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An Evaluation of the Relationship between Cooking and Wellness Behaviors in College Students

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AN EVALUATION OF THE RELATIONSHIP BETWEEN COOKING AND WELLNESS BEHAVIORS IN COLLEGE STUDENTS

BY

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This thesis is approved as a creditable and independent investigation by a candidate for the Master of Science in Nutrition and Exercise Science degree and is acceptable for meeting the thesis requirements for this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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ABSTRACT

AN EVALUATION FO THE RELATIONSHIP BETWEEN COOKING AND DIETARY BEHAVIORS IN COLLEGE STUDENTS

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Background: Few studies have examined the relationship between cooking and wellness behaviors in college students.

Objective: Determine the association between cooking, wellness behaviors, fruit and vegetable (FV) intake and body mass index (BMI) in college students.

Design and Participants: A cross-sectional analysis was conducted using baseline data a multi-state, Community-Based Participatory Research project aimed at preventing weight gain in first-year college students. Physical activity (PA), cooking (type, frequency and confidence), intention for meal planning (MP), mealtime behaviors, and cups of FV, were measured using validated survey tools. BMI was calculated from measured height and weight. Study participants were first-year students (n=1,108) considered at-risk for weight gain from eight universities completed baseline assessments.

Statistical Analysis: Multiple linear regression assessed the ability of lifestyle behaviors to predict FV intake and BMI after controlling for sex; significance was $p \leq 0.05$. Stata 13.1 was used for data analyses.

Results: Highly active individuals reported significantly greater FV intake (2.7±.1) than moderately active (2.1±.1, p=.000) or inactive (1.7±.3, p=.000). FV intake was greater in those reporting meal preparation 4-7 times weekly (3.0±.2) compared to 1-3 (2.4±.1, p=.018) or zero (2.3±.1, p=.002). Cooking mostly convenience and ready-made meals

was associated with significantly lower FV intake (2.1±.1) compared to cooking from basic ingredients (2.6±.1, p=.000) or not cooking (2.4±.1, p=.013). Intention for MP and mealtime behaviors were positively associated with FV intake (p=.000 and p=.000, respectively). Preparing meals from basic ingredients was associated with a lower BMI (23.8±.3) than consuming mostly convenience and ready-made meals (24.6±.3, p=.035) or not cooking (24.6±.2, p=.032). Positive mealtime behaviors were inversely related to BMI (p=.009).

Conclusions: FV intake and BMI are associated with PA, cooking, and dietary behaviors supporting previous research that healthy behaviors cluster together. Interventions aimed at improving dietary intake or weight status in college students could benefit from incorporating PA, cooking, and MP components.

Chapter 1: INTRODUCTION

Over the past decade, obesity has become a major public health concern. Nearly 35% of American adults are classified as obese, and the prevalence continues to rise at an alarming rate.[1] Contributing to the increased prevalence of obesity is the continued adult weight gain of approximately 0.8-0.9 kilograms per year.[2,3] An adult is characterized as obese when total body weight is higher than what is considered healthy based on an individual's calculated body mass index (BMI).[4,5] One method to calculate BMI is weight in kilograms divided by the square of height in meters.[5] A BMI of 30 or greater is classified as obese.[4] An extremely complex disease, obesity is affected by many factors and can predispose individuals to several non-communicable diseases including heart disease, stroke, diabetes, hypertension, sleep apnea, liver disease, and orthopedic injuries.[6,7] Additionally, obesity can hinder self-esteem, negatively impact concentration, and increase the risk of depression and other psychosocial disorders.[8] Being obese as an adolescent or young adult also increases the risk of obesity and associated adverse health issues as an adult.[9]

Unhealthy behaviors like poor dietary intake, decreased physical activity, inconsistent sleep patterns, and increased sedentary time are learned at a young age and tend to continue through adolescence into adulthood.[9-12] In a study conducted by Gordon-Larsen et al[13], a high proportion of obese adults were previously obese as adolescents (ages 13-20), and only a small proportion of adolescents moved out of the obese category (to overweight or normal weight) as they became adults.[13] Young adults are also at greater risk for experiencing unintended weight gain as the transition between high school and college presents many opportunities for lifestyle changes.[10] On average,

young adults attending college gain 0.73 kg (1.61 lbs) to 3.99 kg (8.78 lbs) during their first year.[14] Although this initial weight gain may occur, weight gain often persists beyond the first year and continues throughout the duration of one's college experience.[8,12,15] This trend of weight increase may negatively impact health and weight outcomes in later adulthood, so the first year of college may represent a 'tipping point' in lifestyle behavioral patterns that persist into adulthood.[12,15]

Young adults attending college experience major lifestyle changes often relating to poor dietary intake.[6,16] A variety of individual and environmental factors influence dietary intake. Barriers to healthy eating may include availability and accessibility of food and the resources necessary to prepare food, lack of knowledge or skills in cooking and nutrition, lack of time, and lack of motivation to live healthily. [16,17] Increased consumption of fatty foods and decreased consumption of fruits and vegetables, whole grains and lean proteins are also directly related to weight gain and adiposity.[18,19]

Poor dietary intake is often influenced by physical activity, cooking, and dietary patterns.[20,21] The National College Health Risk Behavior Survey reported that 94.6% of all college students surveyed did not consume the recommended five servings of fruits and vegetables daily in 2015, compared to 73.7% in 1995.[22-24] With the preponderance of college students not meeting recommendations for fruit and vegetable intake, it is necessary to determine which factors influence diet to determine potential intervention strategies. Research indicates that food preparation is associated with better diet quality.[21,25,26] Unfortunately, young adults commonly lack the skills, knowledge, and self-efficacy necessary to plan and prepare basic, nutritious meals.[27] In a focus group study by Jones et al., college students noted lack of time and motivation as a primary barrier to

preparing meals in their current living environment.[17] Students also reported their living environment did not readily support food preparation.[28,29] Participation in regular physical activity is also associated with a more healthful diet compared to sedentary individuals.[20]

Cooking skills contributes to poor dietary intake; and therefore, the purpose of this study is to determine lifestyle behaviors that are associated with increased fruit and vegetable intake and lower BMI. It is hypothesized that students' physical activity, cooking patterns, and dietary behaviors will be associated with fruit and vegetable intake and BMI. Specifically, students participating in physical activity, regularly preparing meals from basic ingredients, and having positive dietary behaviors will consume greater quantities of fruits and vegetables and have a lower BMI.

Statement of the Problem

College is an important transitional period in the lives of young adults and small fluctuations in weight often occur. Although there are many factors that may influence this change, weight status, dietary intake and their relationship to lifestyle behaviors such as physical activity, cooking, and dietary behaviors is important.

Significance of the Study

It is clearly outlined in the current literature that dietary intake is associated with physical activity and cooking patterns. However, a gap in the literature exists specifically for the college student population and minimal research examines the relationship between dietary behaviors (intention for meal planning and mealtime behaviors) and dietary intake as well as cooking confidence and wellness indicators. College students are

a unique population because they often do not have access to a well-functioning kitchen or whole, basic ingredients. This study focuses on the college student population.

Variables

1. Dependent Variables
    a. Fruit and vegetable intake
    b. Body Mass Index (BMI)
2. Independent Variables
    a. Cooking skills
    b. Cooking frequency
    c. Cooking confidence
    d. Intention for meal planning and mealtime behaviors
    e. Physical activity
    f. Demographics

Limitations

1. Time for recruitment and assessment of participants were to happen within five weeks of the semester's start
2. Lack of self-regulation, motivation, or control while completing the required College Environment Behavioral and Perceptions Survey (CEBPS)
3. Living environment and support for home food preparation
4. Body Mass Index instrumentation
5. To be eligible for the study, participants were considered to have low fruit and vegetable intake

6. Measuring behaviors by self-report may have been influenced by social desirability

Delimitations

1. Population—college students ages 18-24
2. Community Based Participatory Research
3. Large, diverse sample size
4. Comprehensive evaluation of fruit and vegetable intake and physical activity
5. Utilized measured anthropometrics opposed to self-reported

Assumptions

1. Students will answer survey questions honestly and take their time to provide accurate responses

Research Hypothesis

Aim: Determine which lifestyle behaviors—physical activity, cooking frequency, cooking type, cooking confidence, intention for meal planning and mealtime behaviors—are associated with fruit and vegetable intake and BMI at baseline.

Hypothesis: It is hypothesized that students' physical activity, cooking patterns, and dietary behaviors will be associated with increased fruit and vegetable intake and lower BMI. Specifically, students participating in physical activity, regularly preparing meals from basic ingredients, and exhibiting positive dietary behaviors will consume greater quantities of fruits and vegetables and have a lower BMI.

Chapter 2: REVIEW OF LITERATURE

A literature review was conducted to better understand college students' physical activity, cooking patterns and dietary behaviors in relation to dietary quality and BMI. Obesity, possible influencing factors, and its affect throughout the lifecycle were reviewed.

Obesity: History and Current State of the Epidemic

For several centuries, overweight and obesity were not pressing issues. Chronic food shortages and food insecurity was a main concern for individuals, resulting in more normal or underweight individuals than overweight or obese.[30,31] However, nearly four decades ago, obesity rates began to rise as food became more readily available to consumers.[30,31] Recently, rates have peaked and obesity is currently considered to be a national public health crisis.[32] Obesity affects around one-third, or 30%, of all American adults and approximately 17% of school-aged children and adolescents.[32,33] Although obesity affects nearly all populations, severity per individual greatly differs and is often influenced by a complex combination of influencing factors.[32,34] If trends continue, and the current state of obesity rises, research estimates there will be an approximate 33% increase in obesity over the next two decades.[31] If estimates are accurate, 51% of the population will be obese by 2030, with 42% characterized as 'low' obese and 11% severely (morbidly) obese.[31] Despite obesity rates being higher than ever before, it is possible the rate of obesity could be stabilizing.[31,34] Evidence indicates there have been 'lulls' in obesity rates during the past decade but environmental risk factors remain an issue and prevention strategies are still required to combat the obesity epidemic.[31]

Obesity: Causes and Consequences

Obesity is not only related to an individual's lifestyle and eating behaviors, but it can also be influenced by a variety of other factors such as environment, genetics, and internal attitude.[6,35] Frequently, a complex combination of multiple factors causes an individual to become overweight or obese.[32] Some research indicates that obesity's only cause is an imbalance of energy; more specifically, a positive energy balance resulting from excess calorie consumption.[36,37] Although a positive energy balance is required to experience weight gain, it cannot be designated the sole cause of overweight and obesity.[6] A multi-factorial disease, obesity can be associated with a complex interaction between environmental and genetic factors.[34] Undeniably, genetic background heavily influences the possibility of an individual developing obesity. Research indicates that the likelihood and level of obesity in children increases when both parents are obese and as the level of obesity in parents' increases.[35] However, genetic factors alone play only a partial role in the development of obesity. When combined with environmental factors that do not support healthy lifestyles, the likelihood of obesity development increases.[34,38] For example, dietary intake is often influenced by the surrounding food environment so lack of resources and poor access to healthy foods may cause a decline in dietary quality directly relating to obesity development over time.[38] Low socio-economic status, diminished psychologic state, or low education levels may also increase the likelihood of developing obesity.[38]

In addition to genetic and environmental factors, an individual's lifestyle during childhood may also predict health in adulthood and throughout life.[13,33,35] Children with a high BMI or early development of overweight often experience obesity during adulthood.[13,33] A study conducted by Gordon-Larsen et al. examined dynamic patterns of

obesity change among individuals across the lifecycle.[13] This study concluded that a high incidence of obesity occurs during the transition to adulthood and only a small proportion of adolescents characterized as obese moved out of the obese category (to overweight or normal weight) when entering adulthood.[13] In both males and females, and across a variety of ethnic groups, childhood obesity was found to be only moderately predictive of adult health, while adolescent obesity is highly predictive.[13] Children also adapt lifestyle behaviors and patterns from parent modeling because families do not only share genetics, but also environments and habits.[35] Brown et al. inferred that parental overweight may be the most significant risk factor for children because food choices and activity patterns are learned from parents at a young age.[35]

Obesity can also have a negative impact on an individual's overall health. Obese adults are at increased risk of developing several adverse health effects including cardiovascular disease, diabetes, hypertension, stroke, liver disease, and various cancers.[33,34] In addition to health consequences, obesity also negatively impacts the economy since the overall economic cost of overweight and obesity is extremely high.[34] Nearly 10% of all United States healthcare costs in 2002 were related to obesity, and if the trend continues as projected (51% by 2030)[31], healthcare costs will rise to approximately $549.5 billion annually.[31]

College Students: Prevalence of Obesity and Lifestyle Patterns

In 2011, there were approximately 20 million individuals attending college in the United States.[39] Weight gain during this period is often referred to as the 'freshman 15'. The freshman 15 is a popular belief that most students gain 15 pounds (6.82 kg) during their first year of college.[14,40] A notion glorified by the media, there is little evidence that

such extreme changes in weight actually occur.[14] Various studies indicate weight gain is generally equal to about 33% of 15 pounds, ranging from 1.61-8.78 kg.[10,14] Although most literature refutes the freshman 15 concept, there is evidence that small changes in weight often do occur.[8,14,40,41]

Contrary to popular belief and theories like the freshman 15, college weight gain is not unique to the freshman year.[15] Research indicates that students gain an average of 1.6 kg during a typical 4-year college career with an approximate 1.2% increase in adiposity.[15] A study conducted by Racette and colleagues (n=204) followed students throughout four years of their college career examining changes in body weight and BMI. Results suggested that from freshman to senior year, the prevalence of obesity increased 8%.[42] Another study involving a large cohort of students at a public University in Rhode Island concluded that during the freshman year, the prevalence of overweight and obese participants increased from 21.6% to 36%.[12] This study also followed students into their sophomore year and concluded that overweight and obesity prevalence increased 20.3% to 35.1% from the start of freshman year to the end of sophomore year.[12] Additionally, data included in this study indicated that weight gained was often not lost over time[12], because body fat gained can be difficult to lose once accumulated.[43] Finally, a study by Lloyd-Richardson et al. conducted in a private University found that 70% of the study population gained weight during the freshman year, and nearly one-third of those students gained at least 4kg.[12]

Weight gain during this period can often be attributed to changes in lifestyle and behaviors as a result of the transition from high school to higher education.[10,15] This transition is often referred to as a ‘tipping point’ for behavior change and acts as a period

of high risk for weight gain in young adults.[12,15] As young adults begin living away from home, they encounter more freedom and may abandon old routines and adapt a new, potentially negative, lifestyle.[10,15,43] In a study conducted by Deforche et al., the prevalence of overweight doubled from high school to higher education as a result of new, adapted behaviors.[10] Such behaviors included decreased physical activity, increased sedentary time, poor dietary intake, decreased sleep, increased stress, and increased alcohol consumption; all of which promote unsolicited weight gain.[2,8,10,43] High baseline BMI might also predict weight gain during college.[2] Kasparek et al. concluded an individual's initial BMI score was most highly associated with weight gain in young adults attending college.[2] Overweight students involved in the study gained nearly twice as much weight during a 6-month period than those of a normal weight with a 6.21 lb and 10.96 lb increase in weight, respectively.[2]

In addition to the higher education transition and elevated baseline BMI, other factors can predict weight gain in college-aged individuals. Body image acts as a psychological predictor of weight gain.[8] Negative thoughts about one's body may prompt an individual to cause harm to the body by starvation or purging.[8] Campus involvement and academic performance also heavily influences lifestyle in college students. More involved students generally participate in more physical activity and are at lesser risk of developing unwanted weight gain.[8] Involvement in campus activities also generates feelings of community integration among the campus, suppressing possible feelings of loneliness and isolation, both of which are related to overconsumption and weight gain.[8] Students with poor academic aptitude are also at greater risk for weight gain.[8] This gain could be related to stress, lack of education about living healthily, or lack of time.[8,17,21]

College Students: Dietary Intake and Food Preparation

Often included in the extreme lifestyle changes college students experience is a change in dietary intake. In 1995, the College Health Risk Behavior Survey concluded that only 73.7% of all college students in the United States were not consuming the recommended five servings of fruits and vegetables daily.[23] In 2015, the number of students failing to consume the recommended servings increased to 94.6%.[24] Instead, the average college student consumes approximately 2.90 servings/day of fruits and vegetables, well below the national recommended value.[28] Many factors influence the dietary choices individuals make. For college-aged students, available resources, self-perceived skills, and lack of time are particularly influential.[21,28] More specifically, students lack the time, skills, and resources to plan and prepare nutritious home-prepared meals on a regular basis.[21] A study done by Larson et al. examined the relationship between cooking efficacy and dietary intake.[21] Young adults with frequent home food preparation reported purchasing fast food less often and consuming greater amounts of fruits and vegetables.[21] Overall, 31% of students reporting frequent food preparation consumed at least five servings of fruits and vegetable daily, compared to only 3% of individuals with less frequent food preparation behaviors.[21]

Food preparation is associated with better diet quality.[21,25,44] Unfortunately, college students' food preparation is inadequate, particularly in those students housed on campus.[21] A variety of components predict cooking frequency and ability. One's enjoyment of cooking heavily influences food preparation.[25,26] Greater enjoyment of planning and preparing meals increases the frequency of home food preparation.[25,26] Education levels and gender can also affect the amount of cooking an individual does.

According to a study done by Hartmann et al., females are more likely to prepare meals in the home than males, and those with higher education levels are likely to have better skills to do so.[25] Most significantly, individuals that are conscious of their health and are motivated to live healthily are more likely to spend the time and effort to prepare a healthy meal.[25]

Food preparation is also related to decreased consumption of fast food (food-away-from-home).[44] As society further develops, the population continues to lead fast-paced lives, consuming more convenience foods and less home prepared meals.[45] In 1978, 73% of individuals ages 19-29 reported eating meals in the home environment compared to only 57% in 1996.[45] Similarly, only 15% of the population in 1978 reported eating three or more commercially prepared meals weekly, compared to 31% in 1996, and 41% in 2000.[45] Each meal away from home is associated with a 130 kcal/day increase and greater intake of sodium and fat, with decreased intake of fiber.[44]

In addition to fast food, ready-meals have gained popularity. Ready-meals can be described as those that require few or no extra ingredients often designed to replace the main course of a homemade meal.[26] They are thought to save both time and money, but persistent consumption is heavily associated with being overweight.[26] Like fast food, ready-meals are often rich in energy, fat, salt, and sugar but low in fruits, vegetables, whole grains, and calcium.[26] With this drastic change in society, children and young adults likely will never learn the necessary skills required to plan and prepare healthy, nutritious meals.

Although possessing skills in the kitchen and knowledge of cooking do not guarantee creation of meals from healthy, basic ingredients, research indicates that

having the necessary knowledge and motivation is related to improved dietary quality and increased consumption of fruits and vegetables.[21,26]

Physical Activity Patterns and Dietary Behaviors

Participation in physical activity is also related to certain lifestyle behaviors such as dietary intake or weight status. Gillman et al. examined the relationship between physical activity and dietary behaviors in men and women and concluded that decreasing levels of physical activity was associated with a poor diet. Individuals that were moderately or vigorously active were more likely to meet dietary recommendations than sedentary individuals were.[20] Dietary intake of fruits, vegetables, fiber, calcium, folate, and vitamins A, C, and E were also greater in people who were more active.[20,46]

In addition to dietary intake, physical activity can also impact weight status and BMI. Hemmingsson and Ekelund concluded that the association between physical activity and BMI was weak in regards to non-obese individuals.[47] However, in obese individuals, the association was highly significant,[47] suggesting physical activity has greater influence on weight status in overweight or obese individuals. Another study examining the association between pedometer-determined activity and health indicators concluded that fewer steps/day was associated with increased waist circumference, increased BMI and greater likelihood of developing metabolic syndrome.[48]

Community Based Participatory Research

Community-based participatory research (CBPR) is an innovative research approach designed to increase the value of research studies for both researchers and the community being studied.[49] CBPR aims to improve heath and reduce health disparities by integrating education and social action.[50] Interventions encompassing CBPR focus on

relationships between the academic (research) and community partners and are meant to benefit all parties equally.[49,50] Community-based participatory research involves long-term commitments, co-learning between researchers and community members and capacity building to benefit all partners and effectively improve health.[50] CBPR has become a widely used method of improving health and eliminating health disparities within communities, and was the research design for the GetFRUVED project described later in the manuscript.

Chapter 3: MANUSCRIPT

Introduction

Unhealthy behaviors like poor dietary intake, decreased physical activity, inconsistent sleep patterns, and increased sedentary time are learned at a young age and tend to continue through adolescence into adulthood.[9-12] In a study conducted by Gordon-Larsen et al[13], a high proportion of obese adults were previously obese as adolescents (ages 13-20), and only a small proportion of adolescents moved out of the obese category (to overweight or normal weight) as they became adults.[13] Young adults are also at greater risk for experiencing unintended weight gain as the transition between high school and college presents many opportunities for lifestyle changes.[10] On average, young adults attending college gain 0.73 kg (1.61 lbs) to 3.99 kg (8.78 lbs) during their first year.[14] Although this initial weight gain may occur, weight gain often persists beyond the first year and continues throughout the duration of one's college experience.[8,12,15] This trend of weight increase may negatively impact health and weight outcomes in later adulthood, so the first year of college may represent a 'tipping point' in lifestyle behavioral patterns that persist into adulthood.[12,15]

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Cooking skills contributes to poor dietary intake; therefore, the purpose of this study is to determine lifestyle behaviors that are associated with increased fruit and vegetable intake and lower BMI. It is hypothesized that students' physical activity, cooking patterns, and dietary behaviors will be associated with fruit and vegetable intake and BMI. Specifically, students participating in physical activity, regularly preparing meals from basic ingredients, and having positive dietary behaviors will consume greater quantities of fruits and vegetables and have a lower BMI.

Methods

GetFRUVED Project

Data were collected through the GetFRUVED research project in the fall of 2015. GetFRUVED is a community-based participatory research project utilizing social marketing and environmental change to promote health and prevent unintended weight gain among older adolescents entering college. Eight universities collected data at baseline, and all students that were assessed from all universities were included in the data set for this cross-sectional study.

Participants

Potential participants were recruited through new student and freshman orientation, fliers, tabling, promotional item giveaways, e-mails, class presentations, and postcards (Appendix A). Interested participants were required to complete a short eligibility survey (Appendix B). All participants were first-year college students at least 18 years of age or older attending a participating GetFRUVED university, consuming less than two servings of fruits or three servings of vegetables daily, on average. In addition to the previous criteria, students were also required to meet at least one additional criterion. Additional criteria included (1) having a Body Mass Index (BMI) $\geq$ 25 kg/m^2 based on participant's self-reported height and weight, (2) self-identifying as a first-generation college student, (3) identifying his/her parent(s) as overweight or obese, (4) coming from a low-income background, measured through an affluence scale, or (5) self-identifying as a racial minority. Individuals meeting eligibility criteria were invited to participate in the study. Only freshman participants completing all assessments (survey and anthropometrics) were included in the data set for analysis. Data were collected from 1,108 participants at baseline. For this cross-sectional study, Institutional Review Board

(IRB) approval was obtained at all universities in accordance with the policy statements of the Human Subjects Committee. All participants provided written informed consent.

Assessments

Anthropometric: Height and weight were assessed by trained researchers per standard protocols. Each measurement was taken twice and the average was recorded. Height was recorded to the nearest 0.1 cm using a SECA 213 Portable Stadiometer. Both measurements were required to be within 0.2 cm of each other, or a third measurement was taken. Weight was measured using a SECA digital scale and collected to the nearest 0.1 kg. Like height, measurements were within 0.2 kg of each other or a third measurement was collected. All instruments were calibrated prior to all assessments. BMI was calculated from measured height and weight using the standard metric equation.

Cooking type, frequency, and confidence: Cooking type, frequency, and confidence were measured using a short survey originally developed to assess the impact of cooking interventions.[51] Questions relating to cooking type queried the type of cooking students participated in at the time of survey completion. Options included (1) cooking convenience foods and ready-made meals, (2) combining ready-made ingredients to make a complete meal, (3) prepare dishes from basic ingredients, (4) other, or (5) don't cook at all. Participants responded with either yes or no, were allowed to choose more than one method, and were able to describe 'other' methods of cooking they perform. 'Other' (written) methods were converted into pre-existing categories and can be viewed in Appendix E. For example, written responses such as 'dining hall' or 'family cooks' was converted into 'don't cook at all' while 'microwavable meals' or 'frozen meals' became cooking convenience foods and ready-made meals.

Cooking type responses (‘do not cook at al’, ‘cooking mostly convenience foods and ready-made meals’, and ‘prepare dishes from basic ingredients’) were scored from least to greatest level of complexity in cooking with ‘do not cook at all’ as least and and ‘prepare dishes from basic ingredients’ as greatest. An individual marking multiple methods of cooking was categorized based on the highest level of cooking they reported. For example, an individual reporting they cook by combining ready-made ingredients to make a complete meal and prepare dishes from basic ingredients would be categorized in the category ‘preparing dishes from basic ingredients’.

Cooking frequency was assessed using one question addressing how often per week participants prepared meals from basic ingredients. Response choices were (1) daily, (2) 4 – 6 times weekly, (3) 2 – 3 times weekly, (4) once weekly, (5) less than once weekly, and (6) never.[51] For data analysis, cooking frequency was divided into three categories—‘0x weekly’, ‘1 – 3x weekly’, and ‘4 – 7x weekly’—representing how often participants prepare and cook a main meal from basic ingredients.

Cooking confidence was measured using a seven-point Likert scale with four different questions addressing how confident participants felt about practicing various cooking techniques like being able to cook from basic ingredients, following a recipe, tasting food they have not eaten before, and preparing and cooking new foods and recipes.[51] Responses were (1) extremely confident, (2) very confident, (3) moderately confident, (4) neutral, (5) slightly confident, (6) not very confident, and (7) not at all confident.[51] ‘Choose not to answer’ was also an option. Each confidence variable was reverse coded to allow for accurate data analysis (1=Not at all Confident, 7=Extremely Confident). The average score of all four questions was calculated for an overall cooking

confidence score. Cronbach's alpha was calculated to ensure internal consistency of the calculated variable. Cronbach's alpha was calculated to be 0.89, signifying good internal reliability.[52,53]

Meal Planning: Intention for meal planning and mealtime behaviors were assessed using adopted survey questions from Project YEAH, originally adopted from Strong et al.[54-56] Intention for meal planning was measured using six questions on a five-point Likert scale. Participants were asked to indicate how often in the past three months they had the intention to practice meal planning behaviors (1=Never to 5=Always). The average score of all six questions was calculated for an overall intention for meal planning score (α=.71). Similar to intention for meal planning, mealtime behaviors were measured using a five-point Likert scale with four questions asking participants to indicate how often in the past three months they had practiced the noted mealtime behaviors (1=Never to 5=Always). The average score of all four questions was calculated for an overall mealtime behavior score (α=.73).

Dietary intake: Dietary intake was measured using the National Cancer Institute's Fruit and Vegetable Screener. Questions queried how much and how often participants consumed various fruits and vegetables over the last month. A final score was calculated as cups of fruits/vegetables and presented as mean ± SD.[57,58] Participants reporting greater than or equal to 15 cups of fruit and vegetables per day were excluded from data analysis relating to fruit and vegetable intake. As a result, five participants were not included.

Physical activity: International Physical Activity Questionnaire (IPAQ) was administered to all participants to assess self-reported physical activity over the past

seven days.[59,60] IPAQ is a validated survey tool for young and middle aged adults' ages 15-69 years and provides mean daily minutes of physical activity.[59,60] For data analysis, participants' physical activity was divided into three categories—inactive, moderately active, and highly active—based on self-reported activity level.[61] Moderately active participants met minimum public health physical activity recommendations reporting participation in vigorous activity at least three days weekly for 20 minutes, at least five days of moderate-intensity activity for at least 30 minutes, or at least 5 days of any combination of walking, moderate or vigorous intensity activities equaling a minimum of at least 600 MET-minutes per week.[61,62] Highly active individuals exceeded the minimum public health physical activity recommendations whereas inactive individuals did not report physical activity participation.[61]

Data Analysis

Stata 13.1 (2013) statistics software was used for all data analysis. Descriptive statistics were calculated for each variable at baseline. Multiple linear regression was used to assess the ability of physical activity, cooking patterns, and dietary behaviors to predict fruit and vegetable intake and BMI, after controlling for the influence of sex. Multiple variables were assessed for their relationship to fruit and vegetable intake and BMI, but only sex was significant, therefore it was included in the final regression analysis. Statistical significance was set at $p \leq 0.05$.

Results

Surveys and anthropometric measurements were collected from 1,108 participants at baseline. A comprehensive demographic description of the participant population is presented in Table 1. Participants were 18.5±.6 years old with 53.9% White, 10.5%

Black/African American, 3.1% Hispanic/Latino, and 32.6% other (including biracial). Mean fruit and vegetable intake was 2.4±2.0 cups/day and BMI was 24.4±4.9.

Fruit and Vegetable Intake

Fruit and vegetable intake was significantly associated with physical activity, cooking frequency, cooking type, intention for meal planning and mealtime behaviors (Figure 1). Highly active individuals reported significantly greater fruit and vegetable intake (2.7±.1) than both moderately active (2.1±.1, p=.000) and inactive individuals (1.7±.3, p=.000). Intake did not differ between moderately active and inactive individuals (p=.139). Intake was also greater in those reporting meal preparation 4 – 7 times weekly (3.0±.2) compared to 1 – 3 times weekly (2.4±.1, p=.018) or zero times weekly (2.3±.1, p=.002). No significant difference in fruit and vegetable intake was present between those reporting preparation 1 – 3 times and zero times weekly (p=.507). Cooking type was also associated with dietary intake. Reports of cooking mostly convenience and ready-made meals was associated with significantly lower intake of fruits and vegetables (2.1±.1) compared to preparing meals from basic ingredients (2.6±.1, p=.000) or not cooking at all (2.4±.1, p=.013). Intake did not differ between individuals preparing meals from basic ingredients and not cooking (p=.137). Intention for meal planning and mealtime behaviors were also positively related to fruit and vegetable intake. Greater intention for meal planning was associated with greater fruit and vegetable intake (R^2=.041, p=.000,). Mealtime behaviors was also positively associated with fruit and vegetable intake. Positive mealtime behaviors were associated with increased consumption of fruits and vegetables (R^2=.093, p=.000). Participants' cooking confidence was also included in analysis but was not significantly associated with fruit and vegetable intake (p=.272).

Body Mass Index

Cooking type and mealtime behaviors were the only variables to be significantly associated with BMI (Figure 2). Preparing meals from basic ingredients was associated with a lower BMI (23.8±.3) than consuming mostly convenience foods and ready-made meals (24.6±.3, p=.035) or not cooking at all (24.6±.2, p=.032). BMI did not differ between individuals cooking mostly convenience foods or ready-made meals and individuals not cooking (p=.939). BMI was inversely associated with mealtime behaviors. Practicing healthy mealtime behaviors was associated with a lower BMI (p=.009, R^2=.007).

Discussion

Because foods are often not consumed exclusively for the nutrient composition, there are many factors that can be associated with an individuals' dietary intake.[63] This study identified behaviors that were likely associated with fruit and vegetable intake and BMI in college students. Highly active individuals had significantly greater fruit and vegetable intake than moderately active and inactive individuals. Previous research has addressed the relationship between dietary intake and physical activity. A study conducted by Gillman et al. examined the relationship between physical activity and dietary behaviors in men and women and concluded that decreased levels of physical activity were associated with a less healthful diet.[20] Compared to sedentary individuals, moderately and vigorously active individuals were more likely to meet dietary guidelines.[20] Sedentary individuals generally consumed less 'healthy' foods and nutrients, such as fruits and vegetables, dietary fiber, calcium, folate, and vitamins A, C, and E.[20] Another study examining the dietary intake of very active individuals found that

active individuals actually consumed greater calories than inactive individuals when the end goal was to maintain weight.[64] Although calorie consumption may be increased with increased physical activity, it is important to consider total nutrient composition of calories. Eaton et al. reports individuals participating in higher levels of physical activity consumed more fiber, calcium, and antioxidant vitamins and less total and saturated fat compared to inactive individuals.[46] The present study did not find a significant association between BMI and physical activity, possibly because of the study's specific inclusion criteria. Although this study does not support previous findings, it is well established in the literature that more active individuals weigh less—often yielding a lower BMI—than those who are sedentary.[65,66]

Other literature has examined a likely association between food preparation (type and frequency) and diet quality. In the present study, more frequently preparing meals from basic ingredients was associated with greater fruit and vegetable intake. Previous research also supports these findings. Larson et al. concluded that young adults more frequently participating in food preparation and consuming fast food less often were more likely to meet the dietary objectives of *Healthy People 2010* for fat, calcium, fruit and vegetables.[21] The majority of young adults involved in the study did not perform most of the food preparation behaviors listed, however authors noted that the most young adults participating in the study did perceived their food preparation skills to be adequate.[21]

Some research suggests that other variables, such as sex, race/ethnicity, and fast food restaurant use, have a greater influence on one's involvement in food preparation and purchasing.[21] The current study only accounted for sex as a confounding variable, but future research could examine the effect of these other influencing factors. Larson et al.

also noted that although individuals more frequently preparing food at home are more likely to meet dietary recommendations, it is important to note that many young adults involved in food preparation were still not meeting the guidelines.[21] Although the current study also addresses cooking confidence as a possible factor influencing dietary intake and BMI, no significant differences were found. Minimal research currently addresses cooking confidence, but a critical review assessing the theory of planned behavior notes that self-efficacy is often viewed as a concept related to behavior.[67] Theoretically, the more individuals believe in their capability to achieve different levels of performance, the more likely behavior change will happen.[68] The more confidence an individual has in his/her ability to cook, the more likely he/she is to frequently participate in food preparation and cooking. Thus, more studies should be conducted because confidence could be a method of motivation to improve lifestyle.

Fruit and vegetable intake and BMI were also associated with cooking type. Cooking mostly convenience and ready-made meals was associated with significantly lower intake of fruits and vegetables compared to preparing meals from basic ingredients or not cooking at all. No difference in fruit and vegetable intake was found between individuals preparing meals from basic ingredients and not cooking. Survey questions about dietary intake inquired ‘how often in the past month’ participants consumed certain products. Since data collection happened within the first month of school, students could have consumed home-cooked meals prepared by another member of the family. Additionally, many first-year students have meal plans that do not require them to plan and prepare their own meals.

Intention for meal planning and mealtime behaviors were also addressed. Fruit and vegetable intake was related to greater intention for meal planning and improved mealtime behaviors, and a lower BMI was associated with improved mealtime behaviors. Intention for meal planning is related to how frequently in the past three months participants had reminded themselves to participate in healthy behaviors like eating in moderation or thinking about beverage choices. Mealtime behaviors pertain to how often participants actually took action and made healthy choices. Few studies examine the specific relationship of meal planning intention and mealtime behaviors to dietary intake and health, but the theory of planned behavior suggests that intention is an important attitude toward action.[68] An individual's intention to perform (or not perform) a specific action or behavior is the immediate, most significant determinant of that action.[67] While the theory of planned behavior provides theoretical evidence to support the relationship between dietary intake, BMI, and dietary behaviors, more research is needed.[67,68]

Previous research also suggests that healthy behaviors tend to cluster together. In a study by Colby et al., individuals that reported more healthful behaviors consumed more fruits and vegetables, had greater intention for meal planning and mealtime behaviors, consumed less fat and calories from sugar-sweetened beverages, reported greater physical activity, and had a lower average BMI compared to more at-risk individuals.[69] Another analysis using Project WebHealth data reported similar findings, suggesting that individuals reporting more healthful behaviors had greater fruit and vegetable intake and physical activity, and lower BMI than at-risk individuals of the same sex.[70] Although the current study was not a cluster analysis, certain healthful behaviors did show association with fruit and vegetable intake and BMI. Individuals with greater

physical activity consumed more fruits and vegetables, and cooking patterns and dietary behaviors were related to improved dietary intake and decreased BMI.

Strengths of this study were its large, diverse sample and use of a comprehensive evaluation of fruit and vegetable intake and physical activity using validated evaluation tools (NCI Fruit and Vegetable Screener and IPAQ). This study also measured height and weight, eliminating risk of false-reporting. However, study limitations should also be considered when interpreting results. The extensive GetFRUVED survey included numerous sections, so it is possible participants lacked motivation and control, thus failing to complete the survey accurately. Additionally, inclusion criteria for GetFRVUED were highly specific. Inclusion of additional criteria might have led to an observation of greater differences in outcome variables. Finally, measuring behaviors by self-report may have been influenced by social desirability.

Conclusion

Behaviors adapted and learned during adolescence and as a young adult are likely to persist into adulthood. Poor health behaviors can result in negative health outcomes. Identifying lifestyle behaviors associated with dietary intake and BMI is important because interventions to improve lifestyle could result in health benefits that improve quality of life and reduce disease risk and mortality. Additionally, healthy behaviors tend to cluster together, suggesting prevention and intervention efforts to improve dietary intake or BMI may also subsequently improve other health behaviors. Interventions aimed at improving dietary intake and BMI could benefit from including food preparation and physical activity components, emphasizing cooking skills, tips for meal planning, and strategies to make behavior change.

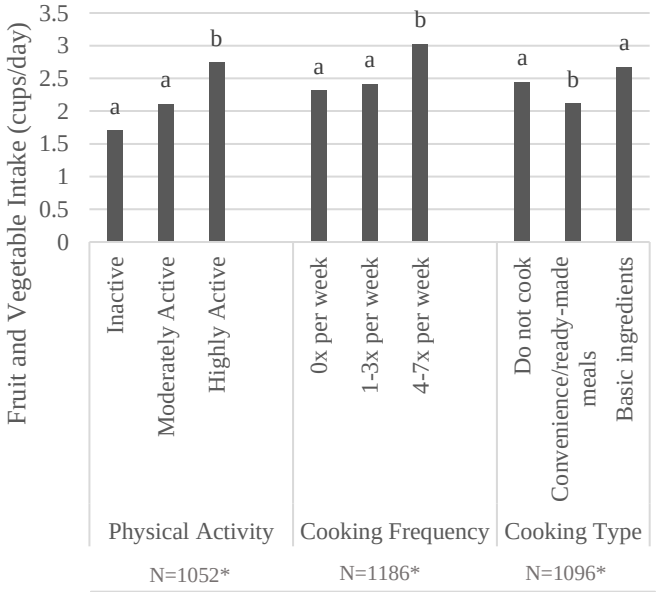
TABLES

Table 1: FRUVED Participant Baseline Demographics

Variable	**n, (%)**
Age, n (%)	
18-19	1,095 (98.8%)
20 and older	13 (1.2%)
Ethnicity, n (%)	
White only	597 (53.9%)
Black only	116 (10.5%)
Hispanic/Latino only	34 (3.1%)
Other (including biracial)	361 (32.6%)
Residency, n (%)	
On campus	962 (86.9%)
Off campus	141 (12.7%)
University, n (%)	
Auburn University	69 (6.2%)
University of Florida	298 (26.9%)
Maine University	164 (14.8%)
Kansas State University	111 (10.0%)
Syracuse University (New York)	145 (13.1%)
University of Tennessee	164 (14.8%)
South Dakota State University	67 (6.0%)
West Virginia University	87 (7.9%)
Relationship Status, n (%)	
Single	738 (66.6%)
In a committed relationship	345 (31.1%)
Working Hours, n (%)	
I do not work	799 (72.1%)
I do work (1 hour or greater per week)	288 (26.0%)
Pell Grant Eligible, n (%)	
Yes	388 (35.0%)
No	659 (59.5%)
Sex, n (%)	
Male	368 (33.2%)
Female	736 (66.4%)
BMI, mean ± SD	24.4 ± 4.9
Fruit and vegetable intake (cups) mean ± SD	2.4 ± 2.0

FIGURES

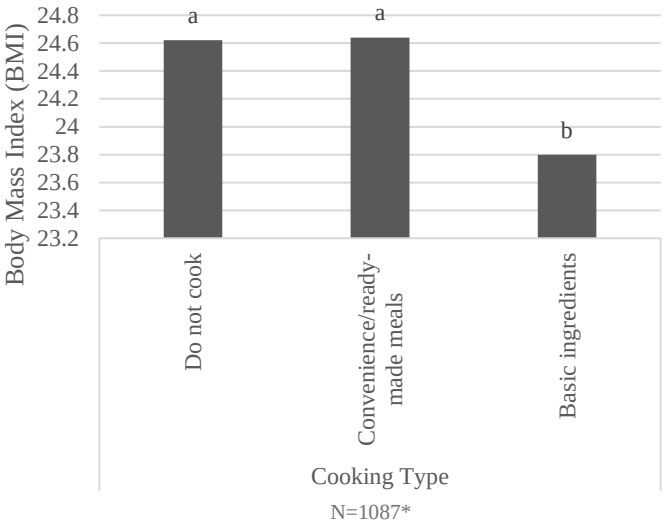
Figure 1: Categorical variables significantly influencing fruit and vegetable intake.[1]



[1]Bars sharing a letter are not significantly different at $p \leq .05$

*N values vary from total recruited participants due to missing data for each variable.

Figure 2: Categorical variables significantly influencing BMI.[1]



[1]Bars sharing a letter are not significantly different at $p \leq .05$

*N values vary from total recruited participants due to missing data for each variable.

APPENDIX

Appendix A: FRUVED Recruitment Materials

Recruitment E-mail
Dear XXXX,

South Dakota State University has been selected to participate in a four-year program in which students work together to improve the healthfulness of the overall campus experience. As a part of the program, student's behaviors, thoughts, and health are going to be measured each year from the first through fourth year of study. You are coming into the university during the first year of this program.
Since you are coming into the university during the first year of this program, you are invited to participate. If you are eligible and decide to participate in this study, you will be able to receive $75 over the next year for approximately four hours of your time. You would receive the first payment of $30 for coming to the first assessment this fall. During the two-hour assessment we would conduct some physical measurements including: neck, waist and hip circumference, height, and weight. You would also be asked to complete some surveys about your health, health-related behavior, and thoughts about campus. You will also be able to meet other students, play games, win some prizes, get a t-shirt, and enjoy some food.
If you are interested in taking part of this project, please go to www.fruved.com and complete a short survey to determine if you are eligible. If you are eligible and participate in the project, in addition to the benefits described above, you will also be helping to shape South Dakota State University and contributing to the health of future students.

Please let us know if you have any questions. You may contact us at fruvedsdsu@gmail.com or 605-688-6199.

Sincerely,
SDSU FRUVED Research Team

Recruitment handouts, business card, and postcard

Fruved Research Team
SDSU HNS Department
Box 2203
Brookings, SD 57007

Please deliver to:

Hello SDSU Student,

If you're interested in joining the Fruvement, take our survey at **getfruved.com**!

You will earn a $5 gift card and receive a health report card comparing your healthfulness to the campus average.

You can also choose to potentially match with an upperclassman health peer mentor to help you navigate your first year of college!

Follow us @getfruvedsdsu

GetFRUVED

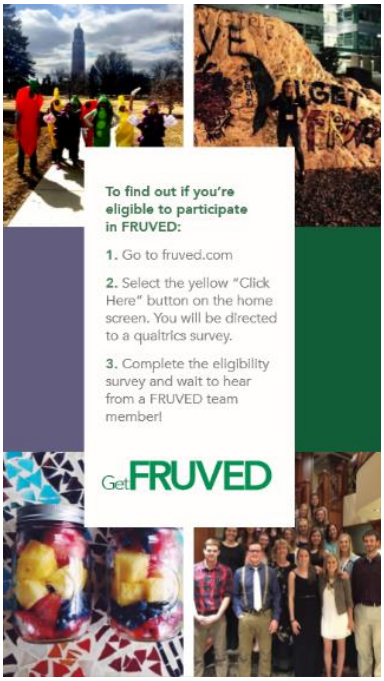
GetFRUVED

WHAT IS FRUVED?

It is a USDA grant-funded project and stands for (FRUits and VEgetables), but it is about much more! The project's goal is to help students make healthier choices. We have giveaways, free campus events, and health peer mentoring.

GetFRUVED
@SDSU

To find out if you're eligible, go to:
FRUVED.COM



To find out if you're eligible to participate in FRUVED:

1. Go to fruved.com
2. Select the yellow "Click Here" button on the home screen. You will be directed to a qualtrics survey.
3. Complete the eligibility survey and wait to hear from a FRUVED team member!

GetFRUVED

GetFRUVED

A USDA grant-funded project that aims to reduce obesity and increase healthier lifestyles within college freshman.

What is the purpose? Not only does Fruved focus on nutrition and physical activity, but it also addresses other important factors in maintaining a healthy lifestyle such as stress, sleep, hydration, and substance abuse.

Why should you join the Fruvement? This project also offers several cutting-edge student led interventions and activities that all students are encouraged to attend. The project promotes community-building and health, in hopes of improving lifestyles campus-wide.

THE BENEFITS OF JOINING **FRUVED:**

THE COLLEGE EXPERIENCE

A large part of the college experience is branching out and becoming involved in opportunities around campus while meeting other students whom have similar interests as yourself. FRUVED offers this opportunity and aims to promote a healthy lifestyle. FRUVED is a partnership between students and researchers at eight different universities, all working together with the fundamental goal of changing the world for the better. Diet, physical activity, sleep habits, and stress management are only a few of the key elements that influence a healthy lifestyle and FRUVED focuses on all of these and many more.

OUR ACTIVITIES

The goal of this study is to use interactive, peer-led, and social marketing-environmental interventions to help college students manage their weight by improving their lifestyle behaviors. A hard-working group of sophomores and juniors have worked to design a whole year of fun activities including sunrise yoga, Zumba, and cooking classes - just to name a few.

HELPING OTHERS

As a member of FRUVED, during the 2016-2017 school year you will have the opportunity to mentor high school students to help them develop interventions to promote healthy lifestyles for the incoming freshman class. Ultimately, high school students will work with middle school students, and then middle school students will work with elementary schools creating a "chain reaction" to implement healthy lifestyles in academic environments.

GETTING INVOLVED

If you are interested in joining the fruvement and becoming a member of the influential FRUVED team, visit fruved.com to fill out the eligibility survey. If you are eligible, you will be asked to complete a few online surveys and come in for some physical assessments. These assessments are meant to be fun and you will have the opportunity to win prizes, eat some free food, and meet other students! You can also earn $75 for only four hours of your time.

Appendix B: FRUVED Eligibility Screening Tool

Eligibility Screening Tool

1) Are you entering (Enter Your University Here) as a first-year (freshmen) college student this fall (not transferring from another University or Community College)?

- ☐ Yes
- ☐ No

2) Are you 18 years old or older?

- ☐ Yes
- ☐ No

3) Think about what you usually ate last month. Please think about all the fruits and vegetables that you ate last month. Include those that were:

- Raw and cooked,
- Eaten as snacks and at meals
- Eaten at home and away from home (restaurants, friends, take-out), and
- Eaten alone and mixed with other foods.

Including snacks, how many cups of fruit and 100% fruit juice do you usually eat each day?

- ☐ Less than ½ cup
- ☐ ½ cup
- ☐ 1 cup
- ☐ 1 ½ cups
- ☐ 2 cups
- ☐ 2 ½ cups
- ☐ 3 cups
- ☐ 3 ½ cups
- ☐ 4 cups
- ☐ 4 ½ cups
- ☐ 5 cups
- ☐ 5 ½ cups
- ☐ 6 cups or more
- ☐ Choose not to answer

Including snacks, how many cups of vegetables do you usually eat each day?

- ☐ Less than ½ cup
- ☐ ½ cup
- ☐ 1 cup
- ☐ 1 ½ cups
- ☐ 2 cups
- ☐ 2 ½ cups
- ☐ 3 cups
- ☐ 3 ½ cups
- ☐ 4 cups

- 4 ½ cups
- 5 cups
- 5 ½ cups
- 6 cups or more
- Choose not to answer

4) These questions are about physical activities (exercise, sports, physically active hobbies…) that you may do in our LEISURE time.
How often do you do **VIGOROUS leisure-time** physical activities for **AT LEAST 10 MINUTES** that cause **HEAVY** sweating or **LARGE** increases in breathing or heart rate? (e.g. running, cross-country skiing, cycling, basketball)

- Never
- _____ per day / week / month / year (Circle)
- Unable to do this type of activity
- Don't know

How often do you do **LIGHT OR MODERATE LEISURE-TIME** physical activities for **AT LEAST 10 MINUTES** that cause **ONLY LIGHT** sweating or a **SLIGHT** to **MODERATE** increase in breathing or heart rate? (e.g. walking, easy cycling, tennis)

- Never
- _____ per day / week / month / year (Circle)
- Unable to do this type of activity
- Don't know

^ALL these above must be met in order to be eligible, PLUS ONE (or more) of the following must be affirmative (or affluence scale indicate lower income status):

5) Are you the first person in your immediate family to attend college?

- Yes
- No
- I don't know/not sure

6) Are either of your parents overweight or obese?

- Yes
- No
- I don't know/not sure

7) Affluence Scale Questionnaire:

Do you have your own bedroom (for just you, or you and your partner/spouse?)

- Yes
- No

How many computers/laptops are in your home?

- Zero
- One
- Two
- Three

- Four
- Five
- Six
- Seven
- Eight
- Nine
- Ten
- More than ten

How many cars, vans, or trucks does your family own?

- Zero
- One
- Two
- Three
- Four
- Five
- Six
- More than six

How many times did you travel away on vacation with your family during the past 12 months?

- Never
- 1 time
- 2 times
- 3 or more times

12) Are you Hispanic or Latino?

- Yes
- No
- I don't know/not sure
- Choose not to answer

13) Which one or more of the following would you say is your race?

- White
- Black or African American
- Asian
- Native Hawaiian or Other Pacific Islander
- American Indian or Alaska Native
- Other (Please Specify) _____

14) How tall are you?

_____ Feet _____ inches

What is your current weight?

_____ pounds

15) What gender are you

Male

Female

Appendix C: FRUVED Survey Consent Form

Fruved Freshmen Survey Consent Form

Dr. Sarah Colby is studying the health and fitness of young adults on the University of Tennessee campus. We want to study you to help understand the factors associated with nutrition and physical activity on health and fitness on the University of Tennessee campus. As a part of this process, there will be a semester long class on social marketing interventions that promote healthy behaviors on college campuses.

What Will You Be Asked to Do?

You will be asked to have your weight, height, blood pressure, neck, hip, and waist circumference measured, complete surveys, have a photo taken of your face, and possibly wear an accelerometer for seven days in the beginning and the end of the semester. Assessments will take approximately nine hours total in the semester to complete. You may choose to not to complete any of the assessments or measurements that you are not comfortable with.

Benefits to Participation

You will receive financial compensation for your time. You will receive the financial stipend after completion of the assessment process at each of the time points below. Partial compensation will not be provided at any time point.

Year	Term	Amount
2015	**Fall**	**$30**
2016	**Spring**	**$45**
2016	**Fall**	**$45**
2017	**Spring**	**$55**
2017	**Fall**	**$60**
2018	**Spring**	**$75**
2018	**Fall**	**$100**
2019	**Spring**	**$125**
	Total	**$535**

Risks to Participation

There is minimal risk to participating in the study, primarily due to time and inconvenience.

Confidentiality

All information you is provided is confidential and protected. All data collected will be kept on the researcher's password protected computer and in the University of Tennessee, Nutrition Education and Behavior Laboratory, for up to seven years and then destroyed. Non- identifiable information will be stored indefinitely in an electronic version accessible to researchers and used for secondary data analysis.

Voluntary

Participation in this study is voluntary. If you choose to take part in this study, you may stop at any time.

Contact Information

Contact Dr. Sarah Colby for questions about the research project at (865)974-6248, at the University of Tennessee. If you have questions about your rights as a participant, contact the Office of Research Compliance Officer at (865) 974-3466.

By clicking on the continue button below, you are agreeing to participate in the Fruved Research Project.

Continue No thank you, I don't want to participate

Appendix D: FRUVED Survey Questions (only pertinent sections provided)

Fruit and Vegetable Intake

	Question Text	Response Options
NCIfv0	Think about what you usually ate last month. Please think about **all** the fruits and vegetables that you ate **last month**. Include those that were: • Raw and cooked, • Eaten as snacks and at meals • Eaten at home and away from home (restaurants, friends, take-out), and • Eaten alone and mixed with other foods. Report how many times per month, week, or day you ate each food, and if you ate it, how much you usually had. Choose the best answer for each question. Mark only one response for each question. Over the last month, how often did you …	

NCIfv1	**…drink 100% juice** such as orange, apple, grape, or grapefruit juice? Do not count fruit drinks like Kool-Aid, lemonade, Hi-C, cranberry juice drink, Tang, and Twister. Include juice you drank at mealtimes and between meals.	1) Never 2) 1-3 times last **month** 3) 1-2 times per **week** 4) 3-4 times per **week** 5) 5-6 times per **week** 6) 1 time per **day** 7) 2 times per **day** 8) 3 times per **day** 9) 4 times per **day** 10) 5 or more times per **day** 11) Choose not to answer
NCIfv2	Each time you drank 100% juice, how much did you usually drink?	1) Did not drink 100% juice 2) Less than ¾ cup (less than 6 ounces) 3) ¾ to 1 ¼ cup (6 to 10 ounces) 4) 1 ¼ to 2 cups (10 to 16 ounces) 5) More than 2 cups (more than 16 ounces) 6) Choose not to answer
NCIfv3	...eat fruit? Count any kind of fruit – fresh, canned, and frozen. Do not count juices. Include fruit you ate at all mealtimes and for snacks.	Same as NCIfv1
NCIfv4	Each time you ate fruit, how much did you usually eat?	1) Did not eat fruit 2) Less than 1 medium fruit (less than ½ cup) 3) 1 medium fruit (about ½ cup) 4) 2 medium fruits (about 1 cup) 5) More than 2 medium fruits (more than 1 cup) 6) Choose not to answer
NCIfv5	...eat **lettuce salad** (with or without other vegetables)?	Same as NCIfv1
NCIfv6	Each time you ate lettuce salad, how much did you usually eat?	1) Did not eat lettuce salad 2) About ½ cup 3) About 1 cup 4) About 2 cups 5) More than 2 cups 6) Choose not to answer
NCIfv7	...eat **French fries** or fried potatoes?	7) Same as NCIfv1
NCIfv8	Each time you ate French fries or fried potatoes, how much did you usually eat?	1) Did not eat French fries or fried potatoes 2) Small order or less (about 1 cup or less) 3) Medium order (about 1 ½ cups) 4) Large order (about 2 cups) 5) Super-size order or more (about 3 cups or more) 8) Choose not to answer
NCIfv9	…eat **other white potatoes**? Count baked, boiled, and mashed potatoes, potato salad, and white potatoes that were not fried.	6) Same as NCIfv1

NCIfv10	**Each time you ate these potatoes, how much did you usually eat?**	**1) Did not eat these types of potatoes** **2) 1 small potato or less (1/2 cup or less)** **3) 1 medium potato (1/2 to 1 cup)** **4) 1 large potato (1 to 1 ½ cups)** **5) 2 medium potatoes or more (1 ½ cups or more)** **Choose not to answer**
NCIfv11	...eat cooked dried beans? Count baked beans, bean soup, refried beans, pork and beans, and other bean dishes.	Same as NCIfv1
NCIfv12	Each time you ate these beans, how much did you usually eat?	1) Did not eat cooked dried beans 2) Less than ½ cup 3) ½ to 1 cup 4) 1 to 1 ½ cups 5) More than 1 ½ cups 6) Choose not to answer
NCIfv13	...eat **other vegetables**? Do not count: 1) Lettuce salads 2) White potatoes 3) Cooked dried beans 4) Vegetables in mixtures such as in sandwiches, omelets, casseroles, Mexican dishes, stews, stir-fry, soups, etc 5) Rice Count: All other vegetables – raw, cooked, canned, and frozen	Same as NCIfv1
NCIfv14	Each of these times that you ate other vegetables, how much did you usually eat?	1) Did not eat these vegetables 2) Less than ½ cup 3) ½ to 1 cup 4) 1 to 2 cups 5) More than 2 cups 6) Choose not to answer
NCIfv15	...eat **tomato sauce**? Include tomato sauce on pasta or macaroni, rice, pizza and other dishes.	Same as NCIfv1
NCIfv16	Each time you ate tomato sauce, how much did you usually eat?	1) Did not eat tomato sauce 2) About ½ cup 3) About ½ cup 4) About 1 cup 5) More than 1 cup 6) Choose not to answer
NCIfv17	...eat **vegetable soups**? Include tomato soups, gazpacho, beef with vegetable soup, minestrone soup, and other soups made with vegetables.	Same as NCIfv1
NCIfv18	Each time you ate vegetable soup, how much did you usually eat?	1) Did not eat vegetable soup 2) Less than 1 cup 3) 1 to 2 cups 4) 2 to 3 cups 5) More than 3 cups

NCIfv19	...eat **mixtures** that included vegetables? Count such foods as sandwiches, casseroles, stews, stir-fry, omelets, and tacos.	Same as NCIfv1

Physical Activity

	Question Text	**Response Options**
	How Active Are You? We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport. Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal or make your heart beat much harder than normal. Think only about those vigorous physical activities that you did for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate.	

IPAQ1	During the last 7 days, on **how many days** did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?	1) 0 days 2) 1 day 3) 2 days 4) 3 days 5) 4 days 6) 5 days 7) 6 days 8) 7 days 9) Choose not to answer
IPAQ2	**How much time** did you usually spend doing **vigorous** physical activities on one of those days?	1) Did not do vigorous physical activities 2) 10 minutes 3) 20 minutes 4) 30 minutes 5) 40 minutes 6) 50 minutes 7) 60 minutes 8) 70 minutes (1 hr 10 min) 9) 80 minutes (1 hr 20 min) 10) 90 minutes (1 hr 30 min) 11) 100 minutes (1 hr 40 min) 12) 110 minutes (1 hr 50 min) 13) 120 minutes (2 hrs) 14) 130 minutes (2 hrs 10 min) 15) 140 minutes (2 hrs 20 min) 16) 150 minutes (2 hrs 30 min) 17) 160 minutes (2 hrs 40 min) 18) 170 minutes (2 hrs 50 min) 19) 180 + minutes (3 hrs or more) 20) Don't know/not sure 21) Choose not to answer

	Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal or make your heart beat somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes some increase in breathing or heart rate.	
IPAQ3	During the last 7 days, on **how many days** did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.	Same as IPAQ1
IPAQ4	**How much time** did you usually spend doing **moderate** physical activities on one of those days?	Same as IPAQ2
	Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise or leisure.	
IPAQ5	During the last 7 days, on **how many days** did you **walk** for at least 10 minutes at a time?	Same as IPAQ1
IPAQ6	**How much time** did you usually spend **walking** on one of those days?	Same as IPAQ2

Cooking Patterns

	Question Text	**Response Options**
	How do you prepare meals?	
	What kind of cooking do you do at the moment?	
cook1_1	Cook convenience foods and ready-meals	Y/N
cook1_2	Put together ready-made ingredients to make a complete meal	Y/N
cook1_3	Prepare dishes from basic ingredients	Y/N
cook1_4	Other	Y/N
cook1_4_TEXT	If you chose "Other", please specify	TEXT
cook1_5	Don't cook at all	Y/N
cook1_6	Choose not to answer	Y/N
cook2	In a normal week, how often do you prepare and cook a main meal from basic ingredients, for example, making lasagna starting with ground beef and tomato sauce?	1) Daily 2) 4-6 times a week 3) 2-3 times a week 4) Once a week 5) Less than once a week 6) Never 7) Choose not to answer
	How confident do you feel about…	
cookconfident1	…being able to cook from basic ingredients?	1) Extremely confident 2) Very confident 3) Moderately confident 4) Neutral 5) Slightly confident 6) Not very confident 7) Not at all confident 8) Choose not to answer
cookconfident2	…following a recipe?	Same as cookconfident1
cookconfident3	…tasting foods that you have not eaten before?	Same as cookconfident1
cookconfident4	…preparing and cooking new foods and recipes?	Same as cookconfident1

Intention for Meal Planning and Mealtime Behaviors

	Question Text	**Response Options**
	Indicate below how often in the past 3 months you have done the following:	
MPplan	Remind myself that planning quick and simple meals is important.	1) Never 2) Seldom 3) Occasionally 4) Often 5) Always 6) Choose not to answer
MPhltheasy	Tell myself that healthy meals do not require a lot of work.	Same as MPplan
MPeatmod	Remind myself to eat in moderation	Same as MPplan
MPtreat	Tell myself to allow room for an occasional treat food or dessert for just plain enjoyment.	Same as MPplan
MPbev	Remind myself to think about my beverage choices.	Same as MPplan
MPfv	Tell myself that fruits and vegetables should be included in every meal.	Same as MPplan
MPsnacks	Planned quick, easy, and healthy snacks.	Same as MPplan
MPhlthbev	Select beverages with my health in mind.	Same as MPplan
MPvegadd	Purposely added vegetables to my meals and snacks.	Same as MPplan
MPflex	Was flexible and sensible with my food choices.	Same as MPplan

Appendix E: Written Response (cookTYPE) Coding

TEXT	Recoded To:
Cafeteria Food	cook1_5
Smoothies	cook1_3
Mostly eat precook meals and meals at the dining hall	cook1_1
Meal Plan	cook1_5
Dining Hall	cook1_5
Meal Prep	cook1_3
I eat in the dining hall on campus	cook1_5
Family has made me home cooked food and I have frozen it	cook1_5
I don't cook. My sorority chef cooks	cook1_5
Cafeteria style	cook1_5
Microwave cooking	cook1_1
Cannot cook in dorm. Prepare from basic ingredients at home	cook1_3
Eat dorm food	cook1_1
Bluestem Food Service for Delta Chi	cook1_5
Just ramen and popcorn. All meals are form the dining hall	cook1_5
Dorm food	cook1_1
Eat at dining hall	cook1_5

TEXT	Recoded To:
Leftovers in microwave	cook1_1
Dining meal plan or family cooks	cook1_5
Cannot cook in dorm	cook1_5
Eat food from the dining halls	cook1_5
Cannot cook at college	cook1_5
Mostly eat at dining hall	cook1_5
Cook from scratch	cook1_3
Go to dining hall	cook1_5
Dining hall	cook1_5
Microwavable meals	cook1_1
Smoothies	cook1_3
Microwave food	cook1_1
Pasta, Rice, Potatoes	cook1_3
Boyfriend cooks	cook1_5
Dorm food	cook1_1
Microwave food	cook1_1

Column (student responses)	**sook1_TYPE (code)**
IF: cook1_1 = 1 & cook1_2 = 2 & cook1_3 = 2 & cook1_4 = 2 & cook1_5 = 2 & cook1_6 = 2	**2**: Some cooking, mostly convenience and ready-made meals
IF: cook1_1 = 2 & cook1_2 = 1 & cook1_3 = 2 & cook1_4 = 2 & cook1_5 = 2 & cook1_6 = 2	**2**: Some cooking, mostly convenience and ready-made meals
IF: cook1_1 = 2 & cook1_2 = 2 & cook1_3 = 1 & cook1_4 = 2 & cook1_5 = 2 & cook1_6 = 2	**3**: Prepare meals from basic ingredients
IF: cook1_1 = 2 & cook1_2 = 2 & cook1_3 = 2 & cook1_4 = 1 & cook1_5 = 2 & cook1_6 = 2	ALL cook1_4 RECODED TO DIFFERENT VARIABLE
IF: cook1_1 = 2 & cook1_2 = 2 & cook1_3 = 2 & cook1_4 = 2 & cook1_5 = 1 & cook1_6 = 2	**1**: Does not cook at all
IF: cook1_1 = 1 & cook1_2 = 1 & cook1_3 = 1 & cook1_4 = 2 & cook1_5 = 2 & cook1_6 = 2	**3**: Prepare meals from basic ingredients
IF: cook1_1 = 1 & cook1_2 = 1 & cook1_3 = 2 & cook1_4 = 2 & cook1_5 = 2 & cook1_6 = 2	**2**: Some cooking, mostly convenience and ready-made meals
IF: cook1_1 = 2 & cook1_2 = 1 & cook1_3 = 1 & cook1_4 = 2 & cook1_5 = 2 & cook1_6 = 2	**3**: Prepare meals from basic ingredients
IF: cook1_1 = 1 & cook1_2 = 2 & cook1_3 = 1 & cook1_4 = 2 & cook1_5 = 2 & cook1_6 = 2	**3**: Prepare meals from basic ingredients
IF: cook1_1 = 1 & cook1_2 = 2 & cook1_3 = 2 & cook1_4 = 2 & cook1_5 = 1 & cook1_6 = 2	**2**: Some cooking, mostly convenience and ready-made meals
IF: cook1_1 = 1 & cook1_2 = 1 & cook1_3 = 1 & cook1_4 = 2 & cook1_5 = 1 & cook1_6 = 2	**3**: Prepare meals from basic ingredients
IF: cook1_1 = 2 & cook1_2 = 1 & cook1_3 = 1 & cook1_4 = 2 & cook1_5 = 1 & cook1_6 = 2	**3**: Prepare meals from basic ingredients
IF: cook1_1 = 2 & cook1_2 = 2 & cook1_3 = 2 & cook1_4 = 2 & cook1_5 = 2 & cook1_6 = 2	**5**: No answer (yes) selected/all no's
IF: cook1_1 = 2 & cook1_2 = 2 & cook1_3 = 2 & cook1_4 = 2 & cook1_5 = 2 & cook1_6 = 1	**4**: Choose not to answer

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