables and fruits is something that fits with who I am (1)	○	○	○	○	○	○	○
I see myself as someone who eats sufficient vegetables and fruits. (2)	○	○	○	○	○	○	○
Eating sufficient vegetables and fruits is something that suits me. (3)	○	○	○	○	○	○	○

End of Block: Part 6

Start of Block: Part 7

Q30 Please rate how much you agree with the following statements (1 being very much disagree and 7 being very much agree).

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)
Eating sufficient vegetables and fruits is in my own hands. (1)	○	○	○	○	○	○	○
I find it easy to eat sufficient vegetables and fruits. (2)	○	○	○	○	○	○	○

End of Block: Part 7

Start of Block: Part 8

Q31 I feel that eating vegetables and fruits is...

	1 (0)	2 (1)	3 (2)	4 (3)	5 (4)	6 (5)		
Unwise (1)	○	○	○	○	○	○	○	Wise
Unpleasant (2)	○	○	○	○	○	○	○	Pleasant
Bad (3)	○	○	○	○	○	○	○	Good

End of Block: Part 8

Start of Block: Part 9

Q32 Please rate how much you agree with the following statements (1 being very much disagree and 7 being very much agree).

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)
I feel a strong connection to Utah State University students. (1)	○	○	○	○	○	○	○
I identify with USU students. (2)	○	○	○	○	○	○	○
I consider myself to be a typical USU student. (3)	○	○	○	○	○	○	○

End of Block: Part 9

Start of Block: Part 10

Q33 How many servings (approximately 1/2 cup) of vegetables do you believe the average USU student consumes in a day?

- ○ Less than 1 serving (1)
- ○ 1-2 Servings (2)
- ○ 3-4 Servings (3)
- ○ 5 or more servings (4)

Q34 How many servings (approximately 1/2 cup) of fruit do you believe the average USU student consumes in a day?

- ○ Less than 1 serving (1)
- ○ 1-2 Servings (2)
- ○ 3-4 Servings (3)
- ○ 5 or more servings (4)

End of Block: Part 10

Start of Block: Block 14

Q61 **Before you go, here is what you can expect when you get your palm scanned. This process measures carotenoids found in your skin. Carotenoids are compounds found in many plants, particularly vegetables and fruits. You will be asked to take turns during class to have a scan performed. You will receive a small paper at the beginning of class with some basic information needed to perform the scan. Hand this paper to the person performing the scan, and place your hand on the scanner as instructed. The student performing the scan is instructed to not talk during this scan. You may or may not receive an email with your score on it. If you do not receive an email within a week of the hand scan, do not be alarmed. You are still part of the study and are providing valuable information to the researchers. You will be provided your original and most recent score at the end of the study.**

End of Block: Block 14

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*This same survey was used to assess baseline and post-intervention information

Appendix C: CHAPTER III BASELINE AND POST-INTERVENTION SURVEYS

Chapter III Baseline Survey

Start of Block: Block 8

Q27 Open the attached file. This document provides information about this study. If you agree to continue with the survey, please provide your name and today's date.

- Name (3) _____
- Date (4) _____

Q52 If you choose to continue with the survey, please choose agree below. If you wish to withdraw from the study, please choose disagree.

- Agree (1)
- Disagree (2)

End of Block: Block 8

Start of Block: Default Question Block

Q1 What is your A #? (format A01234567)

_____

Q50 In which class did you hear about this study?

_____

Q2 What is your age? (numbers only please)

_____

Skip To: End of Survey If What is your age? (numbers only please) > 24

Skip To: End of Survey If What is your age? (numbers only please) < 18

End of Block: Default Question Block

Start of Block: Block 4

Q16 Are you a main campus or distance education student?

- ○ Main Campus (1)
- ○ Distance Education (2)

Skip To: End of Survey If Are you a main campus or distance education student? = Distance Education

End of Block: Block 4

Start of Block: Block 6

Q15 What is your year at Utah State University?

- ○ Freshmen (1)
- ○ Sophomore (2)
- ○ Junior (3)
- ○ Senior (4)
- ○ Graduate student (5)

Skip To: End of Survey If What is your year at Utah State University? = Graduate student

End of Block: Block 6

Start of Block: Block 5

Q17 Are you taking a nutrition course this semester?

- ○ Yes (1)
- ○ No (2)

Q3 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to disclose (3)

Q4 What is your height?

- ○ Feet (1) _____
- ○ Inches (2) _____

Q5 What is your weight in pounds?

_____

Q25 What is your race?

- White/Caucasian (1)
- African American (2)
- Hispanic/Latino(a) (3)
- Asian (4)
- Native American (5)
- Pacific Islander (6)
- Other (7) _____

End of Block: Block 5

Start of Block: Block 9

Q27 Over the last month, how many times did you drink 100% juice such as orange, apple grape or grapefruit juice? **Do not include** fruit drinks like kool-aide, lemonade, Hi-C, cranberry juice drink, Tang and Twister. Include juice you drank at all mealtimes and between meals.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q30 If Over the last month, how many times did you drink 100% juice such as orange, apple grape or grape... = Never

Q28 Each time you drank 100% juice, how much did you usually drink?

- ○ Less than 3/4 cup (1)
- ○ 3/4 to 1 1/4 cup (2)
- ○ 11/4 to 2 cups (3)
- ○ More than 2 cups (4)

Q30 Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, frozen. **Do not include** juices. Include fruit you ate at all mealtimes and as snacks.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q34 If Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, fro... = Never

Q29 Each time you ate fruit, how much did you usually eat?

- ○ Less than 1 medium fruit (1)
- ○ 1 medium fruit (2)
- ○ 2 medium fruit (3)
- ○ More than 2 medium fruits (4)
- ○ Less than 1/2 cup (5)
- ○ About 1/2 cup (6)
- ○ About 1 cup (7)
- ○ More than 1 cup (8)

Q34 Over the last month, how many times did you eat lettuce salad (with or without other vegetables)?

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q36 If Over the last month, how many times did you eat lettuce salad (with or without other vegetables)? = Never

Q35 Each time you ate lettuce salad, how much did you usually eat?

- ○ About 1/2 cup (1)
- ○ About 1 cup (2)
- ○ About 2 cups (3)
- ○ More than 2 cups (4)

Q36 Over the last month, how many times did you eat french fries or fried potatoes?

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q38 If Over the last month, how many times did you eat french fries or fried potatoes? = Never

Q37 Each time you ate french fries or fried potatoes, how much did you usually eat?

- Small order or less (about 1 cup or less) (1)
- Medium order (about 1 1/2 cup) (2)
- Large order (about 2 cups) (5)
- Supersize order or more (about 3 cups or more) (3)

Q38 Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mashed potatoes, potato salad, and white potatoes that were not fried.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q40 If Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mas... = Never

Q39 Each time you ate these potatoes, how much did you usually eat?

- ○ 1 small potato or less (about 1/2 cup or less) (1)
- ○ 1 Medium potato (about 1/2 to 1 cup) (2)
- ○ 1 Large potato (about 1 to 1 1/2 cups) (5)
- ○ 2 medium potatoes or more (about 1 1/2 cups or more) (3)

Q40 Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried beans, pork and beans and other bean dishes.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q42 If Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried bean... = Never

Q41 Each time you ate beans, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 1 1/2 cups (5)
- ○ About 1 1/2 cups or more (3)

Q42 Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, potatoes, beans, vegetables in mixtures such as casseroles, Mexican dishes, soups, stir-fries, stews, or rice.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q44 If Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, pot... = Never

Q43 Each time you ate these other vegetables, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 2 cups (5)
- ○ About 2 cups or more (3)

Q44 Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, macaroni, pizza, rice and other dishes.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q46 If Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, maca... = Never

Q45 Each time you ate tomato sauce, how much did you usually eat?

- About 1/4 cup or less (1)
- About 1/2 cup (2)
- About 1 cups (5)
- About 2 cups or more (3)

Q46 Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, beef with vegetable soup, minestrone and other vegetable soups.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q48 If Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, b... = Never

Q47 Each time you ate soup, how much did you usually eat?

- Less than 1 cup (1)
- About 1 to 2 cups (2)
- About 2 to 3 cups (5)
- About 3 cups or more (3)

Q48 Over the last month, how many times did you eat vegetables as part of a mixture? Count foods such as sandwiches, casseroles, stews, stir-fry, omelets or tacos.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

End of Block: Block 9

Start of Block: Block 1

Q9 Please rate how much you agree with the following statements (1 being very much disagree and 7 being very much agree).

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)
I feel a strong connection to Utah State University students. (1)	○	○	○	○	○	○	○
I identify with USU students. (2)	○	○	○	○	○	○	○
I consider myself to be a typical USU student. (3)	○	○	○	○	○	○	○

End of Block: Block 1

Start of Block: Block 2

Q11 How many servings (approximately 1/2 cup) of fruit do you believe the average USU student consumes in a day?

- Less than 1 serving (1)
- 1 Servings (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 servings or more (6)

Q49 How many servings (approximately 1/2 cup) of vegetables do you believe the average USU student consumes in a day?

- Less than 1 serving (1)
- 1 Servings (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 servings or more (6)

End of Block: Block 2

Start of Block: Block 7

Q25 This is a two-part study. To be entered into the drawing, you must complete both portions. To participate in the second half of the study, please enter your email below. You will be emailed more instructions in one week.

○ Email (1) _____

End of Block: Block 7

Chapter III Post-intervention Survey

Start of Block: Default Question Block

Q1 What is your A #? (format A01234567)

_____

End of Block: Default Question Block

Start of Block: Block 3

Q8 Over the last month, how many times did you drink 100% juice such as orange, apple grape or grapefruit juice? **Do not include** fruit drinks like kool-aide, lemonade, Hi-C, cranberry juice drink, Tang and Twister. Include juice you drank at all mealtimes and between meals.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q12 If Over the last month, how many times did you drink 100% juice such as orange, apple grape or grape... = Never

Q10 Each time you drank 100% juice, how much did you usually drink?

- ○ Less than 3/4 cup (1)
- ○ 3/4 to 1 1/4 cup (2)
- ○ 11/4 to 2 cups (3)
- ○ More than 2 cups (4)

Q12 Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, frozen. **Do not include** juices. Include fruit you ate at all mealtimes and as snacks.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q16 If Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, fro... = Never

Q14 Each time you ate fruit, how much did you usually eat?

- ○ Less than 1 medium fruit (1)
- ○ 1 medium fruit (2)
- ○ 2 medium fruit (3)
- ○ More than 2 medium fruits (4)
- ○ Less than 1/2 cup (5)
- ○ About 1/2 cup (6)
- ○ About 1 cup (7)
- ○ More than 1 cup (8)

Q16 Over the last month, how many times did you eat lettuce salad (with or without other vegetables)?

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q20 If Over the last month, how many times did you eat lettuce salad (with or without other vegetables)? = Never

Q18 Each time you ate lettuce salad, how much did you usually eat?

- ○ About 1/2 cup (1)
- ○ About 1 cup (2)
- ○ About 2 cups (3)
- ○ More than 2 cups (4)

Q20 Over the last month, how many times did you eat french fries or fried potatoes?

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q24 If Over the last month, how many times did you eat french fries or fried potatoes? = Never

Q22 Each time you ate french fries or fried potatoes, how much did you usually eat?

- Small order or less (about 1 cup or less) (1)
- Medium order (about 1 1/2 cup) (2)
- Large order (about 2 cups) (5)
- Supersize order or more (about 3 cups or more) (3)

Q24 Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mashed potatoes, potato salad, and white potatoes that were not fried.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q28 If Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mas... = Never

Q26 Each time you ate these potatoes, how much did you usually eat?

- ○ 1 small potato or less (about 1/2 cup or less) (1)
- ○ 1 Medium potato (about 1/2 to 1 cup) (2)
- ○ 1 Large potato (about 1 to 1 1/2 cups) (5)
- ○ 2 medium potatoes or more (about 1 1/2 cups or more) (3)

Q28 Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried beans, pork and beans and other bean dishes.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q32 If Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried bean... = Never

Q30 Each time you ate beans, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 1 1/2 cups (5)
- ○ About 1 1/2 cups or more (3)

Q32 Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, potatoes, beans, vegetables in mixtures such as casseroles, Mexican dishes, soups, stir-fries, stews, or rice.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q36 If Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, pot... = Never

Q34 Each time you ate these other vegetables, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 2 cups (5)
- ○ About 2 cups or more (3)

Q36 Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, macaroni, pizza, rice and other dishes.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q40 If Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, maca... = Never

Q38 Each time you ate tomato sauce, how much did you usually eat?

- ○ About 1/4 cup or less (1)
- ○ About 1/2 cup (2)
- ○ About 1 cups (5)
- ○ About 2 cups or more (3)

Q40 Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, beef with vegetable soup, minestrone and other vegetable soups.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q44 If Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, b... = Never

Q42 Each time you ate soup, how much did you usually eat?

- Less than 1 cup (1)
- About 1 to 2 cups (2)
- About 2 to 3 cups (5)
- About 3 cups or more (3)

Q44 Over the last month, how many times did you eat vegetables as part of a mixture? Count foods such as sandwiches, casseroles, stews, stir-fry, omelets or tacos.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

End of Block: Block 3

Start of Block: Block 2

Q11 How many servings (approximately 1/2 cup) of fruit do you believe the average USU student consumes in a day?

- Less than 1 serving (1)
- 1 Serving (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 or more servings (6)

Q45 How many servings (approximately 1/2 cup) of vegetables do you believe the average USU student consumes in a day?

- Less than 1 serving (1)
- 1 Serving (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 or more servings (6)

End of Block: Block 2

Start of Block: Block 4

Q27 A letter was included in the subject line of your email. Which letter did you receive?

- C (1)
- R (2)
- H (3)
- L (4)

End of Block: Block 4

Start of Block: Block 5

Display This Question:

If A letter was included in the subject line of your email. Which letter did you receive? = C

Q28 Thank you for choosing participate in this study. You were allocated to the control group. Therefore, you did not receive a 'treatment' of any kind.
The information you provided is important to our study as it gives us a comparison group. If you would like your data removed from the study, please email the student investigator Liz Nix at Liz.s@aggiemail.usu.edu.

Display This Question:

If A letter was included in the subject line of your email. Which letter did you receive? = R

Q30 Thank you for choosing participate in this study. You were allocated to the recommendation group. The 'treatment' you received was the information provided in the email, specifically that the recommendation for fruit and vegetable intake is 4-5 cups. This was done to evaluate whether presentation of a recommendation alters self-reported fruit and vegetable intake.

The information you provided is important to our study. If you would like your data removed from the study, please email the student investigator Liz Nix at Liz.s@aggiemail.usu.edu.

Display This Question:

If A letter was included in the subject line of your email. Which letter did you receive? = H

Q31 Thank you for choosing participate in this study. You were allocated to the "High Intake" group, as such. This means that, regardless of how your intake compared to the group, you were informed that you consumed higher than average. This was done in an effort to alter your perception and imply that your peers ate less fruits and vegetables than you do. Prior research has shown that this type of modification of one's perception can influence self-reported intake of fruits and vegetables. The recommendation for fruit and vegetable intake is approximately 4-5 cups per day.

The information you provided is important to our study. If you would like your data removed from the study, please email the student investigator Liz Nix at Liz.s@aggiemail.usu.edu.

Display This Question:

If A letter was included in the subject line of your email. Which letter did you receive? = L

Q32 Thank you for choosing participate in this study. You were allocated to the "Low Intake" group. This means that, regardless of how your intake compared to the group, you were informed that you consumed lower than average. This was done in an effort to alter your perception and imply that your peers ate more fruits and vegetables than you do. Prior research has shown that this type of modification of one's perception may influence self-reported intake of fruits and vegetables. The recommendation for fruit and vegetable intake is approximately 4-5 cups per day.

The information you provided is important to our study. If you would like your data removed from the study, please email the student investigator Liz Nix at Liz.s@aggiemail.usu.edu.

End of Block: Block 5

Appendix D: CHAPTER IV BASELINE AND POST-INTERVENTION SURVEYS

Chapter IV Baseline Survey

Start of Block: Default Question Block

Q1 Please enter the first letter of your last name and the numbers from your A number. (ex. T00192827)
This information will be sent to your instructor to award extra credit, but will not be kept in the data records.

_____

Q2 What is your age? (numbers only please)

_____

Skip To: End of Survey If What is your age? (numbers only please) < 18

End of Block: Default Question Block

Start of Block: Block 5

Q15 What is your year at Utah State University?

- ○ Freshmen (1)
- ○ Sophomore (2)
- ○ Junior (3)
- ○ Senior (4)
- ○ Graduate student (5)

Q17 Which section of NDFS1020 are you taking this semester? (You can find this information on the canvas page for the class)

- ○ 001 (1)
- ○ 002 (2)
- ○ 003 (3)
- ○ 004 (4)
- ○ 005 (5)

Q3 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to disclose (3)
- ○ Other (4) _____

Q4 What is your height?

- ○ Feet (1) _____
- ○ Inches (2) _____

Q5 What is your weight in pounds?

_____

Q25 What is your race?

- White/European American (1)
- African American (2)
- Hispanic/Latino(a) (3)
- Asian (4)
- Native American (5)
- Pacific Islander (6)
- Other (7) _____

End of Block: Block 5

Start of Block: Block 9

Q27 Over the last month, how many times did you drink 100% juice such as orange, apple grape or grapefruit juice? **Do not include** fruit drinks like kool-aide, lemonade, Hi-C, cranberry juice drink, Tang and Twister. Include juice you drank at all mealtimes and between meals.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q30 If Over the last month, how many times did you drink 100% juice such as orange, apple grape or grape... = Never

Q28 Each time you drank 100% juice, how much did you usually drink?

- ○ Less than 3/4 cup (1)
- ○ 3/4 to 1 1/4 cup (2)
- ○ 11/4 to 2 cups (3)
- ○ More than 2 cups (4)

Q30 Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, frozen. **Do not include** juices. Include fruit you ate at all mealtimes and as snacks.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q34 If Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, fro... = Never

Q29 Each time you ate fruit, how much did you usually eat?

- ○ Less than 1 medium fruit (1)
- ○ 1 medium fruit (2)
- ○ 2 medium fruit (3)
- ○ More than 2 medium fruits (4)

Q34 Over the last month, how many times did you eat lettuce salad (with or without other vegetables)?

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q36 If Over the last month, how many times did you eat lettuce salad (with or without other vegetables)? = Never

Q35 Each time you ate lettuce salad, how much did you usually eat?

- ○ About 1/2 cup (1)
- ○ About 1 cup (2)
- ○ About 2 cups (3)
- ○ More than 2 cups (4)

Q36 Over the last month, how many times did you eat french fries or fried potatoes?

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q38 If Over the last month, how many times did you eat french fries or fried potatoes? = Never

Q37 Each time you ate french fries or fried potatoes, how much did you usually eat?

- Small order or less (about 1 cup or less) (1)
- Medium order (about 1 1/2 cup) (2)
- Large order (about 2 cups) (5)
- Supersize order or more (about 3 cups or more) (3)

Q38 Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mashed potatoes, potato salad, and white potatoes that were not fried.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q40 If Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mas... = Never

Q39 Each time you ate these potatoes, how much did you usually eat?

- ○ 1 small potato or less (about 1/2 cup or less) (1)
- ○ 1 Medium potato (about 1/2 to 1 cup) (2)
- ○ 1 Large potato (about 1 to 1 1/2 cups) (5)
- ○ 2 medium potatoes or more (about 1 1/2 cups or more) (3)

Q40 Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried beans, pork and beans and other bean dishes.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q42 If Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried bean... = Never

Q41 Each time you ate beans, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 1 1/2 cups (5)
- ○ About 1 1/2 cups or more (3)

Q42 Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, potatoes, beans, vegetables in mixtures such as casseroles, Mexican dishes, soups, stir-fries, stews, or rice.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q44 If Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, pot... = Never

Q43 Each time you ate these other vegetables, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 2 cups (5)
- ○ About 2 cups or more (3)

Q44 Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, macaroni, pizza, rice and other dishes.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q46 If Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, maca... = Never

Q45 Each time you ate tomato sauce, how much did you usually eat?

- ○ About 1/4 cup or less (1)
- ○ About 1/2 cup (2)
- ○ About 1 cups (5)
- ○ About 2 cups or more (3)

Q46 Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, beef with vegetable soup, minestrone and other vegetable soups.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q48 If Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, b... = Never

Q47 Each time you ate soup, how much did you usually eat?

- Less than 1 cup (1)
- About 1 to 2 cups (2)
- About 2 to 3 cups (5)
- About 3 cups or more (3)

Q48 Over the last month, how many times did you eat vegetables as part of a mixture? Count foods such as sandwiches, casseroles, stews, stir-fry, omelets or tacos.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

End of Block: Block 9

Start of Block: Block 2

Q11 How many servings (approximately 1/2 cup) of fruit do you believe the average USU student consumes in a day?

- ○ Less than 1 serving (1)
- ○ 1 Servings (2)
- ○ 2 Servings (3)
- ○ 3 servings (4)
- ○ 4 servings (5)
- ○ 5 servings or more (6)

Q49 How many servings (approximately 1/2 cup) of vegetables do you believe the average USU student consumes in a day?

- ○ Less than 1 serving (1)
- ○ 1 Servings (2)
- ○ 2 Servings (3)
- ○ 3 servings (4)
- ○ 4 servings (5)
- ○ 5 servings or more (6)

Q46 Please rank your intake and the intake of other USU students on a scale of 1 to 10.

0 1 2 3 4 5 6 7 8 9 10

My Intake (1)	
Typical USU student (3)	

End of Block: Block 2

Start of Block: Block 7

Q25
This is a two part study. Please enter your email address to be emailed the second survey in 8 weeks.

○ Email (1) _____

End of Block: Block 7

Chapter IV Post-Intervention Survey

Start of Block: Default Question Block

Q1 Please enter the first letter of your last name and the last 4 digits of your A number? (ex. T1234)

_____

End of Block: Default Question Block

Start of Block: Block 3

Q8 Over the last month, how many times did you drink 100% juice such as orange, apple grape or grapefruit juice? **Do not include** fruit drinks like kool-aide, lemonade, Hi-C, cranberry juice drink, Tang and Twister. Include juice you drank at all mealtimes and between meals.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q12 If Over the last month, how many times did you drink 100% juice such as orange, apple grape or grape... = Never

Q10 Each time you drank 100% juice, how much did you usually drink?

- ○ Less than 3/4 cup (1)
- ○ 3/4 to 1 1/4 cup (2)
- ○ 11/4 to 2 cups (3)
- ○ More than 2 cups (4)

Q12 Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, frozen. **Do not include** juices. Include fruit you ate at all mealtimes and as snacks.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q16 If Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, fro... = Never

Q14 Each time you ate fruit, how much did you usually eat?

- ○ Less than 1 medium fruit (1)
- ○ 1 medium fruit (2)
- ○ 2 medium fruit (3)
- ○ More than 2 medium fruits (4)

Q16 Over the last month, how many times did you eat lettuce salad (with or without other vegetables)?

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q20 If Over the last month, how many times did you eat lettuce salad (with or without other vegetables)? = Never

Q18 Each time you ate lettuce salad, how much did you usually eat?

- ○ About 1/2 cup (1)
- ○ About 1 cup (2)
- ○ About 2 cups (3)
- ○ More than 2 cups (4)

Q20 Over the last month, how many times did you eat french fries or fried potatoes?

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q24 If Over the last month, how many times did you eat french fries or fried potatoes? = Never

Q22 Each time you ate french fries or fried potatoes, how much did you usually eat?

- Small order or less (about 1 cup or less) (1)
- Medium order (about 1 1/2 cup) (2)
- Large order (about 2 cups) (5)
- Supersize order or more (about 3 cups or more) (3)

Q24 Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mashed potatoes, potato salad, and white potatoes that were not fried.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q28 If Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mas... = Never

Q26 Each time you ate these potatoes, how much did you usually eat?

- 1 small potato or less (about 1/2 cup or less) (1)
- 1 Medium potato (about 1/2 to 1 cup) (2)
- 1 Large potato (about 1 to 1 1/2 cups) (5)
- 2 medium potatoes or more (about 1 1/2 cups or more) (3)

Q28 Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried beans, pork and beans and other bean dishes.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q32 If Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried bean... = Never

Q30 Each time you ate beans, how much did you usually eat?

- 1/2 cup or less (1)
- 1/2 to 1 cup (2)
- About 1 to 1 1/2 cups (5)
- About 1 1/2 cups or more (3)

Q32 Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, potatoes, beans, vegetables in mixtures such as casseroles, Mexican dishes, soups, stir-fries, stews, or rice.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q36 If Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, pot... = Never

Q34 Each time you ate these other vegetables, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 2 cups (5)
- ○ About 2 cups or more (3)

Q36 Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, macaroni, pizza, rice and other dishes.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q40 If Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, maca... = Never

Q38 Each time you ate tomato sauce, how much did you usually eat?

- ○ About 1/4 cup or less (1)
- ○ About 1/2 cup (2)
- ○ About 1 cups (5)
- ○ About 2 cups or more (3)

Q40 Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, beef with vegetable soup, minestrone and other vegetable soups.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q44 If Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, b... = Never

Q42 Each time you ate soup, how much did you usually eat?

- Less than 1 cup (1)
- About 1 to 2 cups (2)
- About 2 to 3 cups (5)
- About 3 cups or more (3)

Q44 Over the last month, how many times did you eat vegetables as part of a mixture? Count foods such as sandwiches, casseroles, stews, stir-fry, omelets or tacos.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

End of Block: Block 3

Start of Block: Block 2

Q11 How many servings (approximately 1/2 cup) of fruit do you believe the average USU student consumes in a day?

- Less than 1 serving (1)
- 1 Serving (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 or more servings (6)

Q45 How many servings (approximately 1/2 cup) of vegetables do you believe the average USU student consumes in a day?

- Less than 1 serving (1)
- 1 Serving (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 or more servings (6)

End of Block: Block 2

Start of Block: Block 3

Q39 Which section of NDFS1020 were you in?

- 1020-001 Natalie Norris Tuesday 9-10:15 (1)
- 1020-002/003 Natalie Norris Tuesday 10:30-11:45 (2)
- 1020-004 Liz Nix Thursday 10:30-11:45 (3)
- 1020-005 Dr. Heidi Wengreen 1:30-2:45 (4)

Q35 Please choose the phrase that best describes your attendance.
(This question is to determine your exposure to the intervention. Your grade will, in no way, be affected by how you respond to this question. Your instructor will not be able to link your response to this question to your A number or name)

- I attended almost every class session and only missed 1-2 classes (1)
- I was there most of the time and missed about 3-5 classes (3)
- I attended fairly regularly but missed 6-8 classes (4)
- I attended every class in the beginning of the semester, but stopped attending consistently after the first couple weeks. (5)
- I went to class sporadically and attended about 4-8 classes spread throughout the semester. (6)
- I attended class 1-3 times this semester (7)
- I did not come to class this semester (9)

Q37 Did you observe any unusual behavior in the fellow students of your class? If yes, please explain.

- Yes (1) _____
- No (3)

End of Block: Block 3

Start of Block: Block 4

Q36 Thank you for participating in this study. The purpose of this study was to determine if exposure to fellow students snacking on vegetables in class increased consumption of vegetables or perception of peers' consumption of vegetables. Sections 002 (003) and 004 were the treatment groups, which means that in your class, there were approximately 10 hired "peer models" who came to this class for the sole purpose of eating vegetables in your presence. This was done in an attempt to change your perception about your peers' regular intake of vegetables, which may have an impact on your personal eating behaviors. Previous studies have shown that peer modeling may increase fruit or vegetable eating behavior.
If you were in the 001 section or the 005 section you were in the control group and received no intervention.

If you wish to remove your data from this study for any reason, please contact the student researcher at liz.s@aggiemail.usu.edu or (435) 512-6184.

End of Block: Block 4

Appendix E: CHAPTER V PRE AND POST SURVEY

Chapter V Baseline Survey

Start of Block: Default Question Block

Q1 What is your A number (this will be collected in order to award you extra credit. Ex. A01234567)?

_____

Q2 What is your age? (numbers only please)

_____

Skip To: End of Survey If What is your age? (numbers only please) < 18

End of Block: Default Question Block

Start of Block: Block 4

Q16 Are you a main campus or distance education student?

- ○ Main Campus (1)
- ○ Distance Education (2)

Skip To: End of Survey If Are you a main campus or distance education student? = Distance Education

End of Block: Block 4

Start of Block: Block 6

Q15 What is your year at Utah State University?

- ○ Freshmen (1)
- ○ Sophomore (2)
- ○ Junior (3)
- ○ Senior (4)
- ○ Graduate student (5)

Skip To: End of Survey If What is your year at Utah State University? = Graduate student

End of Block: Block 6

Start of Block: Block 5

Q17 Are you taking a nutrition course this semester?

- ○ Yes (1)
- ○ No (2)

Q3 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to disclose (3)
- ○ Other (4) _____

Q4 What is your height?

- Feet (1) _____
- Inches (2) _____

Q5 What is your weight in pounds?

_____

Q25 What is your race?

- White/European American (1)
- African American (2)
- Hispanic/Latino(a) (3)
- Asian (4)
- Native American (5)
- Pacific Islander (6)
- Other (7) _____

Q61 Have you used self-tanner in the past week?

- Yes (1)
- No (3)

Q62 Describe your multivitamin use?

- Never (1)
- Rarely (2)
- Sometimes (3)
- Most of the time (4)
- Always (5)

End of Block: Block 5

Start of Block: Block 9

Q50 I am always willing to admit when I make a mistake.

- True (1)
- False (2)

Q52 I always try to practice what I preach.

- True (1)
- False (2)

Q53 I never resent being asked to return a favor.

- True (1)
- False (2)

Q54 I have never been irked when people have expressed ideas very different from my own.

- True (1)
- False (2)

Q55 I have never deliberately said something that hurt someone else's feelings.

- True (1)
- False (2)

Q56 I like to gossip at times.

- True (1)
- False (2)

Q57 There have been occasions when I took advantage of someone.

- True (1)
- False (2)

Q58 I sometimes try to get even rather than forgive and forget.

- True (1)
- False (2)

Q59 At times, I have really insisted on having things my own way.

- True (1)
- False (2)

Q60 There have been occasions when I felt like smashing things.

- True (1)
- False (2)

End of Block: Block 9

Start of Block: Block 9

Q27 Over the last month, how many times did you drink 100% juice such as orange, apple grape or grapefruit juice? **Do not include** fruit drinks like kool-aide, lemonade, Hi-C, cranberry juice drink, Tang and Twister. Include juice you drank at all mealtimes and between meals.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q30 If Over the last month, how many times did you drink 100% juice such as orange, apple grape or grape... = Never

Q28 Each time you drank 100% juice, how much did you usually drink?

- ○ Less than 3/4 cup (1)
- ○ 3/4 to 1 1/4 cup (2)
- ○ 11/4 to 2 cups (3)
- ○ More than 2 cups (4)

Q30 Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, frozen. **Do not include** juices. Include fruit you ate at all mealtimes and as snacks.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q34 If Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, fro... = Never

Q29 Each time you ate fruit, how much did you usually eat?

- ○ Less than 1 medium fruit (1)
- ○ 1 medium fruit (2)
- ○ 2 medium fruit (3)
- ○ More than 2 medium fruits (4)
- ○ Less than 1/2 cup (5)
- ○ About 1/2 cup (6)
- ○ About 1 cup (7)
- ○ More than 1 cup (8)

Q34 Over the last month, how many times did you eat lettuce salad (with or without other vegetables)?

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q36 If Over the last month, how many times did you eat lettuce salad (with or without other vegetables)? = Never

Q35 Each time you ate lettuce salad, how much did you usually eat?

- ○ About 1/2 cup (1)
- ○ About 1 cup (2)
- ○ About 2 cups (3)
- ○ More than 2 cups (4)

Q36 Over the last month, how many times did you eat french fries or fried potatoes?

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q38 If Over the last month, how many times did you eat french fries or fried potatoes? = Never

Q37 Each time you ate french fries or fried potatoes, how much did you usually eat?

- Small order or less (about 1 cup or less) (1)
- Medium order (about 1 1/2 cup) (2)
- Large order (about 2 cups) (5)
- Supersize order or more (about 3 cups or more) (3)

Q38 Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mashed potatoes, potato salad, and white potatoes that were not fried.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q40 If Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mas... = Never

Q39 Each time you ate these potatoes, how much did you usually eat?

- ○ 1 small potato or less (about 1/2 cup or less) (1)
- ○ 1 Medium potato (about 1/2 to 1 cup) (2)
- ○ 1 Large potato (about 1 to 1 1/2 cups) (5)
- ○ 2 medium potatoes or more (about 1 1/2 cups or more) (3)

Q40 Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried beans, pork and beans and other bean dishes.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q42 If Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried bean... = Never

Q41 Each time you ate beans, how much did you usually eat?

- 1/2 cup or less (1)
- 1/2 to 1 cup (2)
- About 1 to 1 1/2 cups (5)
- About 1 1/2 cups or more (3)

Q42 Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, potatoes, beans, vegetables in mixtures such as casseroles, Mexican dishes, soups, stir-fries, stews, or rice.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q44 If Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, pot... = Never

Q43 Each time you ate these other vegetables, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 2 cups (5)
- ○ About 2 cups or more (3)

Q44 Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, macaroni, pizza, rice and other dishes.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q46 If Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, maca... = Never

Q45 Each time you ate tomato sauce, how much did you usually eat?

- About 1/4 cup or less (1)
- About 1/2 cup (2)
- About 1 cups (5)
- About 2 cups or more (3)

Q46 Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, beef with vegetable soup, minestrone and other vegetable soups.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q48 If Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, b... = Never

Q47 Each time you ate soup, how much did you usually eat?

- Less than 1 cup (1)
- About 1 to 2 cups (2)
- About 2 to 3 cups (5)
- About 3 cups or more (3)

Q48 Over the last month, how many times did you eat vegetables as part of a mixture? Count foods such as sandwiches, casseroles, stews, stir-fry, omelets or tacos.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

End of Block: Block 9

Start of Block: Block 2

Q64 How many servings (approximately 1/2 cup) of fruit do you eat per day?

- ○ Less than 1 serving (1)
- ○ 1 Servings (2)
- ○ 2 Servings (3)
- ○ 3 servings (4)
- ○ 4 servings (5)
- ○ 5 servings or more (6)

Q66 How many servings (approximately 1/2 cup) of vegetables do you eat per day?

- ○ Less than 1 serving (1)
- ○ 1 Servings (2)
- ○ 2 Servings (3)
- ○ 3 servings (4)
- ○ 4 servings (5)
- ○ 5 servings or more (6)

Q49 How many servings (approximately 1/2 cup) of fruits do you believe the average USU student consumes in a day?

- Less than 1 serving (1)
- 1 Servings (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 servings or more (6)

Q65 How many servings (approximately 1/2 cup) of vegetables do you believe the average USU student consumes in a day?

- Less than 1 serving (1)
- 1 Servings (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 servings or more (6)

End of Block: Block 2

Start of Block: Block 8

Q46 Please rank your own fruit and vegetable intake and that of other USU students below (10 being meeting or exceeding the recommendation (4 to 5 cups per day) and 1 being not getting any fruits or vegetables at all.

0 1 2 3 4 5 6 7 8 9 10

Your intake (1)	
Other USU students (3)	

End of Block: Block 8

Start of Block: Block 7

Q49 Which Section of CHEM2315 are you currently in?

- 001- Monday 11:30-2:20 (1)
- 002-Monday 12:30-3:20 (2)
- 003-Monday 2:30-5:30 (3)
- 004-Tuesday 8:30-11:20 (4)
- 005-Tuesday 9:30-11:20 (5)
- 006-Tuesday 11:30-2:20 (6)
- 007-Tuesday 12:30-3:20 (7)
- 008-Tuesday 2:30-5:20 (8)
- 009-Wednesday 11:30-2:20 (9)
- 010-Thursday 8:30-11:20 (10)
- 011-Thursday 9:30-12:20 (11)
- 012-Thursday 11:30-2:20 (12)
- 013-Thursday 12:30-3:20 (13)
- 014-Monday 3:30-6:20 (14)
- 015-Monday 5:30-8:20 (15)
- 016-Tuesday 3:30-6:20 (16)

Q25
This is a two part study. We are also asking you to participate in the second survey in 7 weeks time for full participation and extra credit points.

○ Email (1) _____

End of Block: Block 7

Chapter V Post-intervention Survey

Start of Block: Default Question Block

Q1 What is your A number? (Ex. A01234567)

_____

End of Block: Default Question Block

Start of Block: Block 6

Q39 Which Section of CHEM2315 are you currently in?

- 001- Monday 11:30-2:20 (1)
- 002-Monday 12:30-3:20 (2)
- 003-Monday 2:30-5:30 (3)
- 004-Tuesday 8:30-11:20 (4)
- 005-Tuesday 9:30-11:20 (5)
- 006-Tuesday 11:30-2:20 (6)
- 007-Tuesday 12:30-3:20 (7)
- 008-Tuesday 2:30-5:20 (8)
- 009-Wednesday 11:30-2:20 (9)
- 010-Thursday 8:30-11:20 (10)
- 011-Thursday 9:30-12:20 (11)
- 012-Thursday 11:30-2:20 (12)
- 013-Thursday 12:30-3:20 (13)
- 014-Monday 3:30-6:20 (14)
- 015-Monday 5:30-8:20 (15)
- 016-Tuesday 3:30-6:20 (16)

End of Block: Block 6

Start of Block: Block 5

Q37 How many servings (approximately 1/2 cup) of fruit do you eat per day?

- Less than 1 serving (1)
- 1 Servings (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 servings or more (6)

Q39 How many servings (approximately 1/2 cup) of vegetables do you eat per day?

- Less than 1 serving (1)
- 1 Servings (2)
- 2 Servings (3)
- 3 servings (4)
- 4 servings (5)
- 5 servings or more (6)

End of Block: Block 5

Start of Block: Block 3

Q8 Over the last month, how many times did you drink 100% juice such as orange, apple grape or grapefruit juice? **Do not include** fruit drinks like kool-aide, lemonade, Hi-C, cranberry juice drink, Tang and Twister. Include juice you drank at all mealtimes and between meals.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q12 If Over the last month, how many times did you drink 100% juice such as orange, apple grape or grape... = Never

Q10 Each time you drank 100% juice, how much did you usually drink?

- ○ Less than 3/4 cup (1)
- ○ 3/4 to 1 1/4 cup (2)
- ○ 11/4 to 2 cups (3)
- ○ More than 2 cups (4)

Q12 Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, frozen. **Do not include** juices. Include fruit you ate at all mealtimes and as snacks.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q16 If Over the last month, how many times did you eat fruit? Count any kind of fruit-fresh, canned, fro... = Never

Q14 Each time you ate fruit, how much did you usually eat?

- ○ Less than 1 medium fruit (1)
- ○ 1 medium fruit (2)
- ○ 2 medium fruit (3)
- ○ More than 2 medium fruits (4)
- ○ Less than 1/2 cup (5)
- ○ About 1/2 cup (6)
- ○ About 1 cup (7)
- ○ More than 1 cup (8)

Q16 Over the last month, how many times did you eat lettuce salad (with or without other vegetables)?

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q20 If Over the last month, how many times did you eat lettuce salad (with or without other vegetables)? = Never

Q18 Each time you ate lettuce salad, how much did you usually eat?

- ○ About 1/2 cup (1)
- ○ About 1 cup (2)
- ○ About 2 cups (3)
- ○ More than 2 cups (4)

Q20 Over the last month, how many times did you eat french fries or fried potatoes?

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q24 If Over the last month, how many times did you eat french fries or fried potatoes? = Never

Q22 Each time you ate french fries or fried potatoes, how much did you usually eat?

- Small order or less (about 1 cup or less) (1)
- Medium order (about 1 1/2 cup) (2)
- Large order (about 2 cups) (5)
- Supersize order or more (about 3 cups or more) (3)

Q24 Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mashed potatoes, potato salad, and white potatoes that were not fried.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q28 If Over the last month, how many times did you eat other white potatoes? Count baked, boiled and mas... = Never

Q26 Each time you ate these potatoes, how much did you usually eat?

- ○ 1 small potato or less (about 1/2 cup or less) (1)
- ○ 1 Medium potato (about 1/2 to 1 cup) (2)
- ○ 1 Large potato (about 1 to 1 1/2 cups) (5)
- ○ 2 medium potatoes or more (about 1 1/2 cups or more) (3)

Q28 Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried beans, pork and beans and other bean dishes.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q32 If Over the last month, how many times did you eat beans? Count baked beans, bean soup, refried bean... = Never

Q30 Each time you ate beans, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 1 1/2 cups (5)
- ○ About 1 1/2 cups or more (3)

Q32 Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, potatoes, beans, vegetables in mixtures such as casseroles, Mexican dishes, soups, stir-fries, stews, or rice.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q36 If Over the last month, how many times did you eat other vegetables? Do not count lettuce salad, pot... = Never

Q34 Each time you ate these other vegetables, how much did you usually eat?

- ○ 1/2 cup or less (1)
- ○ 1/2 to 1 cup (2)
- ○ About 1 to 2 cups (5)
- ○ About 2 cups or more (3)

Q36 Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, macaroni, pizza, rice and other dishes.

- ○ Never (1)
- ○ 1-3 times last month (2)
- ○ 1-2 times per week (3)
- ○ 3-4 times per week (4)
- ○ 5-6 times per week (5)
- ○ 1 time per day (6)
- ○ 2 times per day (7)
- ○ 3 times per day (8)
- ○ 4 times per day (9)
- ○ 5 or more times per day (10)

Skip To: Q40 If Over the last month, how many times did you eat tomato sauce? Include tomato sauce on pasta, maca... = Never

Q38 Each time you ate tomato sauce, how much did you usually eat?

- ○ About 1/4 cup or less (1)
- ○ About 1/2 cup (2)
- ○ About 1 cups (5)
- ○ About 2 cups or more (3)

Q40 Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, beef with vegetable soup, minestrone and other vegetable soups.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

Skip To: Q44 If Over the last month, how many times did you eat vegetable soups? Include tomato soup, gazpacho, b... = Never

Q42 Each time you ate soup, how much did you usually eat?

- Less than 1 cup (1)
- About 1 to 2 cups (2)
- About 2 to 3 cups (5)
- About 3 cups or more (3)

Q44 Over the last month, how many times did you eat vegetables as part of a mixture? Count foods such as sandwiches, casseroles, stews, stir-fry, omelets or tacos.

- Never (1)
- 1-3 times last month (2)
- 1-2 times per week (3)
- 3-4 times per week (4)
- 5-6 times per week (5)
- 1 time per day (6)
- 2 times per day (7)
- 3 times per day (8)
- 4 times per day (9)
- 5 or more times per day (10)

End of Block: Block 3

Start of Block: Block 2

Q11 How many servings (approximately 1/2 cup) of fruit do you believe the average USU student consumes in a day?

- ○ Less than 1 serving (1)
- ○ 1 Serving (2)
- ○ 2 Servings (3)
- ○ 3 servings (4)
- ○ 4 servings (5)
- ○ 5 or more servings (6)

Q45 How many servings (approximately 1/2 cup) of vegetables do you believe the average USU student consumes in a day?

- ○ Less than 1 serving (1)
- ○ 1 Serving (2)
- ○ 2 Servings (3)
- ○ 3 servings (4)
- ○ 4 servings (5)
- ○ 5 or more servings (6)

End of Block: Block 2

Start of Block: Block 3

Q35 Please rank your own fruit and vegetable intake and that of other USU students below (10 being meeting or exceeding the recommendation (4 to 5 cups per day) and 1 being not getting any fruits or vegetables at all.

0 1 2 3 4 5 6 7 8 9 10

Your intake (1)	
Other USU students (3)	

End of Block: Block 3

Start of Block: Block 4

Q35 Did you make an attempt to alter your fruit and vegetable intake based on the information you received?

- ○ Yes (please specify) (1) _____
- ○ No (2)

End of Block: Block 4

Appendix G: CURRICULUM VITAE

Liz Nix

Education

Ph.D. **Utah State University.** Nutrition, Dietetics and Food Science. Nutrition Science emphasis. 2014-present. Estimated graduation with degree in Spring 2018.

B.S. **Utah State University.** Nutrition, Dietetics and Food Science. Dietetics Program. 2010-2014

R.D. **Utah State University.** Coordinated Program of Dietetics with associated internship. 2012-2014.

Work Experience

- Graduate Teaching Assistantship 2015-2017
- SNAP Research Nutrition Educator Jul-Nov 2015
- Undergraduate Teaching Fellow Aug-Dec 2012

Publication

- Heidi J. Wengreen, Elizabeth Nix, Gregory J. Madden, The effect of social norms messaging regarding skin carotenoid concentrations among college students, Appetite, Volume 116, 2017, Pages 39-44, ISSN 0195-6663, http://dx.doi.org/10.1016/j.appet.2017.04.027.
- Elizabeth Nix, Heidi J. Wengreen, Social approval bias in self-reported fruit and vegetable intake after presentation of a normative message in college students, Appetite, Volume 116, 2017, Pages 552-558, ISSN 0195-6663, http://dx.doi.org/10.1016/j.appet.2017.05.045.

Works Submitted for Publication or In Progress

- Elizabeth Nix, Heidi J. Wengreen. Martha Archuleta. The Use of Dietary Assessment Methods in Interventions Aimed at Increasing Fruit and Vegetable Intake in Adults: A Systematic Review. Submitted to JNEB
- Elizabeth Nix, Heidi J. Wengreen. Using descriptive and injunctive normative messages to

influence fruit and vegetable intake in college students: A Pilot Study.

- Elizabeth Nix, Heidi J. Wengreen. Using peer models in natural setting to influence college student perception of and peers' and personal eating behaviors.

Poster Presentations

- Nix E, Wengreen H. The effect of descriptive social norms on skin carotenoid scores and fruit and vegetable intake in college students. SNEB Annual Conference, 2016. Poster presentation.
- Norton MC, Fauth EB, Schaeffer S, Wengreen H, Nix E, Clark C, Dorsch T, Gast J. Intrinsic Motivation and Increases in Physical Activity and Diet Quality in Behavioral Intervention. GSA Annual Conference 2015. Poster presentation.
- Nix E, Wengreen H. The Effect of Descriptive Social Norms on Self-Reported Fruit and Vegetable Intake in College Students. Utah Academy for Nutrition and Dietetics Conference, 2017. Poster presentation

Research Experience

- Initiating and implementing a research project on the validity of self-reported intake when presented with manipulated normative information. Activities included study design, participant recruitment, data collection and analysis, with plans for submission to the Appetite in March 2017 — Spring 2016
- Initiating and implementing a research project on how social norms affect dietary patterns in college students including study design, IRB approval, participant recruitment, data collection and analysis and summarizing information in an abstract and as part of a dissertation. — Spring 2015
- Designing dietary guidelines relating to Alzheimer's preventions. Organizing volunteers to assist in providing cooking demonstrations and education. Establishing tools for evaluation of nutrition data and analyzing subsequent — Spring 2014

data.

Teaching Experience

- Section Instructor-Science and Application of Human Nutrition (Blended course of 120 students) — Spring 2017
- Graduate Teaching Assistant-Test review sessions — Spring 2014
- SNAP Nutrition Education Instructor — Fall 2014
- Cooking Demonstrations for Gray Matters Research project — Spring 2013

Professional Development

- Society for Nutrition Education and Behavior Annual Conference — July 2016
- Graduate and Research Training Series-Utah State University — Fall 2015-Spring 2016
- CITI certification in Human Research — Nov 2013
- Utah Academy of Nutrition and Dietetics Conference — April 2013 & 2016

Awards/Honors

- Best Graduate Student Poster Presentation-Utah Academy of Nutrition and Dietetics conference — 2016
- Graduate Student of the Year-Department of Nutrition and Food Science — 2017

Affiliations/Memberships

- Society for Nutrition Education and Behavior — 2015-Present
- Utah Academy of Nutrition and Dietetics — 2012-Present
- Academy of Nutrition and Dietetics — 2012-Present