HEALTHY EATING INFORMATION AND FOOD CHOICES

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ABSTRACT

The obesity rate amongst American university students has become an item of concern for many colleges and universities across the country. College students are heavily exposed to many unhealthy dietary trends, being reliant on the taste attributes of food for their food decisions, and have a lack of exposure to healthier food options at their campuses. The current study investigated whether providing education on healthy eating information in college students can promote healthy eating, such as a decreased influence of food taste attributes and an increased influence of food healthiness attributes in their food decisions. Fifty-six college students were recruited from the University of Missouri-Kansas City. Participants were randomly assigned to the healthy eating information group (n = 29) and the control group (n = 27). Participants in the health-education group were taught healthy eating information by watching a ten-minute video clip that provided healthy eating information such as portion size and food calories. In contrast, participants in the control condition watched a ten-minute video clip that delivered non-food related information about solar energy. Participants were asked to rate 60 food items based on food healthiness and taste using the Computerized Food Rating and Choice Tasks (Lim et al., 2018) before and after health education. Linear regression models were fitted to examine whether taste and health attributes predicted unique variance in each participant's food preferences. Results showed

that the influence of taste attributes was significantly decreased in participants' food preferences after being taught healthy eating information. Participants in the control condition did not show this effect and demonstrated a significant increase of taste attributes in their food preferences. These findings suggested that providing education on healthy eating information in individuals could help reduce the influence of taste attributes in one's food preference-making process. The findings of this study have implications for the implementation of health education in real-world settings for the promotion of healthy eating and the prevention of obesity.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the College of Arts and Sciences have examined a thesis titled “Healthy Eating Information and Food Choices,” presented by Jarrod J. Sotos, candidate for the Master of Arts degree, and certify that in their opinion it is worthy of acceptance.

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CHAPTER 1

INTRODUCTION

Obesity is a growing concern and is increasingly prevalent among multiple age groups in the United States. Obesity rates have been increasing for the past several decades, especially in children and college students (Skinner & Skelton, 2014). Poor dietary selection habits, lack of healthy food availability, and exposure to many unhealthy foods are important contributing factors to the development of obesity in college students (Racette, Deusinger, Strube, Highstein & Deusinger, 2005). Despite the awareness that foods high in sugar, salt, and fat are unhealthy and fruits and vegetables are healthy, people make unhealthy food choices (Croll, Neumark-Sztainer & Story, 2001). Research findings like these highlight a growing need for research on how to successfully provide health education to college students so that they can make healthier and more informed food choices. To make healthier food choices college students need to consider information such as food healthiness in conjunction with the motivational benefits of consuming food they find appetizing. Past research has shown that taste attributes of food compared with health attributes of food had stronger influences on overall food decisions in college students (Lim, Penrod, Ha, Bruce & Bruce, 2018). However, it has been shown that adults with higher self-control levels use both health and taste information in food decisions (Hare, Camerer & Rangel, 2009). Moreover, individuals make healthier food choices when primed to focus on attentional health cues during their decision-making processes (Gerlach, 2015; Hare, Malmaud & Rangel, 2011). Knowing whether providing health education would promote college students to make healthier food choices using both health and taste information is an important aspect of understanding the eating behaviors of college students. This study attempts to answer this

question, as well as examine the impact of healthy eating information on eating habits in college students.

CHAPTER 2

REVIEW OF LITERATURE

Healthy eating is a multi-faceted issue that must be addressed holistically. Healthy eating habits are typically formed in early to middle childhood and are shaped by one's level of physical activity, access to healthy food, and the family environment they grow up in, all of which have positive correlations with healthier eating (Rennie, Johnson & Jebb, 2005; Schwartz et al., 2011). As eating habits form, one's food preferences also begin to take shape, helping individuals independently determine favorable food attributes, such as being tasty or economical. One's food preference plays a part in influencing both healthy and unhealthy food decisions (Bruce et al., 2016), which can help form future dietary decisions (Sobal et al., 2006). Over time, people develop a "personal food system," which is essentially how past food decisions guide one to make future food decisions (Sobal et al., 2006). In their article, Sobal et al. (2006) write that while these food systems directly impact our food choices, they also impact when and where we choose to make food decisions, how often food decisions are made, and how one's food decision-making process interacts with one's culturally recognizable food choices. All three of these consequences can manifest in one's life in ways that seem not to be food-related, like deciding what gym to work out at (if said gym has an enjoyable food item), who to spend time with (if an individual provides desirable food) and even how one interacts with members of their society with differing characteristics (experience with an enjoyable food from other's culture), all of which are integral for how one interacts with their environment.

Another interesting way healthy eating decisions influence other aspects of life is how we communicate about food to each other (Wiggins, 2004). In her article, Sally Wiggins

examined what healthy eating information and how we disseminate such information to our immediate family members along with other members of society. In general, it was found that most talk concerning healthy eating information is either in the form of generic consumption advice or directed towards individual practices (Wiggins, 2004). Wiggins speculated upon the most effective ways of disseminating healthy eating information to people, stating that, based on her observations, healthy eating information is most well-received in a positive, advice-driven manner (Wiggins, 2004). Essentially, what Wiggins has shown through her research is that healthy eating information can be presented in ways that can lead to meaningful change in diets. Knowing how healthy eating information influences healthy eating decisions, and the implications that arise from healthy eating decisions in other aspects of life, are important to construct effective methods of promoting healthy eating.

Populations that are exposed to many unhealthy foods, such as college students (Racette et al., 2005), appear not to use healthy eating information when making eating decisions. Examining the characteristics of eating habits, as well as specific dietary trends of college students can help us understand why healthy eating information is not consistently applied in food decisions. Before entering the university environment, many students have been exposed to both healthy and unhealthy dietary habits in their homes. The first several years of college are when college students experience major transitions to early adulthood with environmental and lifestyle changes including leaving the parental homes. Eating habits established in the first year or two of college likely carry forward into later college years (Driskell, Kim & Goebel, 2005). Unfortunately, research has shown that the quality of food consumption decreases during this transition from adolescence to young adulthood (Cruz, Ramos, Lopes, & Araújo, 2018), and the incidence rates for obesity as one progresses from

home life and into their college years have been increasing (Gordon-Larsen, Adair, Nelson & Popkin, 2004), which might be a catalyst for the current unhealthy dietary trends we see today. College students have tendencies to make food decisions based on facets such as convenience and taste while ignoring healthy eating information, such as calorie information and portion size (Eertmans, Victoir, Vansant & Van den Bergh, 2005; Morse & Driskell, 2009). Individuals' preference for familiar foods, or neophobia, the fear to try new foods, could also prohibit exposures to new healthy food items introduced during early adulthood (Eertmans et al., 2005). This has the potential to affect eating decisions in three important ways; it could heighten the sensory appeal of familiar foods of the individual, which has the potential to make said individual rate unhealthier foods higher on a scale of preference than healthy food; it could contribute to an individual's neglect of newer, potentially healthier foods that may improve their diet; and it could also make them distrustful of healthy eating information presented to them. This could be potentially very harmful to college students during their first few years. Driskell, Kim, and Goebel (2005) reported that many college students appear to have low exposure to healthy eating information, whether it be unintentional or deliberate, and providing healthy eating information during these first years would be beneficial in the formation of healthy dietary habits of college students.

At a basic demographic level, it has been shown that there are known differences in diet trends amongst male and female college students (Davy, Benes & Driskell, 2006). In their study, researchers asked college students about specific dietary habits, such as active engagement in diet, knowing the specific sugar content of certain foods, knowledge of carbohydrates in foods, and primary sources of healthy eating information in their life. When compared to men, women were found to have tried more low-fat diets, be more likely to

receive healthy eating information from their family, state that there was too much sugar in their current dietary habits, and more likely agree that limited carbohydrate consumption is an important component of the diet process (Davy et al., 2006). These findings show that some college students are cognizant of current healthy and unhealthy dietary habits and trends but appear to not have been influenced to make healthy changes to their current diet.

Huang et al. (2003) that shows how widespread poor dietary trends are amongst college students. They found that college students suffer from overweight or obesity and consume below the recommended amount of fruit, vegetables, and fiber (Huang et al., 2003). These trends are fairly widespread across American universities and point to a need to examine why this is the case and how we can combat these dietary habits. Nelson, Kocos, Lytle, and Perry (2009) conducted a qualitative analysis through the use of focus groups to try and determine some of the underlying factors influencing weight gain, physical activity, and nutrition amongst college students. Primary contributors to college students' dietary habits and nutrition included availability of food on campus, late-night eating, alcohol, lack of time, negative experiences using campus resources, and food in dorm rooms (Nelson et al., 2009). These students also noted that the buffet style of food service, along with how food is marketed on their campus enhances these factors, which, according to the researchers, begs the question of how to combat the stigmas that perpetuate negative dietary habits on college campuses and help lead students to healthier lifestyles.

The American university environment has students, faculty, and staff all coming from different walks of life, so it is important to understand the cultural dynamics of the American university environment and the food decisions that are commonplace for this culture that help form negative dietary habits. One's environment has profound effects on one's eating

decisions, but what specifically about these environments affects our eating decisions? At any given university, college students are highly exposed to many unhealthy and non-nutritious food items (Von Ah & Kang, 2003), and coupled with the highly individualistic culture America and American academic institutions have (Levine et al., 2016), these college students appear to be less engaging with others in their eating habits and more likely to opt for unhealthy foods that are cost-efficient and tasty. Levine et al. (2016) examined culture and healthy eating through the lens of two contrasting environments; the American university environment, which emphasizes independence; and the Japanese university environment, which emphasizes interdependence and group cohesion. In Japanese culture, healthier eating is recommended through bonding with family members and engaging in eating around them, whereas in America, it is the belief that it is solely up to the individual to make healthy eating decisions for themselves (Levine et al., 2016). It was found that if one were able to stick to their culture's philosophies on healthy eating, the more likely they were to have healthier diets. What makes this difficult in the American university environment is the heterogeneous mix of cultures, so for many individuals, their own cultural healthy eating practices might become difficult to follow, so there is a potential for unhealthy eating decision habits to form.

Deliens et al. (2014) were able to illustrate environmental factors that contribute to this pattern at universities, including exams, residency situations, student societies, and overall university lifestyle (Deliens et al., 2014). All of these factors can be stress-inducing, which is a proven catalyst for the establishment of unhealthy eating habits (Von Ah et al., 2003). Developing effective models of health education that takes into account all of these environmental and cultural factors of the American university is important in helping combat the trend of obesity amongst college students. There has been past research on what works

for the university environment as well (Brace, De Andrade & Finkelstein, 2018). In their meta-analysis, Brace and colleagues sought to examine what went into an effective nutritional/healthy eating intervention when it is implemented American universities. Brace et al. (2018) found that these interventions can be effective and maximize outcomes if they are implemented only for a short term, are shown for a long duration during that short term, and use visual displays to show healthy eating information (Brace et al., 2018).

How we receive news and information has changed dramatically over the past twenty years, with younger adults today primarily receiving their news and advertisements through social media and television (Lenhart et al., 2010). Contemporary research has adapted to see which mediums are best suited to provide healthy eating information, with methods that use both technology and play, in the case of children (Lanigan, 2011). Lanigan was able to show that media was listed as a source of health information amongst children more frequently than adults. This was also seen in Ng and Hastings (2011), where college students were surveyed on how they valued their different information sources in their lives and what they perceived to be the best sources of healthy eating information. Results showed that while family and friends were considered to be the most important sources of information amongst college students, media such as the internet and TV were considered the best method for disseminating healthy eating information (Ng & Hastings, 2011). This finding helps decipher what might be the best method for providing health education, which has helped with the development of this study.

Video websites such as YouTube have also been examined for their ability to disseminating healthy eating information to their audiences. YouTube and other digital video streaming services tend to frame obesity and overweight individuals negatively, which in

turn perpetuates unhealthy eating habits (Yoo & Kim, 2012). While this finding is troubling, Sooy and colleagues (2017) wondered whether they would be able to use digital videos in a useful and helpful manner by providing healthy eating information to adolescents and college students (Sooy et al., 2017). They were able to show that digital video clips shown via YouTube, made by primary care providers, that highlight both healthy eating information as well as motivational interviewing techniques, were an effective medium for shaping adolescents and college students' perceptions on healthy eating and their ability to make healthier eating decisions. Providing health education to college students through a similar medium could also lead to changes in one's food decision making.

While there are different aspects of healthy eating information that can be presented, two pertinent items of healthy eating information that are related to food choice and important to this study are portion size and caloric information. Portion size has been studied extensively and has been reported as one of the main contributors to weight gain and obesity (Young & Nestle, 2002). Food consumption is influenced by the quantity of food people have available to them (Levitsky & Youn, 2004) and people tend to eat more as portion size increases (Spanos, Kenda & Vartanian, 2015). This phenomenon has been labeled the "portion-size effect" and has been an obstacle for researchers trying to influence the eating habits of individuals. Individuals tend to ignore portion size information (Byrd-Bredbenner & Schwartz, 2004; Croker, Sweetman & Cooke, 2009), which may contribute to difficulty gauging portion sizes for healthier foods such as fruits and vegetables (Ervin & Smiciklas-Wright, 2001). Ueland and her colleagues (2009) tested whether delivering portion size information influenced the amount of food intake. Three different groups were told that they were served either ½, 1, or 1.5 portions of pasta. The meal was the same amount of pasta

across portion size conditions. Portion size did not influence total food intake. However, across all conditions, individuals perceived that portion size is more relevant to daily nutrient requirements, rather than a guideline for the estimated amount of food intake (Ueland, Cardello, Merrill & Lesher, 2009). These results reflect a need to explore different methods of how to present portion size information to people.

The effect caloric information has on food choice has been mostly studied in research on fast food restaurants (Ahn et al., 2015; Haws & Liu, 2016; Wisdom et al., 2010). Previous research showed that the presence of healthy eating information, like caloric amounts in foods at a fast-food restaurant, reduced overall calorie intake in both healthy and overweight individuals (Ahn et al., 2015; Wisdom et al., 2010). It was also found that providing daily caloric intake targets also reduced calorie intake in healthy weight individuals (Haws & Liu, 2016). There have been some studies that have tested the effect of providing caloric information to individuals outside of the fast-food environment. Lim and his colleagues (2018) tested individuals' food choices with and without calorie information using a mouse-tracking methodology. With the addition of calorie information, food tastiness had less of an influence on participants' food choices, and food healthiness had more of an influence on food choices (Lim et al., 2018). This research shows how caloric information can impact food choices, and even decrease the influence of taste. This study attempts to replicate this finding but with healthy eating information instead of caloric information.

Attentional priming has been used in past research to investigate and influence eating behaviors (Hare, Malmaud & Rangel, 2011). In their neuroimaging study, Hare et al. (2011) presented a food-choice task under three different attention conditions that asked participants to quickly consider the food healthiness, the food taste, or any features (control) before

making food choices. The priming consisted of simple phrases stating either “Consider the Healthiness/Tastiness,” or “Make decisions naturally,” depending on the participant's condition. Subjects were found to have made healthier food choices when they were attentionally primed with the food healthiness cue compared to the control condition but said the difference was not found between the food taste and control conditions (Hare, Malmaud & Rangel, 2011). These findings suggest that attentional priming on the health attributes of food can be a successful method in directing individuals to consider food health information in food choices. That being said, it is still unknown if providing health education can change the overall influence taste and health attributes have on food choices.

The goal of providing health education to these college students is to adapt their food decision-making mechanisms to incorporate more health attributes and fewer taste attributes in their food choices. These food decision-making processes are predominantly automatic and hard to influence (Bublitz, Peracchio & Block, 2010; Cohen & Babey, 2012; Jacquier et al., 2012; Köster & Mojet, 2007; Manning & Soon, 2013; Scheibehenne, Miesler, & Todd, 2007). One of the more important mechanisms that have been researched is taste, and how taste shapes our memory of food and ultimately guides when and what we should eat. People use the word ‘taste’ to describe many different characteristics of food and beverages that influence enjoyment and aversions, including appearance, odor, flavor, texture, and other properties (Sobal et al., 2006). In previous eating decision research, taste has been identified to be a driving force behind one’s eating decisions (Kourouniotis et al., 2016). Taste is the most influential mechanism in the food decision-making process of college students (Deshpande, Basil & Basil, 2009; Kourouniotis et al., 2016; Mai & Hoffman, 2012). While analyzing the implementation of a healthy food decision-making model amongst college

students, Deshpande et al. (2009) found that taste decreased the influence of healthy eating benefits for the students. Other research has pointed to this trend, describing how college students who consider the food taste to be the ultimate driving factor in their food decision-making process were more likely to engage in the consumption of food high in fat, sugar, and salt and less likely to consume fruits and vegetables (Kourouniotis et al., 2016).

Jacquier et al. (2012) assessed the unconscious pleasure mechanisms involved in food choice decisions, which primarily influence one's taste preferences. Jacquier and her team found that unconscious/automatic pleasure mechanisms are a primary source of reference for food decision making (Jacquier et al., 2012). Notably, these decisions are often seen in selecting foods based on certain dietary restrictions an individual might have, whether the food can satisfy their current desire for indulgence, and whether the food in question is adequately priced for one to purchase it (Scheibehenne, Miesler & Todd et al., 2007). Scheilbehenne et al. (2007) described that people often must weigh these factors quickly and thus have to develop simple heuristics to help guide their food choices. If a food initially meets all the criteria of an individual's heuristic, then a quick food decision is made. It is unclear to what extent healthy eating information is involved in developing these unconscious mechanisms of eating decisions.

Raghunathan, Naylor, and Hoyer (2006) also researched just how powerful the influence of taste can be on food choice. The researchers hypothesized that consumers made unhealthy food choices due to an implicit belief that the unhealthier a food was, the better it would taste ("unhealthy = taste"), which makes unhealthy food choices more satisfactory. They found that when individuals reported their disbelief that healthiness is inversely related to taste, they still perceived unhealthier foods as tasting taste better (Raghunathan, Naylor, &

Hoyer, 2006). Raghunathan and colleagues' work highlights that that taste is a critical factor in the food decision-making process, and it is a challenge to introduce information that would lessen or even diminish the influence of taste. The influence of taste is so large that it often disrupts an individual's beliefs about healthy eating, and often makes the individual make food choices that are incompatible with their beliefs (Mai & Hoffmann, 2012). All levels of society place a heavy emphasis on taste in the food decision-making process. This study aimed to explore an efficacious manner to promote healthy eating with reduced emphasis on taste in food decisions.

Research Question

Previous research has provided valuable insight into what we know about the characteristics of the eating habits of college students, mechanisms underlying eating decisions, and factors that influence eating decisions. What these studies point to is that there is some uncertainty surrounding the direct impact of healthy eating information on the eating behaviors of college students. More specifically, it is not fully answered how actively processing healthy eating information would influence the incorporation of food healthiness and taste attributes in eating decisions. This study attempts to answer this question and provide more insight into this growing field of research.

Hypothesis

It was hypothesized that participants provided with health education (i.e., food calories and portion size) would show a significant decrease of taste attributes and an increase of health attributes on their food choices when compared to participants in the control condition who were provided non-food related information.

CHAPTER 3

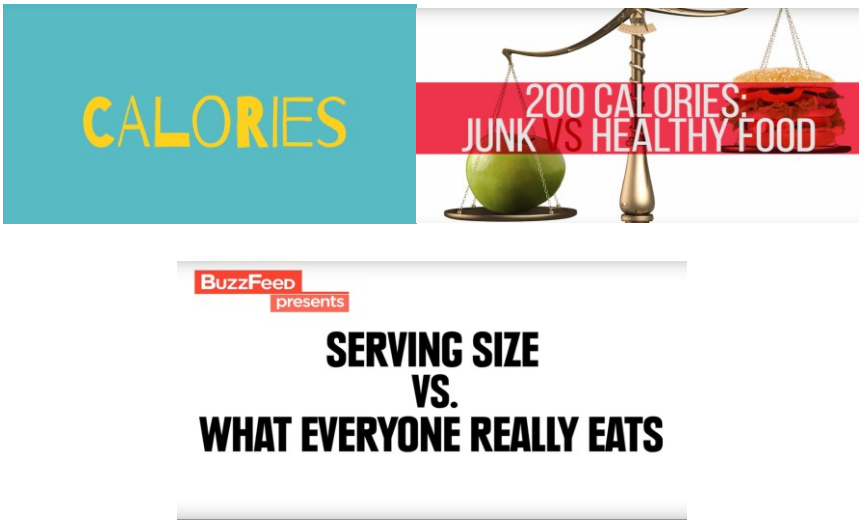
METHODOLOGY

Procedure

Participants were asked not to eat food for 3 hours before coming to the lab to ensure their motivation for food choices. After going through the consent process, research personnel measured the participants' height and weight. Participants were randomly assigned to either the healthy information group or the control group. Following the assignment into a group, participants were asked to fill out a demographic survey. Participants then completed a pre-Behavioral Visual Analog Scale to report their current hunger levels. They then completed the food rating and choice tasks measuring participants' baseline food taste and healthiness ratings and choices on foods (pre-education). Participants made their responses by pushing keys on a keyboard. Participants were told they would receive one of the food items they chose to eat during the food choice task to ensure their motivation for realistic food choices. After completion of food choice tasks, participants in the health-education group watched a short video clip totaling 10 minutes about healthy eating information including portion size and calorie, while participants in the control group watched a 10-minute video clip about non-food related information including solar panels and solar energy (see Figure 3.1). To ensure participants paid close attention, a 10-item quiz covering the topics in the video clips immediately after viewing was given to both the health education group (M = 8.69, SD = 1.339) and the control group (M = 6.11, SD = 1.805). After watching the video clips, all participants then were asked to complete the same food rating and choice tasks they completed at pre-education to measure their health and taste ratings and food choices after being exposed to information in the video clip. Participants then completed a

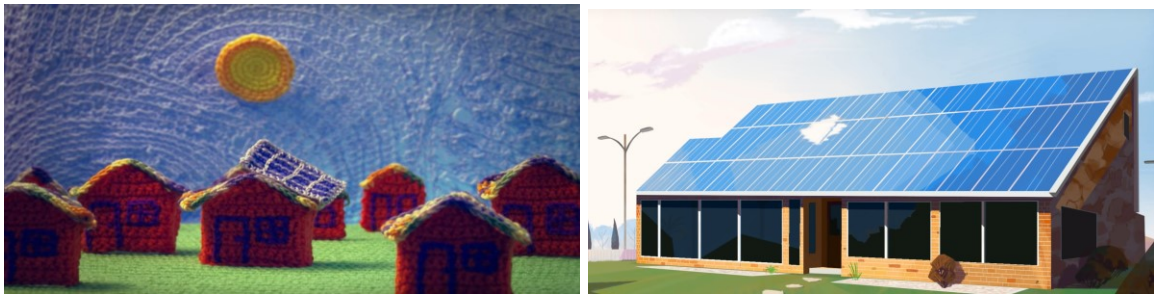
post-Behavioral Visual Analog Scale of hunger to report their hunger levels. Lastly, participants completed the surveys mentioned above, granted credit for their participation, and then sent home.

A. Health Education Video Clip



https://1drv.ms/v/s!AnPcjK66Cb-0wwzaLSoGZTlDIrZm

B. Control Video Clip



https://1drv.ms/v/s!AnPcjK66Cb-0ww0wXux7eEuw7a1M

Figure 3.1. 3.1.A. 10-minute Health Education Videos delivering Healthy Eating Information; 3.1.B. 10-minute Control Video delivering Non-Food Related, Solar Energy Information

Participants

Fifty-six healthy college students (49 female, 7 male; *M* = 21.14 years, *SD* = 1.75), with normal or corrected-to-normal vision participated. All participants were recruited from the University of Missouri-Kansas City PsychPool and had a comprehensive understanding of the English language. The racial background of the participants was 35 Caucasian (63%), 7 Black (13%), 5 Hispanic (9%), 5 Asian (9%), and 4 Multiracial (6%). The mean body mass index (BMI) was 24.71 (kg/m^2; *SD* = 5.73, range 17.4–50.4). Based on the Center for Disease Control and Prevention (CDC) guideline (2020), participants were categorized as healthy weight ($18.5 \leq BMI < 24.9$, $n = 35$; 63%), overweight ($25 \leq BMI < 29.9$, $n = 12$; 21%), and obese ($BMI \geq 30$, $n = 9$; 16%). Three additional participants were recruited but the data were excluded from analyses because they failed to complete the experiment ($n = 1$), or repeated the same responses for all trials during the second trial of the computer task that made the estimations of health and taste attributes impossible ($n = 2$). Participants were randomly assigned to the health-education condition that was shown healthy eating information ($n = 29$, 25 female, $M = 21.18$ years, $SD = 1.93$), and the control condition ($n = 27$, 24 female, $M = 21.25$ years, $SD = 1.92$). There were no reported significant sex-ratio differences between the groups. Before the participant arrived, participant condition was assigned via a random selection of a condition paper that was placed in the participant folder (see Appendix A). This study was approved by the Institutional Review Board at the University of Missouri-Kansas City.

Materials

Computerized Food Rating and Choice Tasks (Lim et al., 2018)

Experimental stimuli included 30 healthy food items, such as vegetables, fruits, and beans, and 30 unhealthy food items, such as fast food, sweet desserts, processed meats, and fried foods. Participants rated each food item based on food healthiness and taste, and whether they would choose to eat or not. Sixty trials consisting of the experimental stimuli were used for each attribute rating and food choice. Four-point scales were used for the taste attributes (very bad, bad, good, or very good) and health attributes (very unhealthy, unhealthy, healthy, or very healthy) for each food item. Preference for each food item was measured using a five-point rating scale (strongly dislike, dislike, neutral, like, or strongly like). Four-point scales were used for food choices (strong no, no, yes, strong yes). The order of the healthiness rating and taste ratings was counterbalanced across participants. Food images were presented without any logos or brand names. The stimulus presentation and behavioral response collection for the computerized food-rating and choice task was controlled by Presentation software (Neurobehavioral Systems, Albany, CA).

Surveys

Four surveys were used to measure eating behavior, personal diet trends, and nutritional knowledge. The Weight Loss Choice Questionnaire (WCQ; Lim & Bruce, 2015) is a 30-question forced-choice questionnaire which asks 3 questions about potential current diet engagement, and 27 hypothetical choices, indicating which option they would prefer a smaller immediate weight loss, or a larger weight loss in the specified number of days (see Appendix B). The Eating Behavior Inventory (EBI; O'Neil et al., 1979) is a 26-item Likert-style questionnaire that gauges the eating behaviors by asking about specific behaviors done

over the previous six-months (see Appendix C). Stunkard's Three-Factor Eating Inventory (Stunkard & Messick, 1985) is a 51-item combined true/false and four-point rating questionnaire which asks about a participant's current eating habits (see Appendix D). The participant's nutritional knowledge was measured using the General Nutrition Knowledge Questionnaire (Kliemann, Wardle, Johnson, Croker, 2016), which is a 48-item questionnaire for measuring participants' knowledge of different aspects of nutrition knowledge such as dietary recommendations, food groups, healthy food choices, diet, and disease and weight management. Four surveys were also used to measure self-control and delay discounting (see Appendix E). The Brief Self-Control Scale (Tangney et al., 2004) is a 36-item Likert scale questionnaire measuring a participant's self-control levels (see Appendix F). Eysenck's Impulsivity Scale (EYIS; Eysenck, Easting, & Pearson, 1984) is a 23-item forced-choice questionnaire measuring the impulsive behaviors of participants (see Appendix G). Delaying Gratification Inventory (Hoerger, Quirk, & Weed, 2011) a 35-item Likert-style questionnaire that measures a participant's ability for accepting delayed gratification regarding food, physical pleasure, social interactions, money, and achievement (see Appendix H). The Monetary Choice Questionnaire (Kirby et al., 1999) is a 27-item forced-choice questionnaire that measures a participant's delay discounting, where the participant chooses to receive smaller immediate monetary rewards or larger delayed monetary rewards (see Appendix I). The current hunger level was measured using the Behavioral Visual Analog Scale of hunger (Sayer, Peters, Pan, Wyatt & Hill, 2018), where participants mark their current state of hunger with a straight line on a 10cm line, along with the hunger level, participants' thirst, satiation, nausea, stomach discomfort, sickness, and average energy level were measured as well. The hunger level was taken using this survey before and after the participant completed

the computerized food rating and choice task (pre-and post-health education) (see Appendix J).

CHAPTER 4

RESULTS

Statistical analyses were modeled on previous work demonstrating that exposure to advertising literacy information decreased the importance of taste in food decision making (Ha et al., 2018). To compute each participant's decision weights of taste attributes and health attributes in food decisions, a linear regression model predicting food decisions from taste and health ratings was fitted for each participant. A beta coefficient of taste attributes represented the relative importance of the taste in food preference, and a beta coefficient of health attributes represented the relative importance of the healthiness in food decisions at the individual level. Similarly, decision weights of taste and health attributes in food preferences were computed.

Results for the main hypothesis of this study were analyzed using a 2 x 2 mixed-model ANOVA, to examine how the relative importance of health attributes on food choices, as well as the relative importance of taste attributes on food choices changed before and after health education. Correlational analyses were run between surveys and taste/health attributes at pre and post-health education, and covariate analyses of hunger level were conducted.

Taste Attributes

A mixed-model ANOVA was conducted with time (pre, post) as a within-subject factor and group (health education, control) as a between-subject factor for the beta coefficient of taste attributes on food choices. Results showed that there was no significant interaction effect between time and group on the beta coefficient of taste attributes in food choices, $F(1, 54) = 1.284$, $p = .262$, partial $\eta^2 = 0.023$.

To explore if the health education influenced food preferences, a mixed-model ANOVA was conducted with time (pre, post) as a within-subject factor and group (health education, control) as a between-subject factor for the beta coefficient of taste attributes on food preferences. The results showed that the main effect of time was not significant, $F(1, 54) = 0.191$, $p = .664$, partial $\eta^2 = 0.004$. But there was a significant interaction effect between time and group on the beta coefficient of taste attributes, $F(1, 54) = 10.641$, $p = .002$, partial $\eta^2 = 0.165$. Paired *t*-tests results showed that the health education group ($\Delta M = -0.148$) showed a significant decrease of the beta coefficient of taste attributes in food preferences after health education ($M_{pre} = 1.095$, $M_{post} = 0.947$), $t(28) = 2.45$, $p = 0.021$. In contrast, the control group ($\Delta M = 0.113$) showed a significant increase of the beta coefficient of taste attributes in food preferences after non-health education ($M_{pre} = 1.034$, $M_{post} = 1.148$), $t(26) = -2.18$, $p = 0.038$ (see Figure 4.1). These results are indicative that exposure to healthy eating information leads to a decrease of taste importance in food preferences in the health education group. This result supported the initial hypothesis that the health education group would show a significant decrease of taste attributes on their food choices after being educated with healthy eating information. In the control group, the results showed that the importance of taste attributes increased significantly over time without the presence of healthy eating information, further indicating that actively processing healthy eating information may have played a role in diminishing the influence of taste in one's food preference making.

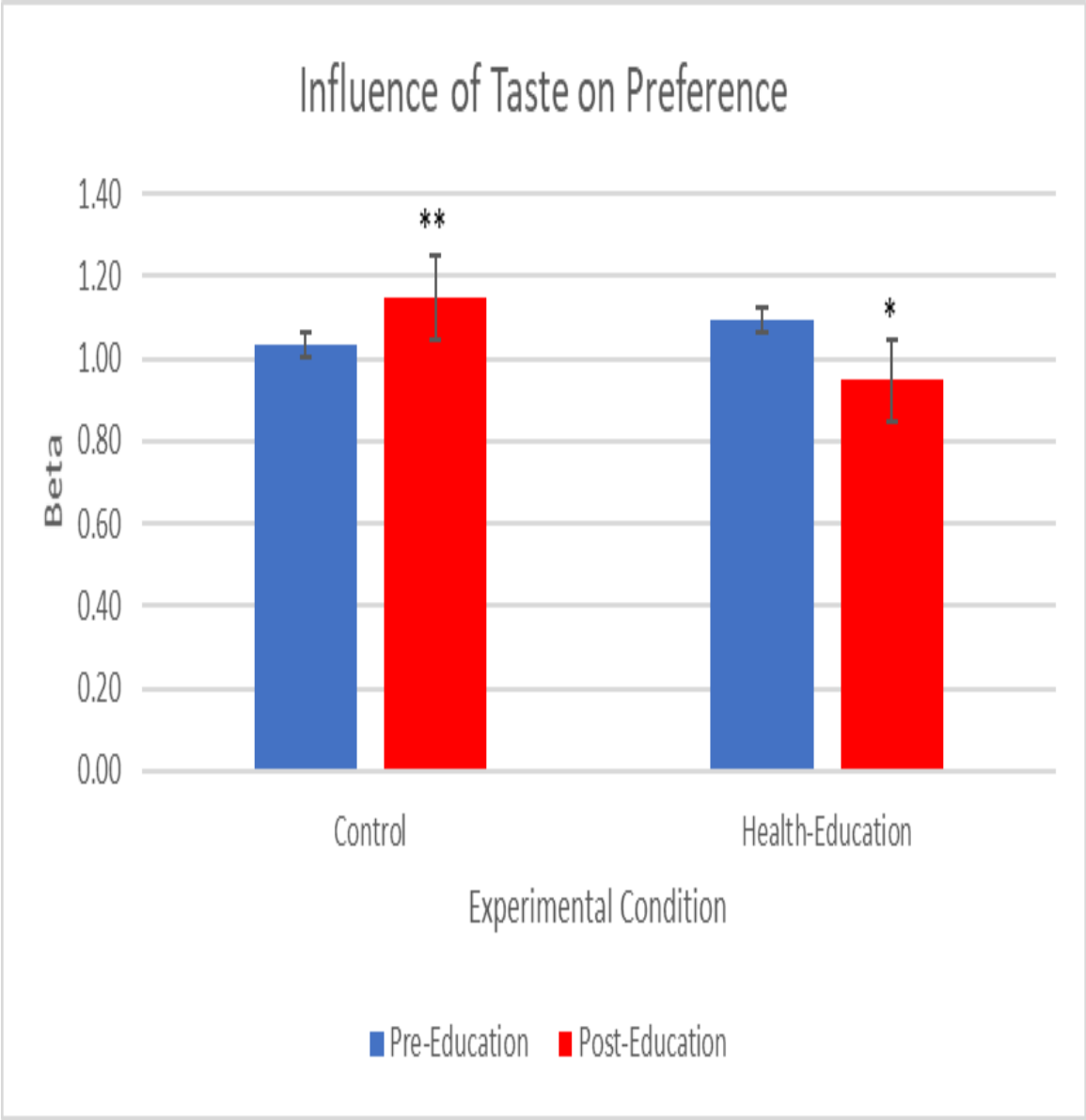


Figure 4.1. Influence of Taste Attributes in Food Preference Making Before and After Health Education

Note. *$p = 0.02$ **$p = 0.038$.

Health Attributes

Similarly, a mixed-model ANOVA was conducted with time (pre, post) as a within-subject factor and group (health education, control) as a between-subject factor for the beta coefficient of health attributes on food choices. However, the results showed that there was no significant interaction effect between time and group on the beta coefficient of health attributes, $F(1, 54) = 0.058$, $p = .810$, partial $\eta^2 = 0.001$.

A mixed-model ANOVA was conducted with time (pre, post) as a within-subject factor and group (health education, control) as a between-subject factor for the beta coefficient of health attributes on food preferences. The results showed no significant main effect of time, $F(1, 54) = 1.594$, $p = .212$, partial $\eta^2 = 0.029$. Additionally, there was no significant interaction found between time and group on the beta coefficient of health attributes, $F(1, 54) = 2.607$, $p = .112$, partial $\eta^2 = 0.046$. Wilcoxon Signed-Ranked Test results showed that the health education group did not show any significant change of the beta coefficient of health attributes in food preferences after being provided with health education ($Z = -1.503$, $p = 0.133$). The control group did not show any change of the beta coefficient of health attributes in food preferences after being shown non-health education (($Z = -0.192$, $p = 0.848$). (see Figure 4.2). These findings suggested that health education did not influence the relative importance of health attributes in food preferences. This result did not support the initial hypothesis that the health education condition would show a significant increase of health attributes on their food decisions after being provided healthy eating education.

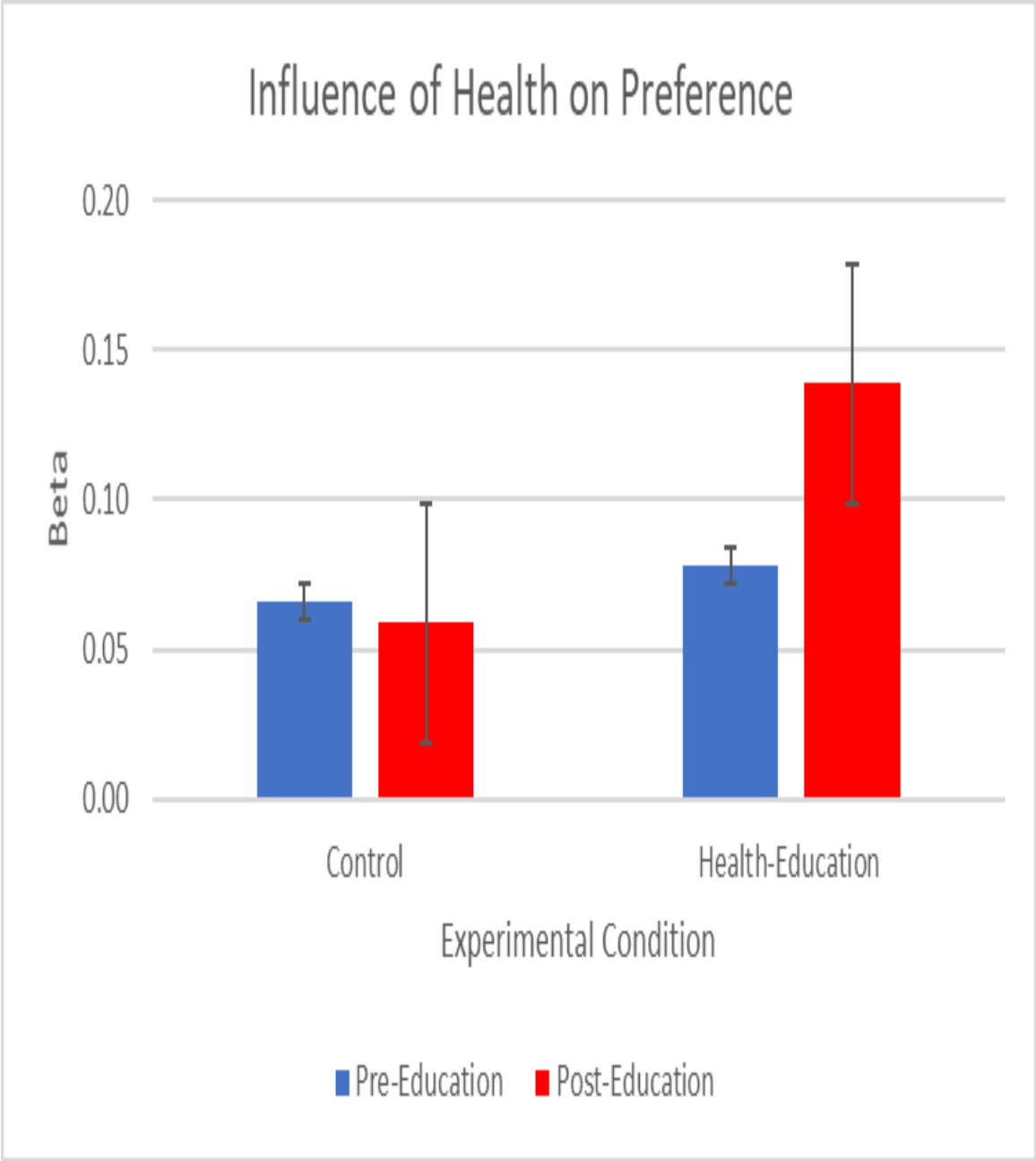


Figure 4.2. Influence of Health Attributes in Food **Preference** Making Before and After Health Education

Surveys

Exploratory correlational analyses were completed on all surveys given to participants to see if there were any unique trends amongst participant groups that could help further explain both group characteristics and potentially the results obtained from the study. The outcome variables assessed in this study (i.e., changes in the decision weights of taste and health attributes in food preferences after healthy eating education) have the potential to be affected by the other factors that are measured in the surveys, and thus it was important to assess for any contributing factors towards our results. Total scores obtained from the surveys were correlated with the pre- and post health education taste and health attribute beta coefficients in food preferences in both the health education and control groups to assess for possible correlations, except for the visual analog scales, where paired-samples t-tests were performed to assess for a significant difference in participant responses to those questions across the duration of the experiment. Descriptive statistics for surveys can be found in Table 4.1 for the health education group and Table 4.2 for the control group.

After running correlational analyses between the surveys and health/taste attributes in food preferences, no variables that measured using surveys were found to be significantly correlated with the difference between the beta coefficients of taste or health attributes in food preferences between pre- and post-health education in both control and health education conditions, indicating no significant trends across the variables measured in the surveys distributed to participants in either group.

Table 4.1**:** Participant Survey Descriptive Statistics for the Health Education Group

	N	Minimum	Maximum	Mean	Std. Deviation
Visual Analog Scale Hunger Pre-Health Education	29	0	10	4.031	2.7586
Visual Analog Scale Hunger Post-Health Education	29	0	10	5.707	3.2142
Weight Loss Choice Questionnaire	26	0	1	0.453	0.498
Monetary Choice Questionnaire	26	0	1	0.494	0.500
Self-Control Scale	26	90	160	121.19	15.577
Eysenck Impulsivity Questionnaire	28	0	19	9.04	5.051
General Nutritional Knowledge Questionnaire Part 1	27	6	14	10.93	1.999
General Nutritional Knowledge Questionnaire Part 2	27	9	29	21.07	4.42
General Nutritional Knowledge Questionnaire Part 3	27	4	12	8.44	1.888
General Nutritional Knowledge Questionnaire Part 4	27	7	19	13.19	3.051
Delayed Gratification Index	28	102	159	130.36	19.22
Three-Factor Eating Questionnaire_- Dietary Restraint	27	3	16	9.07	4.269
Three-Factor Eating Questionnaire_- Disinhibition	27	0	11	6.26	3.157
Three-Factor Eating Questionnaire_- Hunger	26	0	12	6.12	3.315

Table 4.2**:** Participant Survey Descriptive Statistics for the Control Group

	N	Minimum	Maximum	Mean	Std. Deviation
Visual Analog Scale Hunger Pre-Health Education	27	0	9.4	3.733	2.8329
Visual Analog Scale Hunger Post-Health Education	27	0	10	5.652	2.5673
Weight Loss Choice Questionnaire	25	0	1	0.424	0.494
Monetary Choice Questionnaire	25	0	1	0.476	0.499
Self-Control Scale	26	79	146	121.04	18.773
Eysenck Impulsivity Questionnaire	27	0	13	7.74	4.166
General Nutritional Knowledge Questionnaire Part 1	27	7	16	11.7	2.25
General Nutritional Knowledge Questionnaire Part 2	27	13	30	22.07	4.446
General Nutritional Knowledge Questionnaire Part 3	27	4	12	9	1.881
General Nutritional Knowledge Questionnaire Part 4	27	8	19	13.37	3.26
Delayed Gratification Index	27	95	149	130.37	17.813
Three-Factor Eating Questionnaire_-Dietary Restraint	26	0	17	10.42	4.843
Three-Factor Eating Questionnaire_-Disinhibition	26	0	12	6.19	3.163
Three-Factor Eating Questionnaire_-Hunger	26	1	12	5.46	3.277

Hunger Level

Measurements for hunger were taken using the behavioral visual analog scale of hunger before and after health education. Assessing hunger levels as a covariate was done through a mixed-model 2 X 2 ANCOVA with time (pre, post) as a within-subject factor and group (health education, control) as a between-subject factor for the beta coefficient of taste attributes in food preferences, and hunger level at pre-health education as a covariate. The results showed that the interaction effect between time and group was still significant after controlling the pre-health education hunger level, $F(1, 53) = 10.76$, $p = .002$, $\eta_p^2 = .17$, indicating that the group difference in the importance of taste in food preferences was not driven by the hunger.

Assessing the significance of the difference in hunger between groups was done through independent samples *t*-tests. The results showed that the hunger level of the health education group ($M = 4.03$, SD = 2.76), and that of the control group ($M = 3.73$, SD = 2.83) were not significantly different at pre-health education, $t(54) = 0.12$, $p = .990$. Also, the hunger levels of the health education group ($M = 6.25$, SD = 3.38), and those of the control group ($M = 6.52$, SD = 2.67) were not significantly different at post health education, $t(53) = -0.11$, $p = .076$.

To assess the changes in hunger levels before and after health education, paired-samples t-tests were conducted on the pre- and post health education visual analog scales in each group. Significant differences were found within question 1 (“How hungry do you feel?”, $t(26) = -4.722$, $p < .01$), question 3 (“How full do you feel?”, $t(26) = 3.780$, $p < .01$), and question 7 (“On average my energy level is?”, $t(26) = 4.827$, $p < .01$) in the control group. And significant differences were found within question 1 (“How hungry do you

feel?", $t(28) = -4.553$, $p < .01$), question 2 ("How thirsty do you feel right now?", $t(28) = -2.153$, $p = .04$), question 3 ("How full do you feel?", $t(28) = 2.966$, $p < .01$), question 4 ("How nauseated do you feel right now?", $t(28) = -2.592$, $p = .015$), and question 7 ("On average my energy level is?", $t(28) = 4.113$, $p < .01$) in the health education group. These results indicate that participants in both the control and health education groups experience a significant increase in their hunger level, and significant decreases in their level of satiety and energy level, with the health education group also experiencing an increase in their thirst level and nausea.

CHAPTER 5

DISCUSSION

The overall objective of this study was to determine if health education can impact food decisions and preferences in college students. As mentioned previously, obesity among college students is a growing problem, so developing methods that help these students make healthier food choices and rely less on the taste attributes of food is critical. The present study findings revealed that exposure to healthy eating information delivering food calorie and portion size information via video in the health education group significantly reduced the importance of taste in the food preferences. However, this change was not present in the control condition, and rather the importance of taste in food preferences increased significantly from pre- to post-non-health education. Hunger level was analyzed as a covariate to see if the group difference in the importance of taste in food preferences was demonstrated by hunger. In the analyses, the group difference of taste attributes in food preferences was still significant when controlling for hunger level. The hunger level was not found to be significantly different between the two groups at both the pre and post health education measurements. And both groups saw a significant increase in the hunger level between pre-health education and post-health education. These findings together provide evidence that providing health education was effective in reducing the importance of taste in the food preferences of college students.

The findings in this study are similar to what previous research has found on healthy eating information and food decision-making (Ha et al., 2018; Hare, Malmaud & Rangel, 2011; Lim et al., 2018). Ha et al., (2018) implemented a food advertising literacy training that delivered advertising knowledge to children using videos and measured changes in food

health and taste attributes in food decisions. Children who received the training showed a decrease of taste attributes in children's food choices, while children in the control condition did not show a significant change. The results from this current study were able to build upon this finding, showing that promoting healthy eating information is effective for decreasing taste attributes in individual food choices. Hare et al. (2011) presented a food-choice task to participants that had attentional cues to direct participants to pay attention to the healthier aspects of the food presented. Subjects were found to have made healthier food choices in the presence of health cues (Hare, Malmaud & Rangel, 2011). The findings of our current study obtained by having the participants pay attention to healthy eating information build upon Hare et al. (2011)'s findings and adds to the growing literature on the importance of providing education on healthy food choices. Directing the participant's attention towards healthy eating information led to a significant decrease in the taste attributes of food choices. Lim et al. (2018) examined the effects of calorie labeling on an individual's integration of health attributes in their food choices. The researchers were able to find that participants made healthier choices with calorie information present, and the integration of health attributes in food choices was delayed without calorie information (Lim et al., 2018). What differs in this study from Lim et al. (2018) was the use of healthy eating information including both portion size and calories before food choices instead of presenting calorie labeling at the same time as food choices. Similar to Lim et al. study, the current study was able to find significantly less integration of taste attributes by the participants in their food preferences.

Food taste is the main factor determining food choices and consumptions (Glanz et al., 1998), and higher importance of food taste has been shown to interfere with well-rounded

diets (Vadiveloo et al., 2013). In their experiment, Vadiveloo et al. (2013) highlighted either health attributes or taste attributes of food to their participants. Individuals who indicated that they favor taste importance in their consumption habits rated the food with the taste attributes promoted to be tastier than the food with health attributes promoted, even though the foods were identical (Vadiveloo et al., 2013). The result of this current study appears to counteract this effect, instead of showing how strong of an influence being presented with healthy eating information can be.

College students tend to rely on taste for food preferences while ignoring calorie information and portion size (Morse & Drsikell, 2009), but past research has inferred that providing healthy eating information would be beneficial in the formation of healthy dietary habits of college students (Driskell, Kim & Goebel, 2005). These findings support this inference, showing that providing healthy eating information in a health-oriented way can lead to healthier food choices, and perhaps be helpful in obesity prevention. Additionally, our findings also show that lack of this beneficial healthy eating information could potentially lead students to place a heavy emphasis on taste attributes in food preferences, which in turn to continue to make unhealthy eating decisions.

Future research should focus efforts on ways to implement and provide healthy eating information to college students to prevent a decrease in food consumption quality. Past research has examined the dietary decision-making behaviors of overweight and obese individuals, and have found that these individuals are highly susceptible to risk traits like impulsivity and sensitivity to rewards, which has the potential to lead their food preference-making process in an unhealthy direction (Gerlach, 2015). That being said, universities have an opportunity to intervene on behalf of these students and provide resources and

interventions that can combat this trend. Gerlach (2015) showed that when participants have their attention focused on the healthy eating information being presented to them in this study, the risk factors mentioned previously appeared to not factor in their food preference making processes. Future research can use the results of this study, along with research such as Gerlach (2015), as a way to examine and determine what might be effective ways to teach healthy eating information for college students so that they could build long-lasting life habits of healthy eating and the campus environment could help students' establishment of healthy eating and lifestyles.

The results obtained from this study have shown an effective method of providing health education to college students, a population that is highly exposed to unhealthy food and is heavily reliant on factors such as taste and convenience that prevent them from making healthy food preferences. As current numbers have shown the concerning trend of overweight and obesity amongst the American college student, this study provides an opportunity for universities across the country to look at effective ways of sharing healthy eating information with their student population.

The study had several limitations present. The overall sample size was well below the proposed sample size, so the extrapolation of results must be done carefully. Even though there was a control group, the study was not a double-blind experiment. There was a participant imbalance regarding sex within the groups. But there were no significant sex-ratio differences between groups, which shows that the main findings were not related to the effect of sex. It is important to note that the number of healthy and overweight individuals was not balanced across the study, so examining these results through the lens of weight status must be done cautiously. Future research should set out to test how individuals with healthy

weight and individuals with overweight or obese status make food preferences after being taught healthy eating information.

The implications these results have can be applied to real-world, American university settings. These results could be useful when universities try to come up with better healthy eating information education strategies for their students. Having students exposed to healthy eating information continually could be a contributing factor in changing a college student's food-decision making, which in turn could help alleviate the growing concerns surrounding obesity levels within the American university environment. While it is important to note that the presence of healthy eating information alone most likely won't change the dietary habits of the student populace, it could play a part in helping colleges and universities improve the overall physical health and wellness of their student population.

These methods described in this study could allow universities to potentially help their college students in the development of nutrition-related skills and behaviors that in turn help their healthy eating behaviors and improve their overall quality of life. With this study's findings, one can see that exposure to healthy eating information could improve healthy eating and food preference making and has positive implications for preventing obesity during college and potentially later in life.

APPENDIX

APPENDIX A

Participant Randomization Sheet

Healthy Eating Study

ID # _____Cell _____ Height _____Weight _____BMI _____BMI

Category HW / OW / OB

Comments_____

Cell	Cond.	NY Order	Healthiness/Taste Rating Order
1	I	NY	H-T
2	I	NY	H-T
3	I	NY	H-T
4	I	NY	H-T
5	I	NY	T-H
6	I	NY	T-H
7	I	NY	T-H
8	I	NY	T-H
9	I	YN	H-T
10	I	YN	H-T
11	I	YN	H-T
12	I	YN	H-T
13	I	YN	T-H

14	I	YN	T-H
15	I	YN	T-H
16	I	YN	T-H
17	C	NY	H-T
18	C	NY	H-T
19	C	NY	H-T
20	C	NY	H-T
21	C	NY	T-H
22	C	NY	T-H
23	C	NY	T-H
24	C	NY	T-H
25	C	YN	H-T
26	C	YN	H-T
27	C	YN	H-T
28	C	YN	H-T
29	C	YN	T-H
30	C	YN	T-H
31	C	YN	T-H
32	C	YN	T-H

APPENDIX B

Weight Loss Choice Questionnaire (Lim & Bruce, 2015)

Weight-loss Choice Questionnaire (WCQ)

For each of the next 27 hypothetical choices, please indicate which option you would prefer: the smaller immediate weight loss, or the larger weight loss in the specified number of days.

Are you interested in losing body weight?		Yes/No
How much body weight do you wish to lose?		____ LBS
Are you currently dieting?		Yes/No
1. Would you prefer to lose	(A) 5.4 lbs immediately, or	(B)5.5 lbs in 117 days?
2. Would you prefer to lose	(A) 5.5 lbs immediately, or	(B)7.5 lbs in 61 days?
3. Would you prefer to lose	(A) 1.9 lbs immediately, or	(B)2.5 lbs in 53 days?
4. Would you prefer to lose	(A) 3.1 lbs immediately, or	(B)8.5 lbs in 7 days?
5. Would you prefer to lose	(A) 1.4 lbs immediately, or	(B)2.5 lbs in 19 days?
6. Would you prefer to lose	(A) 4.7 lbs immediately, or	(B)5.0 lbs in 160 days?
7. Would you prefer to lose	(A) 1.5 lbs immediately, or	(B)3.5 lbs in 13 days?
8. Would you prefer to lose	(A) 2.5 lbs immediately, or	(B)6.0 lbs in 14 days?
9. Would you prefer to lose	(A) 7.8 lbs immediately, or	(B)8.0 lbs in 162 days?
10. Would you prefer to lose	(A) 4.0 lbs immediately, or	(B)5.5 lbs in 62 days?
11. Would you prefer to lose	(A) 1.1 lbs immediately, or	(B)3.0 lbs in 7 days?
12. Would you prefer to lose	(A) 6.7 lbs immediately, or	(B)7.5 lbs in 119 days?
13. Would you prefer to lose	(A) 3.4 lbs immediately, or	(B)3.5 lbs in 186days?
14. Would you prefer to lose	(A) 2.7 lbs immediately, or	(B)5.0 lbs in 21 days?
15. Would you prefer to lose	(A) 6.9 lbs immediately, or	(B) 8.5 lbs in 91 days?
16. Would you prefer to lose	(A) 4.9 lbs immediately, or	(B) 6.0 lbs in 89 days?
17. Would you prefer to lose	(A) 8.0 lbs immediately, or	(B) 8.5 lbs in 157days?
18. Would you prefer to lose	(A) 2.4 lbs immediately, or	(B) 3.5 lbs in 29 days?
19. Would you prefer to lose	(A) 3.3 lbs immediately, or	(B) 8.0 lbs in 14 days?
20. Would you prefer to lose	(A) 2.8 lbs immediately, or	(B) 3.0 lbs in 179days?
21. Would you prefer to lose	(A) 3.4 lbs immediately, or	(B) 5.0 lbs in 30 days?
22. Would you prefer to lose	(A) 2.5 lbs immediately, or	(B) 3.0 lbs in 80 days?
23. Would you prefer to lose	(A) 4.1 lbs immediately, or	(B) 7.5 lbs in 20 days?
24. Would you prefer to lose	(A) 5.4 lbs immediately, or	(B) 6.0 lbs in 111days?
25. Would you prefer to lose	(A) 5.4 lbs immediately, or	(B) 8.0 lbs in 30 days?
26. Would you prefer to lose	(A) 2.2 lbs immediately, or	(B) 2.5 lbs in 136days?
27. Would you prefer to lose	(A) 2.0 lbs imm ediately, or	(B) 5.5 lbs in 7 days?

APPENDIX C

Eating Behavior Inventory (EBI; O'Neil et al., 1979)

EBI

For each statement, please circle the number that best describes your behavior during the last 6 months.

Never of Hardly Ever Some of the time Half of the time Much of the time Always

1 2 3 4 5

1. I carefully watch the quantity of food that I eat.

1 2 3 4 5

2. I eat foods that I believe will aid me in losing weight.

1 2 3 4 5

3. I keep 1 or 2 raw vegetables available for snacks.

1 2 3 4 5

4. I record the type and quantity of food which I eat.

1 2 3 4 5

5. I weigh myself daily.

1 2 3 4 5

6. I refuse food offered to me by others.

1 2 3 4 5

7. I eat quickly compared to most other people.

1 2 3 4 5

8. I consciously try to slow down my eating rate.

1 2 3 4 5

9. I eat at only one place in my home.

1 2 3 4 5

10. I use the same placement and other utensils for each meal.

1 2 3 4 5

11. I eat and just can't seem to stop.

1 2 3 4 5

12. I eat in the middle of the night.

1 2 3 4 5

13. I snack after supper.

1 2 3 4 5

14. My emotions cause me to eat.

1 2 3 4 5

15. I buy ready-to-eat snack foods for myself.

1 2 3 4 5

16. I shop when I'm hungry.

1 2 3 4 5

17. I shop from a list.

1 2 3 4 5

18. I leave food on my plate.

1 2 3 4 5

19. I serve food family style (serve from bowls on the table).

1 2 3 4 5

20. I watch TV, read, work, or do other things while I eat.

1 2 3 4 5

21. If I'm served too much, I leave food on my plate.

1 2 3 4 5

22. Generally, while I'm at home, I leave the table as soon as I finish eating.

1 2 3 4 5

23. I keep a graph of my weight.

1 2 3 4 5

24. I eat when I'm not really hungry.

1 2 3 4 5

25. I store food in containers where it is not readily visible or in a closed cupboard.

1 2 3 4 5

26. I decide ahead of time what I will eat for meals and snacks.

1 2 3 4 5

APPENDIX D

Stunkard's Three-Factor Eating Inventory (Stunkard & Messick, 1985)

Three-Factor Eating Questionnaire Part I

1. When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal. T / F

2. I usually eat too much at social occasions, like parties and picnics. T / F

3. I am usually so hungry that I eat more than three times a day. T / F

4. When I have eaten my quota of calories, I am usually good about not eating anymore. T / F

5. Dieting is so hard for me because I just get too hungry. T / F

6. I deliberately take small helpings as a means of controlling my weight. T / F

7. Sometimes things just taste so good that I keep on eating even when I am no longer hungry. T / F

8. Since I am often hungry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat. T / F

9. When I feel anxious, I find myself eating. 10. Life is too short to worry about dieting. T / F

11. Since my weight goes up and down, I have gone on reducing diets more than once. T / F

12. I often feel so hungry that I just have to eat something. T / F

13. When I am with someone who is overeating, I usually overeat too. T / F

14. I have a pretty good idea of the number of calories in common food. T / F

15. Sometimes when I start eating, I just can't seem to stop. T / F

16. It is not difficult for me to leave something on my plate. T / F

17. At certain times of the day, I get hungry because I have gotten used to eating then. T / F

18. While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it. T / F

19. Being with someone who is eating often makes me hungry enough to eat also. T / F

20. When I feel blue, I often overeat. T / F

21. I enjoy eating too much to spoil it by counting calories or watching my weight. T / F

22. When I see a real delicacy, I often get so hungry that I have to eat right away. T / F

23. I often stop eating when I am not really full as a conscious means of limiting the amount that I eat. T / F

24. I get so hungry that my stomach often seems like a bottomless pit. T / F

25. My weight has hardly changed at all in the last ten years. T / F

26. I am always hungry so it is hard for me to stop eating before I finish the food on my plate. T / F

27. When I feel lonely, I console myself by eating. T / F

28. I consciously hold back at meals in order not to gain weight. T / F

29. I sometimes get very hungry late in the evening or at night. T / F

30. I eat anything I want, any time I want. T / F

31. Without even thinking about it, I take a long time to eat. T / F

32. I count calories as a conscious means of controlling my weight. T / F

33. I do not eat some foods because they make me fat. T / F

34. I am always hungry enough to eat at any time. T / F

35. I pay a great deal of attention to changes in my figure. T / F

36. While on a diet, if I eat food that is not allowed, I often then splurge and eat other high-calorie foods. T / F

Part II

Directions: Please answer the following questions by circling the number above the response that is appropriate to you.

37. How often are you dieting in a conscious effort to control your weight?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

38. Would a weight fluctuation of 5 lbs. affect the way you live your life?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

39. How often do you feel hungry?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

40. Do your feelings of guilt about overeating help you to control your food intake?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

41. How difficult would it be for you to stop eating halfway through dinner and not eat for the next four hours?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

42. How conscious are you of what you are eating?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

43. How frequently do you avoid ‘stocking up’ on tempting foods?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

44. How likely are you to shop for low-calorie foods?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

45. Do you eat sensibly in front of others and splurge alone?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

46. How likely are you to consciously eat slowly in order to cut down on how much you eat?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

47. How frequently do you skip dessert because you are no longer hungry?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

48. How likely are you to consciously eat less than you want?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely e

49. Do you go on eating binges though you are not hungry?

1	2	3	4
Rarely/never etc.	Sometimes/slightly etc.	usually/moderately	always/extremely etc.

50. To what extent does this statement describe your eating behavior? ‘I start dieting in the morning but because of any number of things that happen during the day, by evening I have given up and eat what I want, promising myself to start dieting again tomorrow.’

1 2 3 4

Rarely/never etc. Sometimes/slightly etc. usually/moderately always/extremely etc.

51. On a scale of 0 to 4, where 0 means no restraint in eating (eating whatever you want, whenever you want it) and 4 means total restraint (constantly limiting food intake and never ‘giving in’), what number would you give yourself?

0 1 2 3 4

APPENDIX E

General Nutrition Knowledge Questionnaire (Kliemann, Wardle, Johnson, Croker, 2016)

GENERAL NUTRITION KNOWLEDGE QUESTIONNAIRE

This is a survey, not a test. Your answers will help identify which dietary advice people find confusing. It is important that you complete it by yourself. Your answers will remain anonymous. If you don't know the answer, mark "not sure" rather than guess. Thank you for your time.

Section 1: The first few items are about what advice you think experts are giving us.

1. Do health experts recommend that people should be eating more, the same amount, or less of the following foods? (tick one box per food)

	More	Same	Less	Not Sure
Fruit	☐	☐	☐	☐
Food and drinks with added sugar	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐
Fatty foods	☐	☐	☐	☐
Processed red meat	☐	☐	☐	☐
Wholegrains	☐	☐	☐	☐
Salty foods	☐	☐	☐	☐
Water	☐	☐	☐	☐

2. How many servings of fruit and vegetables per day do experts advise people to eat as a minimum? (One serving could be, for example, an apple or a handful of chopped carrots) (tick one)

2	☐
3	☐
5 or more	☐
Not sure	☐

3. Which of these types of fats do experts recommend that people should eat less of? (tick one box per food)

	Eat less	Not eat less	Not Sure
Unsaturated fats	☐	☐	☐
Trans fats	☐	☐	☐
Saturated fats	☐	☐	☐

4. Which type of dairy foods do experts say people should drink? (tick one)

Full fat (e.g. full fat milk)	☐
Reduced fat (e.g. skimmed and semi skimmed-milk	☐
Mixture of full fat and reduced fat	☐
Neither, dairy foods should be avoided	☐
Not sure	☐

5. How many times per week do experts recommend that people eat oily fish (e.g. salmon and mackerel)? (tick one)

1-2 times per week ❑
3-4 times per week ❑
Every day ❑
Not sure ❑

6. Approximately how many alcoholic drinks is the maximum recommended per day (The exact number depends on the size and strength of the drink)? (tick one)

1 drink each for men and women ❑
2 drinks each for men and women ❑
2 drinks for men and 1 drink for women ❑
3 drinks for men and 2 drinks for women ❑
Not sure ❑

7. How many times per week do experts recommend that people eat breakfast? (tick one)

3 times per week ❑
4 times per week ❑
Every day ❑
Not sure ❑

8. If a person has two glasses of fruit juice in a day, how many of their daily fruit and vegetable servings would this count as? (tick one)

None ❑
One serving ❑
Two servings ❑
Three servings ❑
Not sure ❑

9. According to the 'eatwell guide' (a guideline showing the proportions of food types people should eat to have a balanced and healthy diet), how much of a person's diet should be made up of starchy foods?
(tick one)

Quarter ❑
Third ❑
Half ❑
Not sure ❑

Section 2: Experts classify foods into groups. We are interested to see whether people are aware of food groups and the nutrients they contain.

1. Do you think these foods and drinks are typically high or low in added sugar? (tick one box per food)

	High in added sugar	Low in added sugar	Not sure
Diet cola drinks	☐	☐	☐
Natural yoghurt	☐	☐	☐
Ice cream	☐	☐	☐
Tomato ketchup	☐	☐	☐
Melon	☐	☐	☐

2. Do you think these foods are typically high or low in salt? (tick one box per food)

	High in salt	Low in salt	Not Sure
Breakfast cereals	☐	☐	☐
Frozen vegetables	☐	☐	☐
Bread	☐	☐	☐
Baked beans	☐	☐	☐
Red meat	☐	☐	☐
Canned soup	☐	☐	☐

3. Do you think these foods are typically high or low in fiber? (tick one box per food)

	High in fiber	Low in fiber	Not Sure
Oats	☐	☐	☐
Bananas	☐	☐	☐
White rice	☐	☐	☐
Eggs	☐	☐	☐
Potatoes with skin	☐	☐	☐
Pasta	☐	☐	☐

4. Do you think these foods are a good source of protein? (tick one box per food)

	Good source of protein	Not a good source of protein	Not sure
Poultry	☐	☐	☐
Cheese	☐	☐	☐
Fruit	☐	☐	☐
Baked beans	☐	☐	☐
Butter	☐	☐	☐
Nuts	☐	☐	☐

5. Which of the following foods do experts count as starchy foods? (tick one box per food)

	Starchy Food	Not a starchy food	Not Sure
Cheese	☐	☐	☐
Pasta	☐	☐	☐
Potatoes	☐	☐	☐
Nuts	☐	☐	☐
Plantains	☐	☐	☐

6. Which is the main type of fat present in each of these foods? (tick one box per food)

	Polyunsaturated fat	Monounsat-urated fat	Saturated fat	Cholesterol	Not sure
Olive oil	☐	☐	☐	☐	☐
Butter	☐	☐	☐	☐	☐
Sunflower oil	☐	☐	☐	☐	☐
Eggs	☐	☐	☐	☐	☐

7. Which of these foods has the most trans-fat? (tick one)

Biscuits, cakes and pastries	☐
Fish	☐
Grapeseed oil	☐
Eggs	☐
Not sure	☐

8. The amount of calcium in a glass of whole milk compared to a glass of skimmed milk is: (tick one)

About the same	☐
Much higher	☐
Much lower	☐
Not sure	☐

9. Which one of the following nutrients has the most calories for the same weight of food? (tick one)

Sugar	☐
Starchy	☐
Fiber/roughage	☐
Fat	☐
Not sure	☐

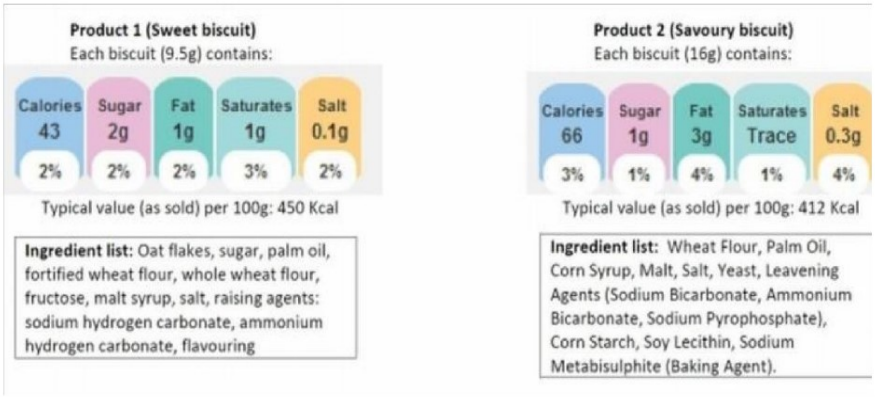
10. Compared to minimally processed foods, processed foods are: (tick one)

Higher in calories	☐
Higher in fiber	☐
Lower in salt	☐
Not sure	☐

Section 3: The next few items are about choosing foods	
1. If a person wanted to buy a yogurt at the supermarket, which would have the least sugar/sweetener? (tick one)	
0% fat cherry yogurt	☐
Natural yogurt	☐
Creamy fruit yogurt	☐
Not sure	☐
2. If a person wanted soup in a restaurant or cafe, which one would be the lowest fat option? (tick one)	
Mushroom risotto soup (field mushrooms, porcini mushrooms, arborio rice, butter, cream, parsley and cracked black pepper)	☐
Carrot butternut and spice soup (carrot , butternut squash, sweet potato, cumin, red chillies, coriander seeds and lemon)	☐
Cream of chicken soup (British chicken, onions, carrots, celery, potatoes, garlic, sage, wheat flour, double cream)	☐
Not sure	☐
3. Which would be the healthiest and most balanced choice for a main meal in a restaurant? (tick one)	
Roast turkey, mashed potatoes and vegetables	☐
Beef, Yorkshire pudding and roast potatoes	☐
Fish and chips served with peas and tartar sauce	☐
Not sure	☐
4. Which would be the healthiest and most balanced sandwich lunch? (tick one)	
Ham sandwich + fruit + blueberry muffin + fruit juice	☐
Tuna salad sandwich + fruit + low fat yogurt + water	☐
Egg salad sandwich + crisps + low fat yogurt + water	☐
Not sure	☐
5. Which of these foods would be the healthiest choice for a pudding? (tick one)	
Berry sorbet	☐
Apple and blackberry pie	☐
Lemon cheesecake	☐
Carrot cake with cream cheese topping	☐
Not sure	☐

6. Which of these combinations of vegetables in a salad would give the greatest variety of vitamins and antioxidants? (tick one)	
Lettuce, green peppers and cabbage	☐
Broccoli, carrot and tomatoes	☐
Red peppers, tomatoes and lettuce	☐
Not sure	☐
7. If a person wanted to reduce the amount of fat in their diet, but didn't want to give up chips, which of the following foods would be the best choice? (tick one)	
Thick cut chips	☐
Thin cut chips	☐
Crinkle cut chips	☐
Not sure	☐
8. One healthy way to add flavour to food without adding extra fat or salt is to add: (tick one)	
Coconut milk	☐
Herbs	☐
Soya sauce	☐
Not sure	☐
9. Which of the following cooking methods requires fat to be added? (tick one)	
Grilling	☐
Steaming	☐
Baking	☐
Sautéing	☐
Not sure	☐
10. Traffic lights are often used on nutrition labelling, what would amber mean for the fat content of a food? (tick one)	
Low fat	☐
Medium fat	☐
High in fat	☐
Not sure	☐
11. "Light" foods (or Diet foods) are always good options because they are low in calories. (tick one)	
Agree	☐
Disagree	☐
Not sure	☐

The following questions are related to food labels:



12. Looking at products 1 and 2, which one has the most calories (kcal) per 100 grams (tick one)

- Product 1 ☐
- Product 2 ☐
- Both have the same quantity ☐
- Not sure ☐

13. Looking at product 1, what are the sources of sugar in the ingredient list? (tick one)

- Sugar and malt syrup ☐
- Sugar, fructose and lecithin ☐
- Sugar, fructose and malt syrup ☐
- Not sure ☐

Section 4: This section is about health problems or diseases related to diet and weight management	
1. Which of these diseases is related to a low intake of fiber? (tick one)	
Bowel disorders	☐
Anaemia	☐
Tooth decay	☐
Not sure	☐
2. Which of these diseases is related to how much sugar people eat? (tick one)	
High blood pressure	☐
Tooth decay	☐
Anaemia	☐
Not sure	☐
3. Which of these diseases is related to how much salt (or sodium) people eat? (tick one)	
Hypothyroidism	☐
Diabetes	☐
High blood pressure	☐
Not sure	☐
4. Which of these options do experts recommend to reduce the chances of getting cancer? (tick one)	
Drinking alcohol regularly	☐
Eating less red meat	☐
Avoiding additives in food	☐
Not sure	☐
5. Which of these options do experts recommend to prevent heart disease? (tick one)	
Taking nutritional supplements	☐
Eating less oily fish	☐
Eating less trans-fats	☐
Not sure	☐
6. Which of these options do experts recommend to prevent diabetes? (tick one)	
Eating less refined foods	☐
Drinking more fruit juice	☐
Eating more processed meat	☐
Not sure	☐

7. Which one of these foods is more likely to raise people's blood cholesterol? (tick one)
Eggs ☐ Vegetable oils ☐ Animal fat ☐ Not sure ☐
8. Which one of these foods is classified as having a high Glycaemic Index (Glycaemic Index is a measure of the impact of a food on blood sugar levels, thus a high Glycaemic Index means a greater rise in blood sugar after eating)? (tick one)
Wholegrain cereals ☐ white bread ☐ Fruit and vegetables ☐ Not sure ☐
9. To maintain a healthy weight people should cut fat out completely. (tick one)
Agree ☐ Disagree ☐ Not sure ☐
10. To maintain a healthy weight people should eat a high protein diet. (tick one)
Agree ☐ Disagree ☐ Not sure ☐
11. Eating bread always causes weight gain. (tick one)
Agree ☐ Disagree ☐ Not Sure ☐
12. Fiber can decrease the chances of gaining weight. (tick one)
Agree ☐ Disagree ☐ Not sure ☐

13. Which of these options can help people to maintain a healthy weight? (answer each one)

	Yes	No	Not sure
Not eating while watching TV	☐	☐	☐
Reading food labels	☐	☐	☐
Taking nutritional supplements	☐	☐	☐
Monitoring their eating	☐	☐	☐
Monitoring their weight	☐	☐	☐
Grazing throughout the day	☐	☐	☐

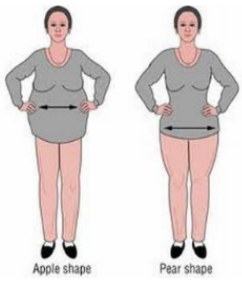
14. If someone has a Body Mass Index (BMI) of 23kg/m^2, what would their weight status be? (tick one)

- ☐ Underweight
- ☐ Normal weight
- ☐ Overweight
- ☐ Obese
- ☐ Not sure

15. If someone has a Body Mass Index (BMI) of 31kg/m^2, what would their weight status be? (tick one

- ☐ Underweight
- ☐ Normal weight
- ☐ Overweight
- ☐ Obese
- ☐ Not sure

Look at the body shapes below:



16. Which of these body shapes increases the risk of cardiovascular disease (Cardiovascular disease is a general term that describes a disease of the heart of blood vessels, for example, angina, heart attack, heart failure, congenital heart disease and stroke)? (tick one)

- ☐ Apple shape
- ☐ Pear shape
- ☐ Not sure

APPENDIX F

Brief Self Control Scale (Tangney et al., 2004)

SCS

Using the scale provided, please indicate how much each of the following statements reflects how you typically are.

Not at all				Very Much
1	2	3	4	5

1. I am good at resisting temptation.
2. I have a hard time breaking bad habits.
3. I am lazy.
4. I say inappropriate things.
5. I never allow myself to lose control.
6. I do certain things that are bad for me if they are fun.
7. People can count on me to keep on schedule.
8. Getting up in the morning is hard for me.
9. I have trouble saying no.
10. I change my mind fairly often.
11. I blurt out whatever is on my mind.
12. People would describe me as impulsive.
13. I refuse things that are bad for me.
14. I spend too much money.
15. I keep everything neat.

16. I am self-indulgent at times.

17. I wish I had more self-discipline.

18. I am reliable.

19. I get carried away by my feelings.

20. I do many things on the spur of the moment.

21. I don't keep secrets very well.

22. People would say I have iron self-discipline.

23. I have worked or studied all night at the last minute.

24. I'm not easily discouraged.

25. It'd be better if I stopped to think before acting.

26. I engage in healthy practices.

27. I eat healthy foods.

28. Pleasure and fun sometimes keep me from getting work done.

29. I have trouble concentrating.

30. I can work effectively toward long term goals.

31. Sometimes I can't stop myself from doing something, even if I know it is wrong.

32. I often act without thinking through all the alternatives.

33. I lose my temper too easily.

34. I often interrupt people.

35. I sometimes drink or use drugs to excess.

36. I am always on time.

APPENDIX G

Eysenck Impulsivity Questionnaire (EYIS; Eysenck, Easting, & Parson, 1984)

EYIS

Mark YES or NO for each of the following questions. There are no right or wrong answers, and no trick questions. Work quickly and do not think too long about the exact meaning of each question.

1. Do you sometimes get so restless that you cannot sit in a chair long? Y/N
2. Do you often long for excitement? Y/N
3. Do you save regularly? Y/N
4. Do you often buy on impulse? Y/N
5. Do you generally do and say things without stopping to think? Y/N
6. Do you often get into a jam because you do things without thinking? Y/N
7. Would you enjoy gambling? Y/N
8. Do you usually work quickly without bothering to check your answers? Y/N
9. Do people you are with have a strong influence on your moods? Y/N
10. Are you an impulsive person? Y/N
11. Do you usually think carefully before doing anything? Y/N
12. Do you often do things on the spur of the moment? Y/N
13. Do you sometimes break rules on the spur of the moment? Y/N
14. Do you mostly speak before thinking things out? Y/N
15. Do you often get involved in things you later wish you could get out of? Y/N
16. Do you get “carried away” by new and exciting tasks that you never think of possible snags? Y/N

17. Do you get bored more easily than most people when doing the same old things? Y/N
18. Do you think that planning takes the fun out of things? Y/N
19. Do you need to use a lot of self-control to keep out of trouble? Y/N
20. Are you often surprised at people's reactions to what you do or say? Y/N
21. Do you get very annoyed if someone keeps you waiting? Y/N
22. Do you get restless if you have to stay around home for any length of time? Y/N
23. Do you sometimes put down the first answer that comes into your head during a test and forget to check it later? Y/N

APPENDIX H

Delaying Gratification Inventory (Hoerger, Quirk, & Weed, 2011)

DGI

Read each of the following statements. Rate how well each statement describes you, using the following 5-point scale.

Strongly Disagree Somewhat Disagree Neutral Somewhat Agree Strongly Agree

1 **2** **3** **4** **5**

1. Sometimes I eat until I make myself sick.
2. I am able to control my physical desires.
3. I hate having to take turns with other people.
4. When someone gives me money, I prefer to spend it right away.
5. I worked hard in school to improve myself as a person.
6. I would have a hard time sticking with a special, healthy diet.
7. When face with a physically demanding chore, I always tried to put off doing it.
8. Usually, I try to consider how my actions affect others.
9. It is hard for me to resist buying things I cannot afford.
10. I have tried to work hard in school so that I could have a better future.
11. If my favorite food were in front of me, I would have a difficult time wanting to eat it.
12. I like to get to know someone before having a physical relationship.
13. There is no point in considering how my decisions affect other people.
14. I tried to spend my money wisely.
15. In school, I tried to take the easy way out.
16. It is easy for me to resist candy and bowls of snack food.

17. I have given up physical pleasure or comfort to reach my goals.
18. I try to consider how my actions will affect other people in the long-term.
19. I cannot be trusted with money.
20. I would rather take the easy road in life to get ahead.
21. I can resist junk food when I want to.
22. I prefer to explore the physical side of romantic involvements right away.
23. I do not consider how my behavior affects other people.
24. When I am able to, I try to save away a little money in case an emergency should arise.
25. I cannot motivate myself to accomplish long-term goals.
26. I have always tried to eat healthily because it pays off in the long run.
27. My habit of focusing on what "feels good" has cost me in the long run.
28. I value the needs of other people around me.
29. I manage my money well.
30. I have always felt like my hard work would pay off in the end.
31. Even if I am hungry, I can wait until it is mealtime before eating something.
32. I have lied or made excuses to go do something more pleasurable.
33. I think that helping each other benefits society.
34. I enjoy spending money the moment I get it.
35. I am capable of working hard to get ahead in life.

APPENDIX I

Monetary-Choice Questionnaire (Kirby et al., 1999)

MONETARY-CHOICE QUESTIONNAIRE

For each of the next 27 choices, please indicate which reward you would prefer: the smaller reward today, or the larger reward in the specified number of days.

1. Would you prefer $54 today, or $55 in 117 days?
2. Would you prefer $55 today, or $75 in 61 days?
3. Would you prefer $19 today, or $25 in 53 days?
4. Would you prefer $31 today, or $85 in 7 days?
5. Would you prefer $14 today, or $25 in 19 days?
6. Would you prefer $47 today, or $50 in 160 days?
7. Would you prefer $15 today, of $35 in 13 days?
8. Would you prefer $25 today, or $60 in 14 days?
9. Would you prefer $78 today, or $80 in 162 days?
10. Would you prefer $40 today, or $55 in 62 days?
11. Would you prefer $11 today, or $30 in 7 days?
12. Would you prefer $67 today, or $75 in 119 days?
13. Would you prefer $34 today, or $35 in 186 days?
14. Would you prefer $27 today, or $50 in 21 days?
15. Would you prefer $69 today, or $85 in 91 days?
16. Would you prefer $49 today, or $60 in 89 days?
17. Would you prefer $80 today, or $85 in 157 days?
18. Would you prefer $24 today, or $35 in 29 days?
19. Would you prefer $33 today, or $80 in 14 days?
20. Would you prefer $28 today, or $30 in 179 days?
21. Would you prefer $34 today, or $50 in 30 days?
22. Would you prefer $25 today, or $30 in 80 days?
23. Would you prefer $41 today, or $75 in 20 days?
24. Would you prefer $54 today, or $60 in 111 days?
25. Would you prefer $54 today, or $80 in 30 days?
26. Would you prefer $22 today, or $25 in 136 days?
27. Would you prefer $20 today, or $55 in 7 days?

APPENDIX J

Behavioral Visual Analog Scale of hunger (Sayer, Peters, Pan, Wyatt & Hill, 2018)

VISUAL ANALOG SCALE

In response to each question, please indicate how you feel right now

How hungry do you feel right now?

Not at all ---------- Extremely

How thirsty do you feel right now?

Not at all ---------- Extremely

How full do you feel right now?

Not at all ---------- Extremely

How nauseated do you feel right now?

Not at all ---------- Extremely

How much stomach discomfort do you feel right now?

Not at all ---------- Extremely

How sick do you feel right now?

Not at all ---------- Extremely

On average my eating level is?

Not at all ---------- Extremely

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