AN ANALYSIS OF DIETARY HABITS OF YOUNG ADULTS SEEKING WEIGHT LOSS

AND THE FEASIBILITY OF A MODIFIED MONITORING SYSTEM USING MOBILE

TECHNOLOGY IN YOUNG ADULTS

by

Ryan Nicole Carter-Stanley

A Senior Honors Project Presented to the

Honors College

East Carolina University

In Partial Fulfillment of the

Requirements for

Graduation with Honors

by

Ryan Nicole Carter-Stanley

Greenville, NC

April 2016

Approved by:

Dr. Lesley Lutes

Department of Psychology, University of British Columbia

INTRODUCTION

With rates of overweight and obesity at the highest in recorded history, for the first time, it is expected that obese young adults will have a significantly lessened life expectancy compared to their non-obese counterparts (Fontaine, Redden, Wang, Westfall, & Allison, 2003.)   However, young adults do not respond well to traditional behavioral therapy weight loss interventions (Gokee-LaRose, Gorin, Raynor, Laska, Jeffery, Levy, & Wing, 2009.) Therefore, new interventions must be explored that could positively assist obese young adults in weight loss. Recent research has attempted to modify treatment in order to address modality utilized by young adults, like technology. Furthermore, there has been an explosion of weight loss mobile apps. However, they still utilize traditional dietary monitoring. Traditional monitoring requires the recording of all foods consumed daily. While effective, this burdensome method elicits a significant decline in monitoring across time (Gokee-LaRose et al., 2009.)   This is particularly concerning given that, just like reducing caloric intake (Ramage, Farmer, Apps Eccles, & McCargar, 2014.), self-monitoring is consistently linked to successful weight loss (Burke et al., 2011)

Recent research evaluating dietary habits of over 120,000 adults across 20 years, has narrowed down the causes of weight gain and loss across time to a small number of foods consumed on a regular basis (Mozaffarian, Hao, Rimm, Willett, & Hu, 2011.). However, there is a paucity of data understanding the daily-caloric intake/patterns of young adults. Therefore, there is significant potential of utilizing a targeted modified monitoring system to monitor and decrease or increase specific food categories, leading to a energy deficit and sustainable weight loss in young adults.

<u>**LITERATURE REVIEW**</u>

Prevalence of Obesity and Associated Risks

Weight gain is a gradual process for most individuals, occurring at only about a pound a year (Mozaffarian, Hao, Rimm, Willet, & Hu, 2011), yet overweight and obesity is an increasingly overwhelming concern for many citizens. In 2005, 1 in 3 adults in the United States were either overweight or obese. By 2030, that number is projected to skyrocket to 1.35 billion overweight individuals and 573 million obese individuals in the world (Kelly, Yang, Chen, Reynolds, & He, 2008.) Considering the associated risks with being overweight, the projected numbers are very alarming. Even mild weight increases have implied risk factors such as metabolic dysfunction, cardiovascular disease, cancer, and diabetes (Mozaffarian et al., 2011.) In addition to the former risks, there is also a strong correlation between overweight and obesity with increased health care cost, morbidity, and premature death (Ramage, Farmer, Apps Eccles, & McCargar, 2014.)

Obesity and Weight Loss in Young Adults

While the frequency of overweight and obesity is extremely concerning in the adult population, it is earlier in life that the struggle with weight truly begins. Young adults, typically defined as 18 to 35 years old, have the highest rates of weight gain due to physical inactivity and poor diet choices (Kolodziejczyk, Norman, Rock, Arredondo, Madanat, Roesch, & Patrick, 2014.) The occurrence of overweight and obesity is higher in this specific age group, tipping over 40% (Gokee-LaRose, Gorin, Raynor, Laska, Jeffery, Levy, & Wing, 2009.) Young overweight and obese adults become older obese adults with the same risks for chronic morbidity and death. The facts are even more alarming in the literature when weight loss interventions are considered. Many weight

loss programs have emerged in response to the obesity crisis. Little research, however, includes young adults and when they are included, attendance, retention, and weight loss is significantly lower compared to older adults (Kolodziejczyk et al., 2014; Gokee-LaRose et al., 2009.) Even in a study that successfully enrolled young adults, young adults achieved less than half of the weight loss achieved by their older adult counterparts (Gokee-LaRose, Gorin, & Wing, 2009.) Literature points to age, as opposed to other demographic variables, as a unique contributor to disparity among weight loss outcomes in interventions (Gokee-LaRose, Gorin, Raynor, Laska, Jeffery, Levy, & Wing, 2009.) There is also a paucity of data about the specific daily caloric intake of young adults, which could, in part, account for why traditional treatments are not working in this population. Therefore, better understanding their caloric intake is crucial to combating the increased weight gain among this age group. Furthermore, past findings indicate that modifying standard behavioral weight loss to specifically target the young adult population could lead to greater recruitment and retention of this age group (Gokee-LaRose et al., 2009.)

Self-Monitoring in Weight Loss

Dietary self-monitoring is a critical component of successful weight loss. In behavioral weight loss interventions, self-monitoring allows individuals to track their dietary progress toward creating negative energy balance (Peterson, Middleton, Nackers, Medina, Milsom, & Perri, 2014), enhances memory of food consumed, thus, reducing ones intake later (Robinson, Aveyard, Daley, Jolly, Lewis, Lycett, & Higgs, 2013.) Furthermore, self-monitoring increases ones awareness of behavior and can be used to self-correct behaviors (Burke, Conroy, Sereika, Elci, Styn, Acharya, Sevick, Ewing, &

Glanz, 2011.) In a systematic review examining the components of successful weight loss and maintenance interventions, it was said that self-monitoring was a part of 92% of the successful interventions (Ramage et al., 2014). Self-monitoring is consistently linked to losing and maintaining weight loss (Burke et al., 2011) and individuals interested in losing weight are advised to self-monitor caloric intake and expenditure (Carels, Young, Coit, Clayton, Spencer, & Hobbs, 2008.)

   Frequency and consistency in recording. The importance of self-monitoring is highly supported in literature; however, incongruity exists among the specifics of monitoring. For example, frequency, consistency, and detail of recording are three different components that make up what used to be considered effective self-monitoring. Recent literature, however, has come fourth that point to the importance of only frequency and consistency, as opposed to detail in recording (Peterson et al., 2014.) While the detail to which one records might not be as important as originally thought, one study found that there is a significant association between the number of self-monitoring diaries completed and weight loss (Burke et al., 2011.) Not only is frequent and consistent self-monitoring important in initially losing weight, but also in maintaining weight loss (Peterson et al., 2014.) On the other hand, participants that did not self-monitor consistently failed to maintain weight loss as well as participants who monitored both frequently and consistently (Peterson et al., 2014.) These findings are significant in suggesting that an approach that decreases burden by modifying the detail of required recording, but maintains adherence, could potentially lead to successful weight loss and maintenance.

Electronic recording. In a study comparing different motilities of dietary self-monitoring, it was determined that participants exhibited greater adherence to self-monitoring using a personal digital assistant (PDA) as opposed to participants who used traditional self-monitoring on paper. Traditional self-monitoring on paper is burdensome and time consuming (Burke et al., 2011.) The switch to electronic dietary self-monitoring not only decreases burden and is preferred by participants, but is also equally accurate to traditional paper records (Hutchesson, Rollo, Callister, & Collins, 2015.) Thus, electronic self-monitoring could be a potential avenue to increase adherence to self-monitoring.

Food Consumption in Young Adults

Descriptive data outlining the unique qualities of young adult food consumption and caloric intake is relatively non-existent in present literature. Modifying self-monitoring methods, in order to meet the needs of young adults, is second to a presently more pressing issue. Finding ways to combat the overwhelming rise of obesity, among young adults in America, is critical, yet unrealistic, if there is no firm understanding of what they are consuming. Furthermore, the first step towards promoting effective weight loss strategies in young adults is 1) to understand what they are actually consuming and 2) how much of it they are consuming.

Food choices in the literature. Young adult dietary intake is a highly under-represented topic in literature. There is, however, some understanding about the food choices that young adults make. When it comes to choosing food, taste is a more influential factor among young adults, than is the nutritional value of the food (Hebden, Chan, Louie, Rangan, & Allman-Farinelli, 2015.) Overall, young adults have an understanding of what is healthy, they just prefer to consume food that taste good

(Caltabiano & Shellshear, 1998.) While it is important to understand why young adults choose to eat what they do, it is of higher priority to understand what they are eating.

In a survey of over 8,000 Americans, the quality of the daily diet of individuals ages 2-65+ were compared to the 2005 Dietary Guidelines for Americans (Hiza, Casavale, Guenther, & Davis, 2013.) The data revealed that young adults scored lower on diet quality in every category; total fruit, whole fruit, total vegetables, dark green and orange leafy vegetables and legumes, and total grains. Children and older adults both had better quality diets than younger and middle-aged adults. (Hiza, et al., 2013.) It is clear that the majority of young adults are making unhealthy food decisions in comparison to other age groups, yet little is known about the specifics of their food consumption. Furthermore, in a study by Liu and cohorts, participants under greater amounts of stress preferred snack foods (sweets, savory foods, chocolates, etc.) to healthier meal foods (fruits, vegetables, fish, meats, etc.) (Liu, Xie, Chou, Koprowski, Zhou, Palmer, Sun, Guo, Duan, Sun, & Johnson, 2007.) These findings were consistent with those of Hebden and cohorts (Hebden, et al., 2015.) Thus, it is logical to conclude that young adults, such as those in college, are under greater amounts of stress and are consuming more snack foods than healthier food.

Little has been published on young adult dietary intake and future research should address the time, frequency, and quantity of such consumption. Present literature establishes the understanding that 1) this age group makes alarmingly unhealthy food choices and 2) their food choices are unique among other groups. Furthermore, before we address the present crisis of obesity among young adults, we first have to gain a better

grasp on their dietary intake in order to make effective behavioral weight loss suggestions.

Energy Deficits in Weight Loss

Aside from dietary self-monitoring, another crucial and undisputable component of weight loss is achieving a deficit in calorie consumption (Ramage et al., 2014.) A caloric reduction of 100 kcal a day, in one study, was found to prevent excessive weight gain in adults (Plachta-Danielzik, Landsberg, Bosy-Westphal, Johannsen, Lange, & J Müller, 2008.) The opposite is also true. A daily 50-100 kcal energy imbalance (consuming more energy than one expends) can cause a gradual weight gain in many individuals (Mozaffarian et al., 2011.) In a systematic review of successful weight loss interventions, it was found that successful interventions suggested 1200-1500 kcal intake a day to adults (Ramage et al., 2014.) Consuming too little calories, less than 1,200 kcal for women and 1,500 kcal for men, would likely result in insufficient vitamin and mineral intake, thus, the 1200-1500 kcal is typically suggested for weight loss (Ramage et al., 2014.)

Macronutrient change. If caloric intake is monitored, managing weight is possible with a variety of different macronutrient distributions (Ramage et al., 2014; Sacks, Bray, Carey, Smith, Ryan, Anton, McManus, Champagne, Bishop, Laranjo, Leboff, Rood, de Jonge, Greenway, Loria, Obarzanek, & Williamson, 2009.) The American Heart Association does, however, recommend decreasing energy from fat to less than 30% (Kolodziejczyk et al., 2014.) Furthermore, a diet with a range of protein, fat, and carbohydrate components could potentially have advantageous effects on cardiovascular disease and diabetes risk factors (Sacks et al., 2009.) In the systemic

review of weight loss interventions, differences in macronutrient intake did not attribute to differences in weight loss between the groups (Ramage et al., 2014.) Moreover, focus should be less on the macronutrient composition of the diet and more on achieving an overall healthy energy deficit.

Low-density foods. Replacing high-density foods with low-density foods, such as fruits and vegetables, reduces energy intake and consequently leads to weight loss (Lapointe, Weisnagel, Provencher, Bégin, Dufour-Bouchard, Trudeau, & Lemieux, 2010; Whigham, Valentine, Johnson, Zhang, Atkinson, & Tanumihardjo, 2012.) Increasing healthy options (fruits and vegetables), as opposed to solely avoiding unhealthy options, worked better for women who were naturally inclined to make approach goals and were associated with positive attitude towards dieting and weight loss (Lapointe et al., 2010). Low-density foods work to maintain satiety (Ello-Martin, Ledikwe, & Rolls, 2005) and are an effective strategy for combating hunger (Ello-Martin, Roe, Ledikwe, Beach, & Rolls, 2007.) In a study by Ello-Martin and cohorts (2007), participants who were advised to replace energy dense foods with low-density foods lost 33% more weight after 6 months than participants who were not advised to decrease energy density intake (Ello-Martin et al., 2007.) Similarly, in a study by Whigham (2012), participants who increased consumption of fruits and vegetables lost more weight and fat. A combined emphasis on reducing caloric intake and increasing low-density food consumption has synergistic effects (Whigham et al., 2012.) Thus, successful weight loss interventions are associated with focusing on energy intake/expenditure and self-monitoring (Ramage et al., 2014) and can be done so by helping participants target specific foods/beverages to increase/decrease (Mozaffarian et al., 2011.)

Modifying Weight Loss Treatment for Young Adults

  Weight gain and weight loss foods. Mozaffarian and colleauges (2011) found 15 foods, over a twenty-year study, that were consistently linked to either weight gain or weight loss. A positive correlation existed between weight gain and potato chips, sugar-sweetened beverages, unprocessed red meats, and processed meats (gain foods) while a negative correlation existed between weight gain and vegetables, whole grains, fruits, nuts, and yogurt (Mozaffarian et al., 2011.) The strongest correlation existed between weight gain and fruits, vegetables, and un/processed red meats. The difference between individuals who lost the most weight and those that lost the least was 3.1 daily servings of vegetables. Once the data was age-adjusted, French fries and potato chips were the greatest weight gain food while yogurt was the greatest weight loss food (Mozaffarian et al., 2011.)

  The Mozaffarian (2011) study suggested that increasing the intake of weight loss foods consequently led to the decreased consumption of other foods, thus, decreasing energy consumption. Potentially, electronically monitoring the intake of specific weight gain and weight loss food and adjusting the intake of both to create an energy deficit could lead to a more simplified and less burdensome intervention to achieve weight loss in a population, such as young adults, that does not adhere to traditional monitoring.

Purpose of Present Study

  The purpose of the present study is to collect descriptive information on food consumption (quantity and composition) as well as caloric intake of young adults that is, otherwise, not represented in present literature. The data will then be compared to a modified monitoring system to determine how effectively the monitoring system captures

the bulk of daily caloric intake of this age group. The rate of adherence to the modified

monitoring system, as compared to traditional monitoring, will also be assessed.

Furthermore, if the modified monitoring system proves to be effective in tracking a

majority of young adult daily caloric intake, and is adhered to by young adults, then

recommendations will be made for a potential weight loss intervention that encourages

decreasing or increasing food categories associated with the greatest energy intake or

deficit, respectively.

Goals of the Present Study

Goal 1: To collect descriptive information on young adult food intake and caloric

consumption that can be added to literature that is lacking in this area.

Goal 2: To explore the effectiveness of a modified self-monitoring app in capturing the

daily caloric intake of young adults in order to understand its potential success as a

component of weight loss.

<div align="center">

METHODS

</div>

Participants

57 female young adult participants were recruited from East Carolina University,

between the ages of 18 and 35 years old. Participants must have been interested in losing

weight, have a BMI greater than 25, have a smartphone with a data plan, computer

access, and be willing to download a free self-monitoring app. All participants also

agreed to not change their eat habits during the duration of the study. Participants were

excluded from the study if they were not within the age range of 18-35 years old,

pregnant or planning to become pregnant, diabetic, currently or in the past have had a

history of bulimia or anorexia.

Table 1. Baseline Demographics of Study Participants

DEMOGRAPHICS:	MEAN	STD
Age	21.04	4.21
BMI	31.45	6.17
Weight	188.05	39.06
RACE:	FREQUENCY	PERCENT
African American	17	29.8
Caucasian	38	66.7
Asian	1	1.8
Other	1	1.8
STUDENT:		
No	8	14
Yes	49	86

Procedures

Recruitment, screening, and baseline assessment. Participants were recruited thru the use of flyers around campus. A study staff member screened each participant in order to determine eligibility. Eligible participants were consented and provided with username and passwords in order to access the Automated Self-Administered 24-Hour Recall (ASA-24). Participants also completed a Perceived Stress Scale (PSS).

Intervention

All participants were instructed to complete an ASA-24 for two consecutive days on their own, one of the days being a weekend day. This study is part of a larger study in

which the 57 used for the present study, were randomized into one of two arms; using

either a traditional self-monitoring app (MyFitnessPal) or a modified self-monitoring app

(TracIt!). Participants were taught about self-monitoring and were instructed to use these

apps to monitor their daily food/beverage intake for 4 weeks upon which the adherence to

each app will be determined.

Targeted vs. traditional self-monitoring. The traditional monitoring app

(MyFitnessPal) required the detailed recording of all items consumed throughout the day,

including brand and portion. The targeted monitoring app, designed by the research team

conducting the larger study, required participants to record the serving size consumed of

9 specific food/beverages that are consistently linked to weight gain as well as 6 specific

food/beverages that are consistently linked to weight loss. The 9 food/beverages (gain

foods) are as follows; sweets/desserts, refined grains, sugar-sweetened beverages/juices,

red meats, processed meats, potatoes, fried foods, butter, and alcohol. The 6

food/beverages (loss foods) are as follows; whole grains, vegetables, nuts, fruits, yogurt,

and water/diet soda.

Measures

Automated Self-Administered 24-Hour Recall. Participants completed a 24-hr

recall of all food and drink consumed within the last 24 hours. Participants were

instructed to do so for two consecutive days, one day being during the weekend. Each

participant was provided a username and password to access the recall from home and,

upon signing in, was guided through completing the recall. The ASA-24 requires that

individuals report the type of food or drink they consumed, time of consumption, brand,

and portion size. Participants were provided with memory jogging questions in order to

assist in remembering potentially forgotten items such as water and toppings. The ASA-24 contains more than 1,100 different food probes and, with each allowing for up to 8 different portion sizes, sums to over 2 million food pathways and 10,000 different food pictures (Zimmerman et al., 2009.) Each "food pathway" is a description of the food type, brand, and portion size of the food and aligns with a food code that provides nutrient data based off of the USDA's Food and Nutrient Database for Dietary Studies and USDA Multiple Pass Method (Zimmerman et al., 2009.) In a study researching the effectiveness of the ASA, it was determined that the ASA-24 performed well in comparison to the true intake and captured 80% of actual consumption (Kirkpatrick et al., 2014.) Thus, the ASA-24 was chosen as a good means by which to capture the daily caloric intake and detailed food consumption of young adults.

Perceived Stress Scale (PSS). Participants were instructed to complete a 10-item stress questionnaire at the time of consenting. Questions measure the degree to which participants identify personal life events as stressful. The questionnaire produces a sum score that ranges from 0-40, higher scores correlating with higher perceived stress (Cohen, Kamarck, & Mermelstein, 1983.) The PSS, in a study by Cohen and colleagues (1983), had a coefficient alpha reliability of 0.85 and validity was, in general, constant among different sex and ages. The PSS, therefore, was chosen as an effective measure to capture the level of stress in each participant's life.

TRACIT Mobile Application. The research team developed the TRACIT mobile application, capturing all of the gain and loss food as outlined by the study from Mozzaffarin and colleagues (2011), to compare to the commercially available MyFitnessPal. The present study sought to compare the overall food consumption of the

participants to how much of that caloric intake was captured by TRACIT to determine its effectiveness as a potential monitoring and goal setting tool.

Analysis

Descriptives of Young Adult Food Consumption. Data from the ASA-24 recalls were both days were collected. The total caloric intake for both days of the participants were averaged as well as the macronutrients: total protein (g), total fat (both unsaturated and saturated), fiber (g), carbohydrates (g), and fruits and vegetables (cup equivalences.) The standard deviations (STD's) were also analyzed for each of the macronutrients and total calories. All analysis was done using SPSS Statistics. The percent of participants that skipped one or more meals on Day 1, on Day 2, and on both days was calculated. Percentages were also collected for how many participants skipped a particular meal on each day. The mealtime of breakfast, lunch, and dinner was averaged between the two days for each participant and those meal times were averaged together to calculate the average time for each meal for the participants as a whole.

Efficiency of TRACIT in Capturing Consumption. Using the data collected from the ASA-24, the foods consumed by each participant were categorized into the same gain food groups and loss food groups used by TRACIT. The total calories that were captures by the TRACIT food groups were analyzed for Day 1 and Day 2. The average percent of calories captured by TRACIT were also analyzed. The calories of combined food items such as "spaghetti with meatballs and red sauce" that could not simply be placed into one group were equally divided among the appropriate groups. For example, if "spaghetti with meatballs and red sauce" was 502 kcal, the calories would be equally divided amongst the following food categories: refined grains, vegetables, and red meats.

While a majority of the calories were able to be accurately overlayed, a small portion of

the food items (26.82%) did not fit into either gain or loss food groups and were therefore

excluded from categorization.

Stress. Using SPSS, a bivariate correlation Pearson test was ran on the stress

score of each participant and their BMI to determine if a correlation existed among the

two factors.

RESULTS

Descriptives of Young Adult Food Consumption. The average caloric intake of

the young adult participants was appromixately 2000 kilocalories per day (See figure 1).

Breaking down the nutrient intake, results showed that young adult women consume a

fairly high amount of protein and carbohydrates, and relatively low amount of fiber, on a

daily basis.

Figure 1. Descriptives/Macronutrient Composition of Participants Food Intake

MACRONUTRIENT	MEAN	STD
Calories (kcal)	1987.90	696.43
Protein (g)	72.62	29.76
Total Fat (g):	81.98	33.84
Unsaturated Fat (g)	49.05	20.22
Saturated Fat (g)	26.48	12.69
Fiber (g)	12.60	5.72
Carbohydrates (g)	231.90	92.47
Fruits and Vegetables (cup equivalents)	2.11	1.53

With regard to meal skipping, results showed that 48% of young adult female participants skipped at least one meal on one of the two days and 33% skipped at least one meal on only one day. Comparatively, results showed that only 19% of the participants ate six meals over the course of two days, with 81% of the participants skipping at least one meal over the course of only two days. Average meal time results were less significant with the average breakfast time being 9:51 am (N=46), lunch at 1:29 pm (N=54), and dinner 7:28 pm (N=56.) Breakfast was the most skipped meal overall followed by lunch and then dinner. During the weekday, however, lunch was less skipped than dinner.

Efficiency of TRACIT in Capturing Consumption. Upon examination of the food intake of young adults and comparison to the TRACIT app, results reveal that TRACIT is, in fact, effective at capturing the participant's caloric intake. Of the average total caloric intake of the participants (1987.90 kcal), 1459.15 kcal would be theoretically captured by the TRACIT app. Furthermore, an average of 1174.74 kcal would be captured by the Gain Foods category and 284.41 kcal would be captured by the Loss Foods category. This translates into 57.91% and 15.27%, respectively, of the 73.18% of calories captured by the app (see Figure 2).

Figure 2. Percent of Participant's Total Calories Captured by the TRACIT Mobile

Application
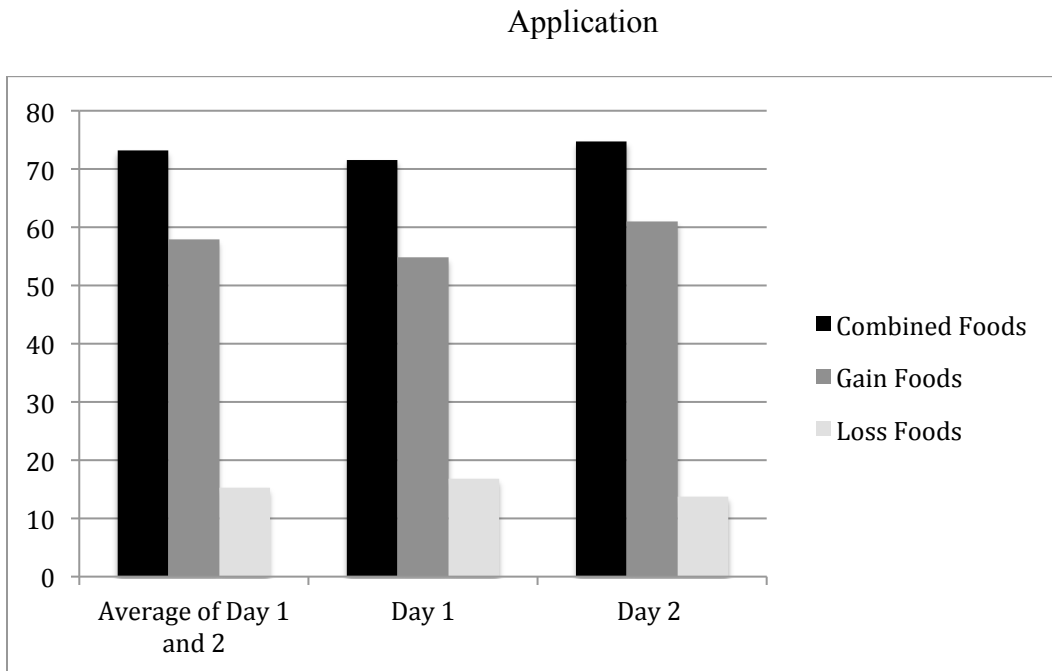
Stress. A very strong statistically significant positive relationship existed between

the average total calories of the young adult participants and their BMI at the time of

consent (p=0.005.) A statistically significant positive relationship also existed between

the BMI of the participants and their PSS Score (p=0.047.)

DISCUSSION

Young adults are a very unique age demographic with specific weight loss needs.

Given the lack of success using traditional behavioral therapy in this group, a better

understanding of young adult patterns as well as innovative ideas and approaches are

desperately needed. Results from the present study showed that caloric intake of young

adult females was approximately 2000 calories, about 200 kcal higher than the national

average for women. Moreover, results indicated that macronutrient intake by young

adults is higher than the average national for women in fat intake (65.92 g),

carbohydrates (223.59 g), and protein (68.63 g) (Wright & Wang, 2010.) Since young

adults are consuming greater amounts of macronutrients than the average adult, this could

be indicative of why they are not adhering to the drastic changes prescribed in traditional

behavioral weight loss interventions.

Another primary focus of the study was to better understand meal patterns of

young adults. According to our results, almost half (48%) of the young adults appeared to

skip meals over the course of a day and the majority (81%) skipped at least one meal over

the course of two days. Implications of these findings of such erratic meal behaviors in

this group could suggest that adhering to the weight loss interventions of older less erratic

consumers, such as older adults, more difficult. In fact, erratic food patterns are patterns

seen in adults with binge eating disorder, which is contraindicated for weight loss until

the binge eating eating treatment is conducted (Masheb, Lutes et al, 2015). Interestingly,

a majority of the initial portions of binge eating treatment consists of developing

consistent food patterns, routine, and pattern (Fairburn, 2013). Based on our present

findings, it would suggest that young adults should not only be assessed for binge eating,

but treatment elements, or pre-treatment consisting of binge-eating treatment, focusing on

meal scheduling, routine, and structure appear paramount in this group.

Another factor that was of interest related to the perceived stress of young adults

as it relates to food consumption and associated outcomes like weight. Interestingly,

young adults in the present study who reported higher levels of perceived stress also had

higher BMI's (p=0.005). This is a trend that is consistent in the general mental health

literature of young adults, suggesting that they are reporting historically high levels of

stress, levels similar to psychiatric patients in an inpatient unit the in 1950's (Sifferlin, 2013). Therefore, it is understandable while they do not adhere to the additional stress of traditional self-monitoring methods when they are experiencing such high levels of stress. As such, clearly future interventions need to both measure and target stress and stress reduction in treatment intervention programs in this population.

Lastly, but perhaps most importantly, we looked at the intake of young adults and how it mapped onto a modified food tracking system: TracIt. Interestingly, this modified self-monitoring application (TracIt) captured almost 75% of the calories consumed by young adults on a daily basis. Given this incredibly high overlap of food consumed by young adults and its tie to weight gain and loss foods as seen in the literature (Mozaffarian et al., 2011), there appears to be some significant opportunity to minimize tracking while maintaining overall food consumption integrity. Tied to the previous concept of stress, perhaps this modified tool might be an a more effective tool for weight loss interventions tailored to meet the demands of the overweight young adult population compared to traditional full monitoring.

Strengths of the Present Study. There are great strengths to the present study. The demographics, for example, reflect a diverse sample of participants including almost 1/3 African Americans. There is also a diversity of both students and non-students, even though it would be beneficial in future studies to have more equal representation between the two groups. The one-month period of tracking was also a strength because it allowed for a reliable portrayal of long-term young adult adherence to the apps. Furthermore, the recruitment of a large sample of young adults with a high BMI was a beneficial contribution to the present literature on young adults.

Limitations of the Present Study. Due to difficulty with recruiting young adult males, the present study only included females. Gender could be an extraneous variable when analyzing the descriptives of young adult food intake and meal skipping. This should be taken into consideration for future research. It was also difficult to categorize food items that were a caloric combination of more than one TRACIT food category. Since ASA-24 did not provide the caloric break down of such foods, it was difficult to account for what percentage of calories should be captured by each food group, therefore insignificant changes in the total calories captured by each food group in TRACIT would occur if we had this information. The data would more accurately portray the effectiveness of the modified app in capturing the participant's caloric consumption.

Future Research. Future research should focus on analyzing long term use of the TRACIT mobile application in a young adult population to measure adherence as well as weight loss results. Understanding that TRACIT is effective in capturing the participant's caloric intake is only the first step. In order for the modified mobile application to be an effective tool for young adults seeking weight loss, it must also be a resource that they will adhere to. As mentioned before, this study only examined the eating habits and descriptives of young adult females. Future research should examine if the same food consumption tendencies exist among young adult males. Furthermore, researchers could analyze the effectiveness of a weight loss intervention that combines making small changes to the meal skipping behaviors of young adults as well as simultaneously treating stress while decreasing BMI. The correlation discovered in the present study should be tested further to determine whether simultaneously treating stress and weight loss leads to more effective interventions.

References:

Burke, L. E., Conroy, M. B., Sereika, S. M., Elci, O. U., Styn, M. A., Acharya, S. D.,

Sevick, M. A., Ewing, L. J., & Glanz, K. (2011). The effect of electronic self-

monitoring on weight loss and dietary intake: A randomized behavioral weight loss

trial. *Obesity (Silver Spring, Md.), 19*(2), 338-344. doi:10.1038/oby.2010.208

Caltabiano, M. L., Shellshear, J. (1998). Palatability versus healthiness as determinants of

food preferences in young adults: A comparison of nomothetic and idiographic

analytic approaches. *Australian and New Zealand Journal of Public Health, 22*(5),

547-551.

Carels, R. A., Young, K. M., Coit, C., Clayton, A. M., Spencer, A., & Hobbs, M. (2008).

Can following the caloric restriction recommendations from the Dietary Guidelines

for Americans help individuals lose weight? *Eating Behaviors, 9*(3), 328-335. doi:

10.1016/j.eatbeh.2007.12.003

Cohen, S., Kamarck, T., & Mermelstein, R. A global measure of perceived stress.

Journal of Health and Social Behavior. 1983;24(4):385–396. doi: 10.2307/2136404.

Ello-Martin, J. A., Ledikwe, J. H., & Rolls, B. J. (2005). The influence of food portion

size and energy density on energy intake: implications for weight management. *The

American Journal of Clinical Nutrition, 82*(suppl), 236S-241S.

Ello-Martin, J. A., Roe, L. S., Ledikwe, J. H., Beach, A. M., & Rolls, B. J. (2007).
Dietary energy density in the treatment of obesity: a year-long trial comparing 2
weight-loss diets. *The American Journal of Clinical Nutrition, 85*(6), 1465-1477.

Fairburn, C. (2013). *Overcoming binge eating: The proven program to learn why you
binge and how you can stop*. New York, NY: The Guilford Press.

Fontaine, K. R., Redden, D. T., Wang, C., Westfall, A. O., & Allison, D. B. (2003).
Years of life lost due to obesity. *JAMA: Journal of the American Medical
Association, 289(*2), 187-193. doi:10.1001/jama.289.2.187

Gokee-LaRose, J., Gorin, A. A., Raynor, H. A., Laska, M. N., Jeffery, R. W., Levy, R.L.,
& Wing, R.R. (2009). Are standard behavioral weight loss programs effective for
young adults? *International Journal of Obesity, 33*(12), 1374-1380.
doi:10.1038/ijo.2009.185

Gokee-LaRose, J., Gorin, A. A., & Wing, R. R. (2009). Behavioral self-regulation for
weight loss in young adults: a randomized controlled trial. *The International Journal
of Behavioral Nutrition and Physical Activity, 6*(10). doi:10.1186/1479-5868-6-10

Hebden, L., Chan, H. N., Louie, J. C., Rangan, A., & Allman-Farinelli, M. (2015). You
are what you choose to eat: factors influencing young adults' food selection
behavior. *Journal of Human Nutrition and Dietetics*. doi: 10.1111/jhn.12312

Hiza, H., Casavale, K. O., Guenther, P. M., & Davis, C. A. (2013). Diet quality of

Americans differs by age, sex, race/ethnicity, income, and education level. *Journal of the Academy of Nutrition and Dietetics, 113*(2), 297-306. doi: 10.1016/j.jand.2012.08.011

Hutchesson, M. J., Rollo, M. E., Callister, R., & Collins, C. E. (2015). Self-monitoring of dietary intake by young women: online food records completed on computer or smartphone are as accurate as paper-based food records but more acceptable. *Journal of the Academy of Nutrition and Dietetics, 115*(1), 87-94. doi:10.1016/j.jand.2014.07.036

Kelly, T., Yang, W., Chen, C-S., Reynolds, K., & He, J. (2008). Global burden of obesity in 2005 and projections to 2030. *International Journal of Obesity, 32*(1), 1431-1437. doi:10.1038/ijo.2008.102

Kirkpatrick, S. I., Subar, A. F., Douglass, D., Zimmerman, T. P., Thompson, F. E., Kahle, L. L., George, S. M., Dodd, K. W., & Potischman, N. (2014). Performance of the automated self-administered 24-hour recall relative to a measure of true intakes and to an interviewer-administered 24-h recall. *The American Journal of Clinical Nutrition, 100*(1), 233-240. doi:10.3945/ajcn.114.083238

Kolodziejczyk, J. K., Norman, G. J., Rock, C. L., Arredondo, E. M., Madanat, H., Roesch, S. C., & Patrick, K. (2014). Strategies that predict weight loss among overweight/obese young adults. *American Journal of Health Behavior, 38*(6), 871-880. doi:10.5993/AJHB.38.6.9

Lapointe, A., Weisnagel, S. J., Provencher, V., Bégin, C., Dufour-Bouchard, A. A.,

    Trudeau, C., & Lemieux, S. (2010). Comparison of a dietary intervention promoting

    high intakes of fruits and vegetables with a low-fat approach: long-term effects on

    dietary intakes, eating behaviours and body weight in postmenopausal women. *The*

    British Journal of Nutrition, 104(7), 1080-1090. doi: 10.1017/S0007114510001716

Liu, C., Xie, B., Chou, C., Koprowski, C., Zhou, D., Palmer, P., Sun, P., Guo, Q., Duan,

    L., Sun, X., & Johnson, C. A. (2007). Perceived stress, depression and food

    consumption frequency in the college students of China seven cities. *Physiology &*

    Behavior, 92(4), 748-754. doi: 10.1016/j.physbeh.2007.05.068

Masheb, R., Lutes, L., Kim, H.M., Holleman, R., Goodrich, D., Janney, C., Kirsh, S.,

    Richardson, C., & Damschroder, L. (2015). High-frequency binge eating predicts

    weight gain among veterans receiving behavioral weight loss treatments. *Obesity,*

    23(1), 54-61. doi:10.1002/oby.20931

Mozaffarian, D., Hao, T., Rimm, E. B., Willett, W.C., & Hu, F.B. (2011). Changes in diet

    and lifestyle and long-term weight gain in women and men. *New England Journal of*

    Medicine, 364(25), 2392-2404. doi:10.1056/NEJMoa1014296

Peterson, N. D., Middleton, K. R., Nackers, L. M., Medina, K. E., Milson, V. A., & Perri,

    M. G. (2014). Healthy strategies for successful weight loss and weight maintenance:

    a systemic review. *Obesity, 22*(9), 1962-1967. doi: 10.1002/oby.20807

Plachta-Danielzik, S., Landsberg, B., Bosy-Westphal, A., Johannsen, M., Lange, D., & J

   Müller, M. (2008). Energy gain and energy gap in normal-weight children:

   longitudinal data of the KOPS. *Obesity, 16*(4), 777-783. doi: 10.1038/oby.2008.5

Ramage S., Farmer A., Apps Eccles K., & McCargar L. (2014). Healthy strategies for

   successful weight loss and weight maintenance: a systemic review. *Applied

   Physiology, Nutrition, and Metabolism, 39*(1), 1-20. doi:10.1139/apnm-2013-0026

Robinson, E., Aveyard, P., Daley, A., Jolly, K., Lewis, A., Lycett, D., & Higgs, S.

   (2013). Eating attentively: a systemic review and meta-analysis of the effect of food

   intake memory and awareness on eating. *The American Journal of Clinical

   Nutrition, 97*(4), 728-742. doi: 10.3945/ajcn.112.045245

Sacks, F. M., Bray, G. A., Carey, V. J., Smith, S. R., Ryan, D. H., Anton, S. D.,

   McManus, K., Champagne, C. M., Bishop, L. M., Laranjo, N., Leboff, M. S., Rood,

   J. C., de Jonge, L., Greenway, F. L., Loria, C. M., Obarzanek, E., & Williamson, D.

   A. (2009). Comparison of weight-loss diets with different compositions of fat,

   protein, and carbohydrates. *The New England Journal of Medicine, 360*(9), 859-874.

   doi: 10.1056/NEJMoa0804748

Sifferlin, A. (2013, February 7). The most stressed-out generation? Young adults. *Time.*

   Retrieved from http://healthland.time.com/2013/02/07/the-most-stressed-out-

   generation-young-adults/

Whigham, L. D., Valentine, A. R., Johnson, L. K., Zhang, Z., Atkinson, R. L., &

   Tanumihardjo, S. A. (2012). Increased vegetable and fruit consumption during

weight loss effort correlates with increased weight and fat loss. *Nutrition &*
Diabetes, 2(e48), 1-5, doi: 10.1038/nutd.2012.22

Wright, J. D. & Wang, C-Y. (2010). Trends in intake of energy and macronutrients from
1999-2000 through 2007-2008. NCHS data brief, no 49. Hyattsville, MD.

Zimmerman, T. P., Hull, S. G., McNutt, S., Mittl, B., Islam, N., Guenther, P. M.,
Thompson, F. E., Potischman, N. A., & Subar, A. F. (2009). Challenges in
converting an interviewer-administered food probe database to self-administration in
the National Cancer Institute automated self-administered 24-hour recall (ASA24).
Journal of Food Composition and Analysis, 22(1), S48-S51.
doi:10.1016/j.jfca.2009.02.003