Changes in BMI and Dietary Behaviors in Overweight and Obese College Freshmen After Measuring Energy Needs, An Individualized Nutrition Consult, and An Eight Week Facebook Nutrition Intervention

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ABSTRACT

CHANGES IN BMI AND DIETARY BEHAVIORS IN OVERWEIGHT AND OBESE COLLEGE FRESHMEN AFTER MEASURING ENERGY NEEDS, AN INDIVIDUALIZED NUTRITION CONSULT, AND AN EIGHT WEEK FACEBOOK NUTRITION INTERVENTION

by

Suzanne Hendricks Saunders

Background: A growing number of college students are classified as overweight or obese, increasing their likelihood of developing a chronic disease as an adult. Studies have shown social media platforms to be effective in increasing awareness and engagement, in combination with other components, to motivate nutrition and lifestyle behavior change. The purpose of this study was to determine if a nutrition consultation discussing energy needs and nutrition education about weight loss, combined with an 8 week Facebook nutrition intervention will 1) decrease BMI and 2) improve dietary habits of college freshman.

Methods: A total of 20 participants were recruited from a large, urban university in Atlanta, GA. Research participants completed a pre-study 3-day food diary, indirect calorimetry to measure resting metabolic rate and a 30-minute individualized consultation with a nutrition graduate student and registered dietitian (RD). Participants then engaged
in an 8-week Facebook nutrition intervention. Height, weight, and 3-day food logs were collected post-study. Pre- and post-study BMI were calculated for each participant, and each food diary (pre and post study) was analyzed for changes in dietary intake (ESHA Food Processor). The data were normally distributed and a paired t-test was used to determine differences between the mean of pre- and post-study weight and BMI.

**Results:** The population (n=8) had an average age of 19.03 years; the majority were female (87.5%) and African American (87.5%). Sixty-three percent of the participants who had pre-post weight measurements (n=8) maintained or decreased their BMI. Additionally, there were no statistically significant differences in fruit (p=0.18) and vegetable (p=0.90) consumption (n=6). A mean decrease of 23.00 ounces/day was seen in sugar-sweetened beverage consumption (p=0.28).

**Conclusion:** These pilot data indicate that a nutrition intervention including nutrition counseling based on individual energy needs and 8-weeks of messages delivered via Facebook is effective in maintaining or decreasing BMI in overweight and obese freshman. Additionally, there were no significant changes in dietary behavior, although there was an observed overall decrease in sugar-sweetened beverages. Future studies of greater length and with a larger sample size should be conducted to determine if more significant dietary changes and weight changes would be observed in this population.
CHANGES IN BMI AND DIETARY BEHAVIORS IN OVERWEIGHT AND OBESE COLLEGE FRESHMEN AFTER MEASURING ENERGY NEEDS, AN INDIVIDUALIZED NUTRITION CONSULT, AND AN EIGHT WEEK FACEBOOK NUTRITION INTERVENTION

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Suzanne Hendricks Saunders

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## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>BMR</td>
<td>Basal Metabolic Rate</td>
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<tr>
<td>CDC</td>
<td>Center for Disease Control and Prevention</td>
</tr>
<tr>
<td>DGA</td>
<td>Dietary Guidelines for Americans</td>
</tr>
<tr>
<td>GPA</td>
<td>Grade Point Average</td>
</tr>
<tr>
<td>IOM</td>
<td>Institute of Medicine</td>
</tr>
<tr>
<td>IRB</td>
<td>Institutional Review Board</td>
</tr>
<tr>
<td>Kcal</td>
<td>Kilocalorie</td>
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<tr>
<td>Kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>Lbs</td>
<td>Pounds</td>
</tr>
<tr>
<td>MSB</td>
<td>My Student Body- Nutrition</td>
</tr>
<tr>
<td>NIH</td>
<td>National Institute of Health</td>
</tr>
<tr>
<td>PA</td>
<td>Physical Activity Factor</td>
</tr>
<tr>
<td>PAL</td>
<td>Physical Activity Level</td>
</tr>
<tr>
<td>RD</td>
<td>Registered Dietitian</td>
</tr>
<tr>
<td>REE</td>
<td>Resting Energy Expenditure</td>
</tr>
<tr>
<td>RMR</td>
<td>Resting Metabolic Rate</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
</tr>
<tr>
<td>TEE</td>
<td>Total Energy Expenditure</td>
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CHAPTER I

CHANGES IN BMI AND DIETARY BEHAVIORS IN OVERWEIGHT AND OBESE COLLEGE FRESHMEN AFTER MEASURING ENERGY NEEDS, AN INDIVIDUALIZED NUTRITION CONSULT, AND AN EIGHT WEEK FACEBOOK NUTRITION INTERVENTION

Introduction

The obesity epidemic has had devastating effects in the United States and is a cause of great global concern.\(^1\)\(^2\) Obesity is the second leading cause of preventable deaths in the United States contributing to approximately 300,000 deaths each year.\(^1\)

From 2011-2012 two-thirds of adults in the United States were classified as overweight, while one-third of adults were classified as obese.\(^3\) In a study of 80,000 college students from 100 college campuses nationwide, 21.9% of the students were overweight, defined by a body mass index (BMI) of 25-29.9 kg/m\(^2\) and 10% were obese with a BMI of 30 kg/m\(^2\) or greater.\(^4\) Young adults with a normal BMI of 18.5-24.9 kg/m\(^2\) are not guaranteed to maintain a healthy weight through midlife; however research shows these individuals have a significantly lower body weight and fewer obesity-related conditions at middle-age than those with a higher BMI as a young adult.\(^5\)

The first-year year of college can be a time of change and transition for young adults. Freshman college students may experience additional freedom in food choices, increased alcohol consumption, and altered sleep patterns.\(^6\)\(^7\) Most college students are familiar with the infamous “Freshman 15”, a phrase that is based on a mythical number of pounds that students are predicted to gain during their first year of college. Research shows that on average college freshmen may gain approximately 3.0 kg (6.6 lbs) during
their first year. Weight gain at this rate could lead students to gain an average of 12 kg (26.4 lbs) over their four-year college career, which could lead to life-long weight struggles and obesity-related health problems.

Research supports the need for an effective weight loss and nutrition education intervention in the college freshman population, typically ages 18-20 years. Educating college students about nutrition and exercise habits to prevent weight gain, especially during their first year of college, is important but can be a challenge. Use of Facebook, Twitter, and Instagram by college age students is 86%, 38%, and 30%, respectively. Studies have shown social media platforms, in combination with other components, to be effective in increasing awareness and engagement. Therefore, social media is an ideal communication tool to use in nutrition interventions with college freshmen.

The purpose of this study was to determine if a nutrition intervention consisting of a 30-minute personalized nutrition consultation with a registered dietitian discussing energy needs based on results of metabolic testing and strategies for weight loss followed by nutrition messages delivered via Facebook would have any effect on BMI and dietary habits of overweight and obese college freshman. We had two hypotheses: 1) a nutrition consultation discussing energy needs based on metabolic testing and nutrition education about weight loss followed by an 8 week Facebook intervention would decrease BMI; and 2) a nutrition consultation discussing energy needs based on metabolic testing and nutrition education about weight loss followed by an 8 week Facebook intervention would improve dietary habits of college freshmen evidenced by increased vegetable and
fruit intake and decreased consumption of sugar-sweetened beverages.
CHAPTER II
REVIEW OF LITERATURE

College Freshmen Weight Gain

The first year of college can be a time of transition and stress that can lead to a number of changes. Studies following students through the transition from high school to their first year of college, known as the freshman year, have revealed weight gain is common. Pullman et al. (2009) investigated the effect of the transition to college life on anthropometric measurements and lifestyle variables in Canadian male freshman students. The study followed 108 male subjects from the summer prior to their freshman year of college into the winter semester of their freshman year. Several outcomes were measured including BMI and dietary intake. The students gained an average of 3.0 kg (6.6 lbs) and BMI increased significantly from summer to winter with a change of 23.5 kg/m² to 24.3 kg/m² (p<0.05). Factors contributing to the students’ weight gain included an increased frequency of binge drinking, the number of alcoholic drinks consumed per week and an increase in sedentary activities like computer use and study time. The study found no significant changes in energy or nutrient intakes based on 24 hour recalls.

Hoffman et al. (2006) studied the importance of interventions on college campuses to prevent weight gain among students entering college. The researchers’ goal
was to measure changes in weight and percentage of body fat in freshman college students. The body fat percentage and height and weight measurements were taken in early September and again 8 months after baseline measurements in late April. The average change in body weight of the 67 students who completed both measurements was 1.36 kg (2.86 lbs) of the participants who gained weight. Nearly 75% of the 67 students who participated in the study gained weight during their freshman year with a mean weight gain of 3.12 kg (6.82 lbs). The study researchers noted that the students would gain an average of 12.4 kg (27.3 lbs) by the conclusion of their four-year education if they continued on this course of weight gain, signifying the importance of an intervention in this population to prevent weight gain.

Body Mass Index (BMI) and Growth Charts

The increase in adult obesity has been mirrored by an increase in pediatric obesity; yet defining overweight and obesity is different for adult and pediatric groups. The BMI-for-age growth charts developed to screen children and adolescents aged 2-20 years are most appropriate to define overweight and obesity in the college freshman population (average age 18-20 years old). These growth charts are published by the Centers for Disease Control and Prevention (CDC) and they provide a reference for tracking growth in U.S. children. A BMI-for-age between the 85th and less than the 95th percentile is considered overweight, and a BMI-for-age greater than or equal to the 95th percentile is defined as obese. College freshman aged 18-20 years with a BMI in the 85th percentile or greater could benefit from a weight-loss intervention to improve their long-term health.
College Students and Dietary Habits

Smith-Jackson and Reel (2012) surveyed freshman women on a college campus about body dissatisfaction and to better understand their perceptions about the “Freshman 15” and its impact on them. The majority of the respondents cited changes in eating habits as the number one cause of weight gain during their freshman year. Access to vending machines, increase in alcohol and fast-food consumption, cost of healthy foods, and buffet-style eating in dining halls were also cited as contributing factors to weight gain. Researchers stated the reasoning provided by the women for the weight gain is beneficial for universities developing programs to target college freshmen.

The research of Huang et al. (2003) and Anding et al. (2001) suggests that the college students’ diet does not follow the Dietary Guidelines for Americans (DGA). Huang et al. (2003) enrolled 736 college students age 18-27 years in their study, and found that most students were not meeting nutrition or physical activity recommendations. In total, 69.4% consumed fewer than the recommended 5 servings of fruits and vegetables per day, and 67.1% reported consuming less than the recommended 20 gm of fiber per day. The study conducted by Anding et al. (2001) assessed the diet, exercise, and health habits of 60 adult female college students. A daily food record was used to estimate food and beverage intake; height and weight were measured to calculate BMI; and physical activity was assessed using the Self-Reported Physical Activity scale. Results showed that the participants met only the minimum number of recommended servings of meat, and they did not meet the DGA minimum for servings of grains, fruits, vegetables, or dairy products. In addition to not meeting the DGA for most food groups, college students are also consuming large amounts of sugar-
sweetened beverages. When evaluating the sugar-sweetened beverage consumption of college students, researchers found that 55% of women and 68% of men consumed 25 gm sugar drinks per day, a daily caloric intake of 350-450 kcals.\textsuperscript{19} In addition, O’Leary et al. (2012) enrolled 50 college students in their study to determine sugary drink consumption and found the median consumption of sugar beverages was 17.7 ounces for men and 10.1 ounces for women.\textsuperscript{20}

These studies illustrate the importance and necessity of an effective nutrition intervention in this age group. Research has shown the benefits of increasing fruit and vegetable intake and decreasing sugar-sweetened beverage intake in weight management. The Dietary Guidelines for Americans (DGA, 2010) state that eating fruits and vegetables instead of higher kcal foods can help adults and children to achieve and maintain a healthy weight.\textsuperscript{21} A positive association has been observed between greater intake of sugar-sweetened beverages, weight gain, and obesity in children and adults.\textsuperscript{22}

**Nutrition Interventions in the College Population**

A number of nutrition interventions have been conducted in the college population. Lin & Dali (2011) performed a review of studies on the effectiveness of nutrition education interventions targeting college students.\textsuperscript{23} A total of 14 studies were reviewed including 1668 participants. The interventions were conducted in three main ways: web-based (3), lectures (10), and supplement provisions (1). The researchers found that dietary intake measures were used in most of the studies, and the interventions had a variety of results including weight loss, increases in fruit/vegetables, whole grains, and dairy intake, and decreases in soft drink consumption.\textsuperscript{23}
In a study by Jozkowski (2007), participants benefitted from an 8-week weight loss intervention. A total of 12 college students participated in the study with an average age of 21.1 years. The study focused on healthy dietary habits and physical activity; weekly meetings were held to educate the participants and were led by students who had successfully lost weight. Researchers found 75% of the participants lost weight and 25% gained weight. The students reported an improved knowledge about nutrition as well as increased confidence in their ability to lose weight.

LaChausse (2012) enrolled 320 college students in their study to determine the impact of an internet-based obesity prevention program. The use of an internet-based intervention for college students is appealing due to the low cost and its potential to reach more students than traditional methods such as counseling or peer education. The students were randomly assigned to 1 of 3 conditions: online course My Student Body-Nutrition (MSB), on-campus course, and a comparison group. The MSB course is an interactive, internet-based program that educates students on nutrition and physical activity. The students were instructed to spend two hours each week for 12 weeks logged into the program, and they had to show completion of a weekly module by submitting a completed checklist. The on-campus course met for two hours for 12 weeks and was taught by a member of the health professions faculty; the course focused on weight-management, stress, nutrition, exercise, and weight-related disease. The students’ weight was self-reported and no significant change was observed, however fruit and vegetable intake increased in the MSB group when compared to the other two groups.
College Students and Social Media

Today’s college students rely on social media to communicate, making it an ideal tool to connect with college freshmen. Bayne and Cianfrone (2013) conducted a study with the purpose of determining the effectiveness of social media marketing on university students’ awareness, interest, and participation in a campus recreation special event.\(^{11}\) Fifty-five undergraduate students with an average of 534 Facebook friends completed the study. There was not a statistically significant difference in interest of the group who received the Facebook updates and the group who did not.\(^{11}\) The participants reported that they spend about 28 minutes per day on Facebook and their awareness of the recreation event increased, however they were not influenced by the Facebook updates to participate in the event.\(^{11}\) The results of this study confirmed that social media alone is not enough to motivate individuals to change, but social media may engage participation.

Junco et al. (2013) investigated the effectiveness of Twitter in the classroom to engage students, assist in student collaboration, and affect their success in class.\(^{14}\) The study noted that Facebook is the most popular for college students, while faculty preferred Twitter.\(^{14}\) The relationship between Twitter use and student grades and engagement was also explored.\(^{14}\) The experimental group used Twitter while the control group used Ning, a service that allows the student to create their own social networking site.\(^{14}\) Both groups received the information via one of the social media platforms simultaneously and outside of scheduled class time.\(^{14}\) The study concluded that over the course of the semester the Twitter group’s engagement score increased significantly more than the Ning control group’s score, and the Twitter group had a higher grade point.
average (GPA) in the course. This research suggests that delivering content to college students via social media can be effective.

An 8-week randomized controlled trial conducted by Napolitano et al. (2013) randomized 52 college and university students into three groups: Facebook (n=17), Facebook plus text messaging (n=18), and a control group that received no intervention (n=17). The online Facebook group had access to the intervention content, which included healthy activities and eating events around campus. The Facebook Plus group received the same content as the Facebook group, but also received encouraging text messages, set goals with a study staff member, received tips on effective ways to monitor their intake and physical activity, identified a buddy who was not participating in the study to provide support, and received a digital scale, a pedometer, a kcal counter book and measuring utensils. The study found the Facebook Plus group lost an average of 2.4 kg (5.3 lbs) over the 8 week period (p<0.05), while the weight in the other two groups showed no significant change from enrollment to the conclusion of the study. Based on previous research, college freshmen gain an average of 3.0 kg (6.6 lbs) during their first year, so the 2.4 kg (5.28 lbs) weight loss would be considered a success. The results of this study show that incorporating social media as a piece of a college or university healthy weight campaign or strategy may be an effective tool to promote weight loss.

Role of Registered Dietitian in Weight Management

According to the Academy of Nutrition and Dietetics, a registered dietitian (RD) is “a food and nutrition expert who translates the science of nutrition into practical solutions for healthy living.” The RD possesses a unique knowledge base, skill set, and
competency in food, nutrition, and nutrition-related health issues.\textsuperscript{26} Snetselaar et al. (2011) evaluated the value of the inclusion of RD counseling sessions as an insurance benefit on body weight and other health parameters.\textsuperscript{27} The participants were provided six visits with an RD throughout the year for assistance with weight management. In comparison with the usual care provided by the insurance provider, a statistically significant difference was observed in weight and waist circumference.\textsuperscript{27}

The nutrition assessment conducted by an RD includes determining energy needs. This is an important piece of information to use when advising patients/clients in weight management clinics and other settings. Accurate determination of energy needs may contribute to success in weight management. Indirect calorimetry is recommended by the Academy of Nutrition and Dietetics in the Adult Weight Management Guidelines (2014) and the Pediatric Weight Management Guidelines for determining energy needs in overweight and obese individuals.\textsuperscript{28}

**Indirect Calorimetry to determine Total Energy Expenditure (TEE)**

If energy intake, defined as food and beverages consumed, is equal to energy output, defined as energy required for physiological functions and physical exercise, the body achieves energy balance.\textsuperscript{29} A gain or loss of body weight results from a consistent imbalance of energy; exceeding energy input beyond output increases weight and not meeting energy needs results in weight reduction. An individual’s energy requirements or total energy expenditure consists of basal metabolic rate (BMR), thermic effect of food, and the energy for physical activity.\textsuperscript{30} BMR is the energy required for the body to sustain life and fuel necessary functions such as heart beat, breathing, renal function, and
blood circulation. In order to measure BMR, the individual must fast and rest horizontally for 12 hours in a room with a constant temperature. Resting metabolic rate (RMR) is approximately 10% greater than BMR and is a measurement of energy needs with fewer restrictions. The individual’s RMR is measured when the person is resting in a comfortable position and has fasted for 2-4 hours. Resting Metabolic Rate positively correlates with fat free body mass and is also affected by age, gender, body composition, hormones, menstrual cycle, and genetics.2

Energy needs can be measured using direct or indirect calorimetry, predictive equations, or the doubly labeled water method. Indirect calorimetry measures the exchange of carbon dioxide and oxygen in inspired and expired air. Resting metabolic rate is measured either by indirect calorimetry or a predictive equation and is multiplied by a physical activity factor to estimate TEE. Some examples of predictive equations include: Mifflin St. Jeor, Institute of Medicine, Schofield, Harris & Benedict, James & Lean, and World Health Organization.

The accuracy of the energy expenditure is important to determine the caloric needs that will result in weight loss; inaccuracy of the predictive equations can contribute to unsuccessful weight management by overestimating or underestimating needs. O’Riordan et al. (2010) enrolled 179 overweight or obese individuals with an average BMI of 41kg/m² who attended a weight management clinic and 17 non-obese individuals who worked at the clinic in their study. The goal was to determine the extent to which predictive equations overestimate and underestimate REE. Indirect calorimetry was used to measure energy needs and it was compared to predictive equations including Schofield, Harris & Benedict, James & Lean, and the World Health Organization. The
results showed a statistically significant difference between indirect calorimetry and Schofield (p=0.034) and James & Lean equations (p=0.003) and a variation in energy needs at each BMI level ranging from 500kcal above to 500kcal below energy needs. A similar study was conducted in a pediatric population with a median age of 12 years that concluded a similar result; indirect calorimetry is more accurate for measuring energy needs than predictive equations.

A review of the literature has shown that an intervention in the college population is necessary to combat the growing obesity epidemic. Targeting college freshman at a time in their lives when change is abundant could be effective in modifying behavior to benefit long-term health. In weight management, the assessment of energy needs is vital for the basis of a nutrition intervention as overfeeding and underfeeding can result in unsuccessful weight management. Indirect calorimetry is the most accurate measurement of resting metabolic rate and is used to determine energy needs when multiplied by a physical activity factor. Social media has been shown to be effective in increasing engagement, but independent of other intervention components, social media does not seem to motivate individuals to action. However, with 86% of college students using the social media site Facebook, this is an effective communication tool for reaching the population.

To our knowledge there has not been an intervention measuring energy needs through indirect calorimetry in an overweight or obese freshman population to educate students about their specific energy needs and how to achieve a healthy weight. Interventions on college campuses including social media components have been developed for weight management and have seen some success.
CHAPTER III

Methods

A total of 20 participants were recruited from a large, urban university in Atlanta, GA to participate in a descriptive research study. The study was approved by the Institutional Review Board (IRB) at Georgia State University. The following inclusion criteria were required for the study participants: 1) 18-20 year old college freshmen 2) BMI ≥ 85th percentile for age and gender as defined and plotted on the Centers for Disease Control and Prevention (CDC) growth charts\textsuperscript{33}(Appendix I), and 3) Facebook account with a minimum of once daily log-in. The following conditions excluded an individual from the study: 1) serious medical issues or co-morbidities, 2) taking any weight modification medications or pursuing a weight loss strategy, 3) pregnant or lactating, and 4) psychiatric or mental health condition that would inhibit participation.

University students were recruited through PantherDining services and student organizations, and in freshman classes; flyers were placed strategically around campus including the student recreation center, campus residential dorms and dining halls, the university center, and library north and south. Permission was sought from the appropriate campus administrations prior to posting.

Research Design

Students contacted the principal investigator via phone or email to indicate their interest in participating in the study. The student investigator emailed the students a link to an online survey (created in Survey Monkey) to determine if inclusion criteria were
met (Appendix II). In the case of PantherDining, the link to the survey was sent directly to the students in the form of an email. Those who met the criteria made an appointment to review and complete the informed consent and scheduled a study enrollment appointment. Upon enrollment, research participants completed a 3-day food diary (2 weekdays and 1 weekend day, Appendix III), indirect calorimetry for measuring RMR and height and weight measurements to determine BMI. Research participants scheduled an appointment for a 30-minute individualized consultation with a nutrition graduate student and an RD seven days post-enrollment and after indirect calorimetry measurement. The personalized consultation included information about RMR, total energy needs for weight goals, BMI, and lifestyle modifications to achieve a healthy weight. The topics discussed at the consultation included: how to build a healthy plate using MyPlate, increasing fruit and vegetable intake, increasing water consumption and limiting sugar-sweetened beverage consumption, and energy balance.

After the personalized 30-minute consultation, the 8-week intervention continued via the social media site Facebook. According to Facebook, the social media site “allows people to stay connected with friends and family, to discover what’s going on in the world, and to share and express what matters to them”. The participants were invited by email to join a “secret” group created for the study participants. In a “secret” Facebook group, only those invited to join the group can see that it exists and any group posts. This “secret” group setting protected the privacy of the study participants so that other Facebook users were not aware of their study participation and were blocked from any study intervention content posted in the group page.

The topics discussed at the individual consult were also the themes of the
Facebook messages delivered to the participants. Messages were delivered 5 times a week covering nutrition and energy balance. The messages were developed from evidence-based websites such as the Academy of Nutrition and Dietetics, United States Department of Agriculture, and ChooseMyPlate.gov (Appendix IV). At the conclusion of the 8 weeks, the students returned for follow up testing to include a 3 day food diary (2 weekdays and 1 weekend day) and weight measurements to determine BMI. After completion of the study, students were emailed an IRB approved post-study survey including 10 questions about their participation in the study (Appendix V). The goal of the survey was to determine which pieces of the intervention the participants felt were beneficial and what areas could be improved upon for future research.

**Statistical Methods**

The data analysis was conducted using Statistical Package for Social Sciences (SPSS 21). The population demographics and anthropometrics were described using frequency statistics. The Shapiro-Wilk test for normality was used to determine if the continuous variables were normally distributed or skewed. The BMI and weight of the participants were normally distributed and a paired t-test was used to determine if there was a statistically significant difference in BMI and weight prior to the intervention and post intervention. Food diaries were analyzed using ESHA Research Food Processor, Nutrition and Fitness Software, and the resulting data in SPSS 21. To determine if dietary habits changed over the course of the intervention, the paired t-test for used for all dietary variables and Wilcoxon Signed-rank test was used for calorie intake.
CHAPTER IV

Results

A total of 81 students responded to the survey; a total of 20 participants met the inclusion criteria and were interested in participating when contacted. The 20 students completed the informed consent to participate in the study. The final results include baseline and follow up data on 8 subjects and baseline and follow-up data and food diary analysis on 6 subjects (Figure 1). The average age of the participants was 19.03 years, and 87.5% were female, African-American, and a BMI in the 95th percentile (Table 1).

Figure 1: Participant Flow Chart

81 respondents

20 respondents met inclusion criteria and consented

13 participants enrolled by completing metabolic test, food diary and height/weight

11 participants joined the secret study Facebook page

10 participants remained members of the Facebook page for the study duration

8 participants returned post study for weight measurement

6 participants turned in the 3-day food diary at study conclusion
Table 1: Descriptors and Anthropometrics*

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number of Participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1 (12.5)</td>
</tr>
<tr>
<td>Female</td>
<td>7 (87.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Number of Participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>African-American</td>
<td>7 (87.5)</td>
</tr>
<tr>
<td>White, Non-Hispanic</td>
<td>1 (12.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age**</th>
<th>Number of Participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>3 (37.5)</td>
</tr>
<tr>
<td>19</td>
<td>4 (50)</td>
</tr>
<tr>
<td>20</td>
<td>1 (12.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BMI Percentile</th>
<th>Number of Participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>85th</td>
<td>1 (12.5)</td>
</tr>
<tr>
<td>95th</td>
<td>7 (87.5)</td>
</tr>
</tbody>
</table>

* n=8
** Mean years (SD)

** Weight and BMI**

The weight and BMI of the participants were normally distributed; therefore, a

paired t-test was used to analyze the results. There were no statistically significant
differences in the participant’s weight, n=8 (p=0.87 +2.13) (Table 2), n=6 (p=0.96 +1.75)
(Table 3) and BMI n=8 (p=0.93 +0.75), n=6 (p=0.32 +0.24) from baseline to post study.

The mean weight for n=8 increased 0.12 kg (0.26 lbs) and the mean weight for n=6
decreased -0.74 kg (-1.63 lbs). The BMI for n=8 increased 0.03 kg/m² and decreased
-0.26 kg/m² for n=6. Participant 5 lost the greatest amount of weight totaling 3.30 kg
(7.26 lbs) and saw the greatest decrease in BMI  -1.10. Participant 7 had the greatest
increase in weight of 3.20 kg (7.04 lbs) and BMI with a change of 1.2.
Table 2: Individual Participants' Weight and BMI changes*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline Weight (kg)</th>
<th>Post Study Weight (kg)</th>
<th>Change in Weight</th>
<th>Baseline BMI (kg/m²)</th>
<th>Post Study BMI (kg/m²)</th>
<th>Change in BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>93.9</td>
<td>92.3</td>
<td>-1.6</td>
<td>37.9</td>
<td>37.3</td>
<td>-0.6</td>
</tr>
<tr>
<td>2</td>
<td>81.1</td>
<td>82.8</td>
<td>1.7</td>
<td>30.9</td>
<td>31.5</td>
<td>0.6</td>
</tr>
<tr>
<td>3</td>
<td>75.4</td>
<td>75.5</td>
<td>0.1</td>
<td>30</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>83.2</td>
<td>83.5</td>
<td>0.3</td>
<td>31.3</td>
<td>31.3</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>105</td>
<td>101.7</td>
<td>-3.3</td>
<td>37.5</td>
<td>36.4</td>
<td>-1.1</td>
</tr>
<tr>
<td>6</td>
<td>87.3</td>
<td>86</td>
<td>-1.3</td>
<td>32.7</td>
<td>32.2</td>
<td>-0.5</td>
</tr>
<tr>
<td>7</td>
<td>80.6</td>
<td>83.8</td>
<td>3.2</td>
<td>31</td>
<td>32.2</td>
<td>1.2</td>
</tr>
<tr>
<td>8</td>
<td>83.4</td>
<td>85.3</td>
<td>1.9</td>
<td>26.3</td>
<td>26.9</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Mean (±SD) 86.24 (±9.3) 86.36 (±7.72) 0.12 32.2 (±3.86) 32.23 (±3.34) 0.03

* n=8
** No significant differences in change in weight (p=0.87) or change in BMI (p=0.93)

Table 3: Individual Participants' Weight and BMI changes*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline Weight (kg)</th>
<th>Post Study Weight (kg)</th>
<th>Change in Weight</th>
<th>Baseline BMI (kg/m²)</th>
<th>Post Study BMI (kg/m²)</th>
<th>Change in BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>93.9</td>
<td>92.3</td>
<td>-1.6</td>
<td>37.9</td>
<td>37.3</td>
<td>-0.6</td>
</tr>
<tr>
<td>2</td>
<td>81.1</td>
<td>82.8</td>
<td>1.7</td>
<td>30.9</td>
<td>31.5</td>
<td>0.6</td>
</tr>
<tr>
<td>3</td>
<td>75.4</td>
<td>75.5</td>
<td>0.1</td>
<td>30</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>83.2</td>
<td>83.5</td>
<td>0.3</td>
<td>31.3</td>
<td>31.3</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>105</td>
<td>101.7</td>
<td>-3.3</td>
<td>37.5</td>
<td>36.4</td>
<td>-1.1</td>
</tr>
<tr>
<td>6</td>
<td>87.3</td>
<td>86</td>
<td>-1.3</td>
<td>32.7</td>
<td>32.2</td>
<td>-0.5</td>
</tr>
<tr>
<td>Mean</td>
<td>87.65 (±10.52)</td>
<td>86.97 (±9.03)</td>
<td>-0.68**</td>
<td>33.38 (±3.46)</td>
<td>33.12 (±2.99)</td>
<td>-0.26**</td>
</tr>
</tbody>
</table>

* n=6
** No significant differences in change in weight (p=0.96) or change in BMI (p=0.32)

Food Diary Analysis

Food diaries (n=6) were analyzed and determined caloric intake was not statistically significant (p=0.46).
Table 4: Participant Caloric Intake/day*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline Kcal/day Intake</th>
<th>Post Study Kcal/day Intake</th>
<th>Change in Kcal/day intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2212</td>
<td>2255</td>
<td>43</td>
</tr>
<tr>
<td>2</td>
<td>5365</td>
<td>1250</td>
<td>-4115</td>
</tr>
<tr>
<td>3</td>
<td>1971</td>
<td>1202</td>
<td>-769</td>
</tr>
<tr>
<td>4</td>
<td>2156</td>
<td>2125</td>
<td>-31</td>
</tr>
<tr>
<td>5</td>
<td>1330</td>
<td>670</td>
<td>-660</td>
</tr>
<tr>
<td>6</td>
<td>1283</td>
<td>2081</td>
<td>798</td>
</tr>
</tbody>
</table>

Median Intake** 2064 (1318, 3000) 1656 (1069, 2158)*** 408 (249, 843)

* n=6
** Median (25th percentile, 75th percentile)
*** no statistically significant differences between baseline and post study daily caloric intake (p=0.46)

The change in fruit and vegetable consumption was normally distributed; the paired t-test determined the changes to be not statistically significant (fruit p= 0.179, vegetable p= 0.895). The mean vegetable consumption decreased -0.05 (+0.91) cups per day. Three (50%) of the 6 participants decreased vegetable consumption with an average of -0.61 cups per day and 50% of the participants increased daily consumption an average of 0.72 cups (Table 5). Overall, daily fruit consumption decreased -0.46 cups; 67% of the participants decreased their consumption an average of 0.86 cups per day and 33% of participants increased daily consumption an average of 0.35 cups.

A decrease was seen in water consumption, however it was not statistically significant (p= 0.69) with a mean decrease of 14.32 (+15.21) ounces per day. One of the 6 participants increased daily water consumption an average of 1.60 ounces with the remaining 5 decreasing intake an average of 17.5 ounces. The consumption of sugar-sweetened beverages did decrease an average of -23.00 (+45.99) ounces per day but this was not statistically significant (p=0.28). Three (50%) of the 6 participants decreased their sugar-sweetened beverage consumption and 50% increased their consumption. The average decrease was 54 ounces per day and the average increase was 8 ounces per day.
with the greatest change seen in participant 2, who decreased daily sugar-sweetened beverage intake from 110 to 0 ounces.

Table 5: Dietary Changes in Vegetables, Fruit and Sugar-Sweetened Beverages*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Change in Vegetable intake (cups/day)</th>
<th>Change in Fruit intake (cups/day)</th>
<th>Change in Sugar-Sweetened Beverage Intake (ounces/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-1.44</td>
<td>-0.62</td>
<td>16.00</td>
</tr>
<tr>
<td>2</td>
<td>-0.24</td>
<td>0.37</td>
<td>-110.00</td>
</tr>
<tr>
<td>3</td>
<td>0.17</td>
<td>-0.44</td>
<td>-28.00</td>
</tr>
<tr>
<td>4</td>
<td>1.06</td>
<td>0.33</td>
<td>-24.00</td>
</tr>
<tr>
<td>5</td>
<td>-0.16</td>
<td>-0.91</td>
<td>4.00</td>
</tr>
<tr>
<td>6</td>
<td>0.92</td>
<td>-1.48</td>
<td>4.00</td>
</tr>
</tbody>
</table>

* n= 6
** mean±SD, no statistically significant differences between baseline and post study; vegetable (p=0.89), fruit (p=0.18), and sugar-sweetened beverages (p=0.28)

Energy Measurement

The metabolic cart used to measure RMR determined that the students average energy needs were 1636.38 (+105.40) kcals. The average activity factor was 1.23, determined based on conversation with the student about their activity level, and the mean daily TEE for the study participants was 2003.55 (+135.26) kcals (Table 6). A post-hoc analysis was conducted to determine the difference, if any, in the TEE from RMR, Mifflin St. Jeor equation and the Institute of Medicine (IOM) equation for overweight and obese individuals. The average total energy needs calculated from the Mifflin St. Jeor equation with a physical activity (PA) factor was 2022.99 (+153.74) kcals. The IOM equation for overweight and obese individuals calculates TEE using a Physical Activity Coefficient (PA) based on a Physical Activity Level (PAL); the mean
TEE was 2259.00 (+197.01) kcals. The IOM equation calculated energy needs to be an average of 255.45 kcals greater than the TEE calculated from the participant’s RMR and activity factor, a statistically significant difference (p=0.014), and 81 kcals (p=0.76) greater than energy needs calculated by the Mifflin St. Jeor equation with an activity factor.

**Table 6: Resting Metabolic Rate and Total Energy Needs**

<table>
<thead>
<tr>
<th>Participant</th>
<th>TEE from RMR x AF**</th>
<th>TEE from Mifflin St Jeor Equation x AF</th>
<th>IOM Equation for overweight/obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1820</td>
<td>1993</td>
<td>2235</td>
</tr>
<tr>
<td>2</td>
<td>2034</td>
<td>2045</td>
<td>2146</td>
</tr>
<tr>
<td>3</td>
<td>1867</td>
<td>1787</td>
<td>2080</td>
</tr>
<tr>
<td>4</td>
<td>2141</td>
<td>2074</td>
<td>2278</td>
</tr>
<tr>
<td>5</td>
<td>1886</td>
<td>2208</td>
<td>2420</td>
</tr>
<tr>
<td>6</td>
<td>2175</td>
<td>1972</td>
<td>2104</td>
</tr>
<tr>
<td>7</td>
<td>1990</td>
<td>1870</td>
<td>2146</td>
</tr>
<tr>
<td>8</td>
<td>2115</td>
<td>2236</td>
<td>2663</td>
</tr>
</tbody>
</table>

Mean 2003.55 (+135.26) 2022.99 (+153.74)** 2259.0 (+197.01)**

* n=8  
** AF = activity factor  
*** No significant difference when compared to TEE from RMR (p=0.76).  
**** Statistically significant difference when compared to TEE from RMR (p=0.014)

**Facebook Engagement**

Nutrition messages were delivered via the social media site Facebook as detailed in the methods section. A downward trend was observed in the viewing of the Facebook messages from week 1 to week 8.

**Table 7: Number of Participants Viewing Facebook Posts per Week**

<table>
<thead>
<tr>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>11</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Day 2</td>
<td>10</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Day 3</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Day 4</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Day 5</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Average</td>
<td>9.2</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>6.4</td>
<td>5.8</td>
<td>5.4</td>
<td>4.4</td>
</tr>
</tbody>
</table>

*n=8*
As shown in Table 8, participants were assessed individually and participant 1, 3, and 6 most actively viewed the messages on the Facebook page, viewing 97.5% of the posted messages. The participants least engaged during the 8 weeks of Facebook messages were participant 2 and 7, who viewed less than 8% of the 40 shared messages.

The participants were able to engage with the page beyond viewing the posted message by “liking” and commenting on posts. Participant 4 was the most active participant on the page, posting on three different occasions; the posts were about food or beverages the participant was planning to eat.

Table 8: Facebook Post Engagement*

<table>
<thead>
<tr>
<th>Participant</th>
<th>FB post views</th>
<th>FB post “likes”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>39</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>34</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>39</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>23</td>
<td>7</td>
</tr>
</tbody>
</table>

n=8

Participant Feedback

A post-hoc analysis was completed on the post study survey data. Following the conclusion of the study, a survey was shared on the Facebook page with ten Facebook group members and emailed directly to the eight participants who returned for a final weigh-in at study conclusion. Six participants completed the survey. Since the survey did not request any identifying information, so it is unknown whether these participants completed the study (n=6, n=8). The first six questions used a 5-point scale, 1 indicating not helpful and 5 indicating very helpful (Appendix VI).
Participants scored the nutrition consult with a registered dietitian and graduate student the highest (4.6/5.0) indicating it was the most helpful component of the intervention. Respondents also indicated that the metabolic test to determine their energy needs was very beneficial (4.2/5.0). Only 33% of the survey participants responded to the remaining four open-ended questions. One participant found the study to be beneficial because it helped the participant to “stay focused on my weight goals”. The same respondent indicated that the program was “pretty effective” and taught the right foods to eat; the participant felt no changes needed to be made and responded that she would participate again because it was not demanding and the “people who constructed it were nice”. Another respondent felt the program was not very effective and suggested the addition of a cooking class or dining hall demonstration to showcase healthier options; she responded that she would probably not participate again because she felt it was just an “information program vs actual education”.
CHAPTER V
Discussion and Conclusion

This is the first study to target the college freshman population with an intervention using the following three components: measuring energy needs through indirect calorimetry; providing an individualized nutrition consult and discussing energy needs for weight goals; and sharing messages via Facebook to educate participants. Maintenance of current BMI or a decrease in BMI was observed in 62.5% of participants who had pre-post weight measurements and 83% of participants that also completed a pre-post food diary. These pilot data indicate that a nutrition intervention including nutrition counseling based on individual energy needs and 8-weeks of messages delivered via Facebook is effective in maintaining or decreasing BMI in overweight and obese freshman. Although no significant changes in dietary behavior were found, there was an observed overall decrease in sugar-sweetened beverages.

When compared with other studies that observed freshman weight gain, our intervention would be considered a success for both groups (n=8 and n=6).\textsuperscript{8,9} Previous research shows without an intervention, the students would have gained more weight during their freshman year.\textsuperscript{8,9} If the trend of weight loss seen in the 8 participants who completed pre-post weight measurements continued over the course of the freshman year (average 36 weeks), the students would have gained an average of 0.54 kg (1.19 lbs). If
the trend of weight loss observed in the 6 participants who completed a pre-post food diary, the students would have lost an average of 3.06 kg (6.73 lbs) during their freshman year. The results of these six participants are consistent with the results seen in Napolitano’s Facebook group. The two participants that did not complete their final food diary both gained weight during the intervention. Implications could be that these participants did not make any dietary changes and as a result did not want to report their intake. The observed participation on the Facebook group page correlates with the results; the participants most engaged lost or maintained weight and the participants least engaged gained weight.

In addition to monitoring weight changes, the food diary was an important piece of the intervention to assess changes in eating habits throughout the eight weeks. There were no statistically significant changes observed, but there were several clinically significant changes observed. The findings with the fruit and vegetable intake are comparable with other studies that concluded college students are not meeting the Dietary Guidelines for Americans for consumption of these food groups. Consumption of sugar-sweetened beverages were addressed at the nutrition consult with the RD and graduate student. The average decrease observed in the sugar-sweetened beverage intake was clinically significant. For example, a student consuming 23 ounces of a soft drink would equate to an intake of 268 kcals and 75 grams of sugar. When the food diaries were analyzed, it was also determined that participants reported consuming a median decrease of 408 kcals, 347 kcals less than TEE calculated from RMR. Considering the majority of the participants were obese, a kcal reduction at this level would be beneficial for weight loss and could indicate why certain participants successfully lost weight. In a
weight management setting, these observed changes are meaningful for patients/clients with weight-loss goals.

Successful weight loss interventions have been conducted using social media as a component of the intervention in the college population.\textsuperscript{13} Napolitano’s study showed that social media alone may not be effective in motivating participants to change behavior, however success was seen when additional components were added to the intervention.\textsuperscript{13} The results of our study support similar findings. Participation on the Facebook page declined each week showing the participants might have benefitted from additional intervention pieces throughout the study to remain engaged. The students that completed the post-study survey stated that knowing their energy needs using the indirect calorimetry test (4.2/5.0) and the nutrition consult with the RD were beneficial (4.6/5.0); however, the Facebook messages were not rated as high (3.5/5.0). In addition to the metabolic testing, added meetings with the RD and graduate student and more Facebook messages may have helped keep the students more engaged through the 8\textsuperscript{th} week.

Through the Facebook piece of the intervention, we were able to follow participant engagement in the study. There are several notable trends observed when analyzing Facebook engagement, participant BMI, weight, and dietary changes. The participant who was most engaged with the Facebook group, viewing 97.5\% of the messages by liking posts and sharing on the group page, maintained her BMI, increased her fruit and vegetable intake, and decreased her sugar-sweetened beverage intake. The participant with the most significant change in her BMI viewed 95\% of the Facebook posts and engaged with the group page by liking posts and sharing. An additional three
participants viewed 97.5% of the Facebook posts and maintained or decreased their BMI. The two participants that were least engaged with the Facebook group, viewing less than 8% of the 40 posts, gained weight. This shows a correlation with Facebook engagement and success with weight loss and dietary changes during the intervention.

Our research agrees with the findings of other studies that indirect calorimetry is the most accurate prediction of energy needs when compared to predictive equations\(^1\).\(^2\) The study showed a statistically significant difference between TEE calculated from RMR measured through indirect calorimetry and the IOM equation (p=0.01), but no significant difference seen between Mifflin St. Jeor equation and TEE calculated from RMR. Additionally the difference observed between the IOM equation and TEE calculated from RMR of 256 kcals is clinically meaningful when working with clients/patients in a weight management setting. A significant difference in estimation of energy needs can result in unsuccessful weight management and the study further confirms that indirect calorimetry is critical to accurately estimate energy needs. In addition to the benefits of accuracy, the participants also found it useful to know their body’s energy needs citing a 4.2/5.0, with 5 indicating “very helpful”.

The study was found to be beneficial with some limitations. More significant changes may have been observed if the study had a larger sample size and the intervention was over a longer time-period. Using a food diary with self-reported information was also a limitation. The participants likely over or underestimate their intake and also the types of foods that they consumed. Also, there is the possibility of error upon interpretation of the food diary by the researchers.
For future research, studies with a larger sample size and longer duration, to last the full freshman year, may observe more significant changes. Future intervention studies would also benefit from using a randomized-control trial, which would allow researchers to determine if weight and dietary changes were directly related to the intervention. Additionally, upon submitting the pre-study food diary, participants stated that they were surprised at how “badly” they were eating and were unaware until they wrote it down. This student feedback indicates that future research incorporating a food recording component throughout the study may be beneficial.

An unexpected finding was the participant’s ranking of the Facebook posts (3.0/5.0) as the least effective of the three intervention pieces. The consult with the RD was ranked the highest (4.6/5.0), and the students also found knowing their energy needs through indirect calorimetry (4.2/5.0) to be very beneficial. Future studies incorporating additional consults with an RD throughout the intervention should promote student engagement. Furthermore, future studies incorporating indirect calorimetry would be perceived as valuable and might result in significant weight loss.

Currently, the National Institute of Health (NIH) is funding a project for an obesity treatment for college students via social media. Napolitano is the primary investigator with a goal of recruiting several hundred college students on two different campuses. Social media and text message will be used to deliver the intervention content and the feasibility of implementing the intervention on college campuses nationwide will be evaluated. This study funding shows others the value in incorporating social media in a weight-loss intervention targeting college students.
In conclusion, our study was the first to target the college freshman population with an intervention using indirect calorimetry, an individualized nutrition consult with an RD discussing energy needs for weight loss, and Facebook to educate participants. The unexpected finding from the post study survey in which the participants ranked the RD consult and individual calorie estimation as the most beneficial components of the intervention was interesting to note. Significant changes were not observed in dietary behavior, however a clinically significant change was observed in sugar-sweetened beverage consumption and a BMI maintenance or decrease was seen in 62.5% (n=8) and 82% (n=6) of participants.


26. Learn More about RDNs. *Acad Nutr Diet*.
   http://www.eatright.org/resources/food/resources/learn-more-about-rdns.


33. Growth Charts - Clinical Growth Charts.


I. CDC Growth Charts
II. Survey Monkey Survey to determine eligibility to participate

Welcome

Thank you for your interest in participating in our research study. To verify your eligibility to participate, please answer the following questions. You will be contacted via phone or email in the next 1-3 days and notified if you are eligible or not eligible to participate in the study. If you are not eligible, or decide not to participate, your information will be destroyed within 1-3 days.

Thank you,
Dr. Sarah Henes, Principal Investigator
Ms. Suzanne Saunders, Student Investigator

1. What is your first and last name?

2. Are you a freshman college student?

3. Please list your current height and weight
   Height (feet and inches) 
   Weight (pounds) 

4. Do you have a Facebook account?
   - Yes
   - No

5. In a typical day, how many times do you check your Facebook account?
   - Once a day
   - 2-5 times a day
   - More than 5 times a day
   - Other (please specify) 

6. Are you currently taking any weight loss medications or involved in a weight loss program?
   - Yes
   - No
   - Other (please specify) 

7. Are you currently pregnant or breastfeeding?
   - Yes
8. Have you been diagnosed with a medical condition that would affect your participation in a research study?
   - Yes
   - No
   - Other (please specify) ________________

9. Have you been diagnosed with a psychiatric or mental health condition that would affect your participation in a research study?
   - Yes
   - No
   - Other (please specify) ________________

10. Please provide your email address and phone number to be contacted if you are eligible to participate in the study.
    - Email Address: _______________________
    - Phone Number: _______________________
    Powered by SurveyMonkey

For the actual online survey, copy and paste the following URL into your browser:
https://www.surveymonkey.com/s/YTKM8D8
III. 3-day Food Diary

3-Day Food Diary

Name: 
Date: 
Weekday 1: 

<table>
<thead>
<tr>
<th>Time</th>
<th>Food Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Record time of meal or snack.</td>
<td>Include brand name, method of preparation, condiments &amp; drinks</td>
</tr>
</tbody>
</table>
3-Day Food Diary

A food diary is where you write everything you eat. This will help determine your (or your child’s) nutritional needs. Follow these tips to complete the food diary:

- Include one weekend day/two weekdays and record ALL food & drinks (including water).
- Use brand names or restaurant names, if known.
- Don’t change your (or your child’s) diet because you are writing it down.
- Keep the diary with you and write down foods as soon as you (or your child) eat.
- Write down the cooking method such as fried, boiled, steamed or grilled.
- Record exact portion sizes, ingredients, and condiments. *Don’t know what a portion size looks like? Refer below.*

<table>
<thead>
<tr>
<th>Portion Size</th>
<th>Looks Like...</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 ounces of meat</td>
<td>Deck of cards/palm of your hand</td>
</tr>
<tr>
<td>1 cup of dry cereal 1 medium fruit/1 cup of fruit</td>
<td>Baseball/your fist</td>
</tr>
<tr>
<td>1 baked potato</td>
<td></td>
</tr>
<tr>
<td>1 cup of yogurt</td>
<td></td>
</tr>
<tr>
<td>1 cup of raw vegetables (ex: lettuce)</td>
<td></td>
</tr>
<tr>
<td>1½ ounces of cheese or 2 slices of cheese</td>
<td>4 stacked dice</td>
</tr>
<tr>
<td>2 Tbsp (ex: peanut butter)</td>
<td>A ping pong ball</td>
</tr>
<tr>
<td>½ cup cooked pasta and rice ½ cup cooked beans</td>
<td>Small computer mouse</td>
</tr>
<tr>
<td>½ cup vegetables or sliced fruit</td>
<td></td>
</tr>
</tbody>
</table>
IV. Facebook Post Content

Week 1

1. Goal check! How are you doing with the goal you set at your nutrition consult? Here is a tip for staying on track with your goal.

Display your goal. Do you look in the mirror before you head out the door, check your phone when you wake up or fire up your computer first thing in the morning? Display your goal in a spot that you won’t miss. This will help to keep you on track!

2. Achieving a healthy weight starts with healthy eating! An easy first step is to make half your plate fruits and veggies. Keep this in mind when you building your plate at the dining hall, ordering at your favorite restaurant or eating at home. For more information on simple steps, visit www.choosemyplate.gov
3. How hungry are you really? Before you eat, rate your hunger from 1-5. If you fall in the 1-2 range, instead of eating, try going for a walk or listening to music. If you are a 3, snack on a healthier option like crunchy celery or carrots instead of a bag of chips. If you are at a 4 or 5, take your time to eat, and stop when you feel satisfied.

![Hunger Scale](image)

4. Be active with friends! Go for a walk, bike ride or hit the recreation center with friends to catch up and have fun. Check out the schedule of fun, FREE fitness classes available at the rec! [http://recreation.gsu.edu/services/fitness/free-fitness-classes/](http://recreation.gsu.edu/services/fitness/free-fitness-classes/)

5. Check out these great tips for giving your mini-fridge a makeover! This list includes great ideas for snacks on the go; grab one as you head out the door to class to keep you feeling your best all day.

![Mini-Fridge Makeover](image)
**Week 2:**

1) Goal check! Keep your goal in mind this week. If you slip up one day, get back on track the next. You can do it!

Goal Tip: Share your goal with others and ask for their support. They can encourage you and may even decide to join you!

2) Use the stairs! Elevators and escalators can be tempting, instead try the stairs. It’s a great habit to start and will help tone your legs at the same time! Start small with one or two flights, and work your way up. SNOW DAY! What are you doing to stay active today?
3) Add more vegetables to your day! Brighten your plate with vegetables that are red, orange or dark green. Vegetables are full of vitamins and minerals and taste great too! Try a new vegetable today- you may be surprised that you actually like it!

Check out these tips for eating more vegetables [http://www.choosemyplate.gov/food-groups/vegetables-tips.html](http://www.choosemyplate.gov/food-groups/vegetables-tips.html)

4) Rethink your drink! The average American drinks 400 calories every day. As we shared in your nutrition consult, cutting back 250-500 calories per day can result in a 1-2 pound weight loss per week. Swapping your sodas, cappuccinos, energy drinks, sweet tea and sports drinks for water can help you to manage your calories.
5. Save dessert for special occasions; a Friday night, birthday or celebration. If you have a sweet tooth and can’t resist, opt for something healthy, such as fresh fruit or a yogurt parfait. What are your favorites for satisfying your sweet tooth?

Week 3:

1) Goal check! What do you plan to do today to bring you one step closer to your goal?

2) Have you heard the saying “Breakfast is the most important meal of the day”? Check out this video to learn more about why it’s a good idea to start your day with breakfast and also learn about some great breakfast ideas. What is your go-to breakfast favorite?

https://www.youtube.com/watch?v=E49gp6sFakM&list=PLaXKViuRcXAHoK7wJ8L8aMnZhGftMtba&index=6

3) Controlling portion sizes can be a challenge! Here are some tips for eating just the right portions.

   A) If you tend to overeat, be aware of the time of day, place, and your mood
while eating so you can better control the amount you eat.

B) Try walking instead of eating, or snack on a healthier option like crunchy celery instead of a bag of chips.

C) Pay attention to feelings of hunger. Stop eating when you are satisfied, not full. If there is still food on your plate or on the table, put it away (or throw it out).

D) Use a smaller plate, bowl, or glass. One cup of food on a small plate looks like more than the same cup of food on a large plate.

4) **Check out these great ideas for adding fruit to your favorite meals.**
   a. Top your cereal with bananas or peaches
   b. Add blueberries to your pancakes
   c. Mix fresh fruit with plain low-fat yogurt
   d. Pack a tangerine, banana or grapes for lunch
   e. Add crushed pineapple to coleslaw or fruit to your dinner salad
   f. Add fruit to your favorite kabobs
   g. For dessert, try baked apples, pears or a fruit salad
5) Remember to Eat the Right Amount of Calories for You! Everyone has a personal calorie limit. Staying within yours can help you get to or maintain a healthy weight. Reaching a healthier weight is a balancing act, but now that you know your energy needs from your metabolic test, it will help you to learn how to balance your "energy in" and "energy out" over the long run.

Week 4

1) Goal Check! Keep your eye on the prize. Remember the big picture when you are making daily decisions. Your decisions will pay off!

2) Try new foods! Keep your meals interesting by selecting foods you have never tried before. You may discover a new favorite food. Some examples of new foods to try include quinoa, kale, mango or lentils. What new foods have you tried recently?
3) Check out these reminders about things we discussed at our nutrition consult. Remember it’s about making small changes, they really do add up!

https://www.youtube.com/watch?v=zaIR-YZpg1w

4) There are so many benefits to staying physically active! Share your favorite ways to stay active.

   a) Increase your chances of living longer
   b) Feel better about yourself
   c) Decrease your chances of becoming depressed
   d) Sleep well at night
   e) Move around more easily
   f) Have stronger muscles and bones
   g) Stay at or get to a healthy weight
   h) Be with friends or meet new people
   i) Enjoy yourself and have FUN!

Here is something new and fun to try!
http://recreation.gsu.edu/touch-the-earth/climbing-wall-bouldering-cave/

5) Portion Distortion! Portion sizes have increased over time and you may be eating more than you realize. Some common food portions can equal the amount that is recommended for the whole day. To see if you know how today’s portions compare to those available 20 years ago, quiz yourself!

http://hp2010.nhlbihin.net/portion/portion.cgi?action=question&number=1

Week 5

1) Goal Check! Remember the goal you wrote down at your nutrition consult? Keep striving for it!

2) Here are some easy ways to cut 150 calories (ENERGY IN).
   1. Drink water instead of a 12-ounce regular soda
   2. Order a small serving of French fries instead of a medium, or order a salad with dressing on the side instead
   3. Eat an egg-white omelet, instead of whole eggs
   4. Skip the late night nachos

Here are some ways to burn an average of 150 calories (ENERGY OUT), in just 30 minutes.
   5. Shoot hoops
6. Walk two miles
7. Hit the rec center with friends
8. Go for a bike ride
9. Dance


3) Make your meal your own! Don’t feel like you have to choose pre-made plates when you are eating at the dining hall. Design your own meal! Fresh veggies from the salad bar can be thrown into your omelet for brunch, or grab some tofu on your way to the pasta station for lean protein.

http://www.choosemyplate.gov/food-groups/downloads/TenTips/DGTipsheet26BeChoosyintheDiningHall.pdf

4) What healthy options have you added to your mini-fridge? Share with us!
   Try these options with protein, which will help you to feel full longer.
   1) Low-fat cheese- pair it with 100% whole-grain bread for a quick snack on the go
   2) Apples to pair with peanut butter
   3) Hummus can be paired with almost anything- carrots, peppers, cucumbers or pretzels to name a few.

5) How often do you eat out? Once a day? Once a week? Rarely? Almost every meal? People who eat out more often, particularly at fast food restaurants, are more likely to be overweight or obese. However, you can still manage your body weight when eating out by making better choices.

   To eat out without blowing your calorie budget, there are three things to think about:
   1. **What** you are eating and drinking,
   2. **How much** you are eating and drinking, and
   3. **How** your meal is prepared.

**Week 6**

1) Goals are dreams with deadlines. How are you progressing toward your goal?
2) Fitness is fun! Grab your friends and head to the Zumbathon at the GSU recreation center tonight. Zumba is a great way to exercise and have fun! Ditch the workout and join the party!

http://recreation.gsu.edu/ai1ec_event/zumbathon-4/?instance_id=21080072

3) Drink water instead of sugary drinks when you’re thirsty. Regular soda, energy or sports drinks, and other sweet drinks usually contain a lot of added sugar, which provides more calories than needed. To maintain a healthy weight, sip water or other drinks with few or no calories. www.choosemyplate.gov

4) Liven up your meals with fruits and vegetables! We talked about making half your plate fruits and veggies. Has this been easy for you? Has this been challenging for you? Share with us!

Add fruits and vegetables to your sandwiches. Whether it is a sandwich or wrap, vegetables make great additions to both. Try sliced tomatoes, romaine lettuce, or avocado on your everyday sandwich or wrap for extra flavor.
5) Share your strategies for balancing your calories in and calories out!

Week 7

1) Goal Check! Remember the goal you set at your nutrition consult? Your daily decisions will help you to reach that goal. You can do it!

2) Ready, Set, Show us your plate!
3) Watch Nutrition in a Minute for another reason to drink more water! How much water are you drinking every day? https://www.youtube.com/watch?v=jJqMR6-ueTQ

4) Dining out can be a challenge when you are trying to reach your nutrition goals. If dinner is away from home, no need to worry. When ordering, ask for an extra side of vegetables or side salad instead of the typical fried side dish.

What substitutes have you made at your favorite restaurants?

5) Staying active and exercising is a great way to balance your energy in and energy out. Check out this great upcoming event at the GSU Recreation Center on April 14th. Sign up and encourage your friends to join you! Free t-shirts for participants.

http://recreation.gsu.edu/ai1ec_event/panther-duathlon-challenge/?instance_id=21080498

Week 8

1) Goal Check! It’s the final week of the study. You are nearing the finish line! Have you reached your goal or made progress during the 8 weeks?

Check your email today for information about dates the week of April 13th for a post-study weigh in and final food diary to complete your study participation.
2) **Choose activities you like.** A lot of different things count as exercise: dancing, walking, gardening, yoga, cycling, playing basketball. To make it easier to get moving, choose whatever gets you moving. What new ways to exercise and stay active have you tried over the 8 weeks?

[Image of people dancing]

http://www.hsph.harvard.edu/nutritionsource/tips-for-getting-exercise-into-your-life/

3) **Vary your fruits and vegetables!** Get the nutrients your body needs by eating a variety of colors, in various ways. Try blue, red, or black berries; red and yellow peppers; and dark greens like spinach and kale.

Show us a picture of the color on your plate today.

4) Water on the go! Water is always convenient. Fill a clean, reusable water bottle and toss it in your bag or backpack to quench your thirst throughout the day. How many times can you refill your water bottle today?

5) That’s a wrap! We look forward to seeing you next week to complete the study. You should have received an email with all the details for completing the study. If you have not already, please respond to the email you received to schedule your time.
V. Post Study Survey

Please respond to each question by circling a number 1-5. 1 not helpful, 5 very helpful

1) How helpful was the program for reaching your weight goals?
   1 2 3 4 5

2) How helpful was the program for reaching your nutrition goals?
   1 2 3 4 5

3) How helpful was it to learn how many calories your body needs? (through the metabolic test at the beginning of the study)?
   1 2 3 4 5

4) How helpful was the nutrition consult with the Registered Dietitian and Graduate Student?
   1 2 3 4 5

5) How helpful were the nutrition messages on Facebook?
   1 2 3 4 5

6) How motivated did you feel throughout the program to reach your goal(s)?
   1 2 3 4 5

Please respond to the following questions:

7. What else was helpful about this nutrition study/program?

8. How effective did you find this program overall?

9. What changes and/or additions would you make to the program/study?

10. Would you participate in this program again? Why or why not?