Motivational Interviewing for Weight Management among College Students

by

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Abstract

BACKGROUND: Approximately 37% of college students are overweight or obese and the COVID-19 pandemic may have exacerbated weight management in college students. The purpose of this study was to determine the effect of a motivational interviewing intervention compared to electronic education (control) on body composition and self-determination theory (SDT) constructs among overweight college students. METHODS: 40 college students were randomized into the MI (18) or control group (22). The MI group received three face-to-face interviews before the pandemic and three video chat interviews after the outbreak of COVID-19 over six months. The control received six electronic education modules. Body composition was measured by the iDexa and SDT variables were assessed with surveys. Interpretative phenomenological analysis was utilized to detail experiences throughout the study. RESULTS: Mixed ANOVAs from pre-post revealed significant interactions in fat mass (p = .029) and lean mass (p = .047). The control group had a larger increase in fat mass compared to the MI group while also losing lean mass, whereas the MI group had an increase in lean mass. There were also significant interactions regarding autonomy (p = .002), relatedness (p = .001), amotivation (p = .010), external regulation (p = .023), identified regulation (p = .017), integrated regulation (p = .001), and intrinsic regulation (p = .014). The MI group had increases in autonomy, relatedness, identified, integrated, and intrinsic regulation while the control group had decreases in these respective constructs. The MI group also had decreases in amotivation and external regulation while the control group had increases in scores. Four themes emerged from both groups relating to the struggles of COVID-19's impact: loss of gym access, mental struggles, boredom/stress eating, and loss of structure/living conditions. Four themes were also identified related to the intervention received: MI was found more remarkable compared to electronic education, MI was

particularly useful during the shutdown, subjects receiving MI enjoyed the autonomy focus, and subjects receiving MI felt comfortable to share information and trusted the MI interventionists. CONCLUSIONS: MI demonstrated strong potential in body composition maintenance when compared to electronic education among overweight college students during a national pandemic. Based on the results of this study, the COVID-19 pandemic impacted college students in their weight management journey. Participants in the MI group felt more successful, which may be in part due to the trustful communication and focus on autonomy of MI.

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LIST OF ABBREVIATIONS

LDL- Low-Density Lipoprotein

HDL- High-Density Lipoprotein

BMI- Body Mass Index RCT-

Randomized Controlled Trial

iDexa- Dual-Energy X-ray

SDT- Self-Determination Theory

BPNES- Basic Psychological Needs in Exercise Scale

ROPAS- Relatedness to Others in Physical Activity Scale

BREQ-3- Behavioral Regulation in Exercise Questionnaire

HCCQ- Health Care Climate Questionnaire

CDC- Centers for Disease Control and Prevention

SMD- Standardized Mean Difference

IRB- Institutional Review Board

PAR-Q- Physical Activity Readiness Questionnaire

MISCHE- Motivational Interviewing Skills in Health Care Encounters

WC- Waist Circumference

BIA- Bio-Electrical Impedance Analysis

IPA- Interpretative phenomenological analysis

MI- Motivational Interviewing

EE- Electronic Education

I. INTRODUCTION

Overview

Obesity is a growing problem among college students in the United States. According to a recent national survey, approximately 37% of undergraduates are overweight or obese according to self-reported height and weight [1]. Despite the national attention, it appears the adult obesity rate continues to grow as data from 2003–2004 and 2013–2014, shows childhood obesity rates remained stable (17.1% to 18.5%), while adults showed an increasing trend (32.2% to 39.6%) [2]. Excess body weight and obesity are associated with numerous poor health outcomes including [3-5]: all-cause mortality, high blood pressure, high low-density lipoprotein (LDL), low high-density lipoprotein (HDL), dyslipidemia, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, breathing problems, certain cancers (endometrial, breast, colon, kidney, gallbladder, and liver), low quality of life, mental illness such as clinical depression, anxiety, and other mental disorders [6, 7], body pain and difficulty with physical functioning [8]. Obesity also has a tremendous cost to the nation economically. In 2008, estimates show that $147 billion were spent on medical treatment for obesity-related issues among adults [9], as well as loss in productivity due to obesity-related nonattendance varied from $3.38 billion to $6.38 billion [10]. Therefore, evidence-based programs to reduce the rate of obesity are needed.

Alterations in physical activity and/or nutrition are two primary methods to address excess body weight. An increase in physical activity has several health benefits. Consistent physical activity is pivotal in chronic disease prevention, weight management, bone health, cardiovascular health, mental health, and sleep [11, 12]. Current exercise guidelines for adults call for at least 150 to 300 minutes a week of moderate-intensity physical activity, or 75 minutes

to 150 minutes a week of vigorous-intensity physical activity, or an equivalent combination of moderate- and vigorous-intensity physical activity. In addition, recommendations include muscle-strengthening activities of moderate or greater intensity that involve all major muscle groups on 2 or more days a week [13]. Despite the known benefits of physical activity, many college students neglect adequate physical activity with 86% failing to meet guidelines for physical activity [14]. It appears that men are more motivated for exercise for fitness-related outcomes while women are more focused on weight and aesthetic related outcomes [15]. A lack of time is a consistent barrier across genders while men also reported a lack of motivation and women reported undesirable experiences with campus facilities [16, 17]. A personalized approach may address these factors due to these differences and the unique issues that impact the decision to exercise among college students.

Nutrition is an integral part of weight management as well, in that correct energy balance between calories used by the body and caloric intake from food and beverages is necessary to manage weight [18, 19]. Expert recommendations suggest a balanced diet of whole grains, fruits, vegetables, lean protein, low-fat and fat-free dairy products, and drinking water [20]. Recommended servings sizes for most adults include 9 servings for grains, 4 servings of vegetables, 3 servings of fruits, 2-3 servings of dairy, and 2 servings of protein (meat, fish, beans, etc.) per day [21]. However, few college students are meeting these recommendations with data showing that 70% of college freshmen ate fewer than 5 fruits and vegetables daily, and more than 50% ate fried or high-fat fast foods at least 3 times during the previous week. By the end of their sophomore year, these aspects did not significantly change and 70% of the 290 students who were reevaluated had gained an average of 4lbs [22]. Price, convenience, and pleasure appear to greatly impact eating decision-making among college students. There are gender differences as well with men reporting all you can eat facilities being a barrier and women

reporting a lack of cooking resources within their living space being barriers to healthy eating [16]. Tailoring responses based on these differences may prove effective in curbing student weight gain.

A national survey also identified numerous challenges with health behaviors among college students including alcohol consumption, sleep, and mental health that affect weight management [1]. Many students have reported heavy drinking (5-7 drinks) during recent outings, which is related to weight gain [23, 24]. It is also evident that most college students are considered "poor sleepers" [25], which is shown to increase BMI (Body Mass Index) [26]. Stress, depression, and anxiety appear to plague many college students, all of which have shown to have a detrimental health impact on anthropometric status [27-29]. While alcohol consumption, sleep behavior, and mental health may not seem as important for weight status when compared to physical activity and nutrition, these factors are associated with college student weight gain and are important to address as a part of a comprehensive behavior change plan.

Overall, interventions aimed at curbing obesity during college have seen little success with merely 3 of 11 interventions evaluated in a systematic review and meta-analysis showing significant changes in weight-related outcomes [30]. It is also important to mention only half of these interventions were randomized controlled trials (RCT). Furthermore, interventions relied heavily on less objective measures for anthropometric status and physical activity. Most interventions have relied on weight and BMI. Utilizing advanced measures, such as the iDexa, would provide health professionals with vital information on measures such as lean mass, bone density, and fat mass. These interventions also relied on self-reported measures for physical activity, which lacks the accuracy of more objective instruments such as accelerometers [31].

Therefore, there is a literature gap in identifying impactful evidence-based interventions to prevent and or reduce obesity in college students. One possible intervention strategy is to utilize a person-centered intervention that focuses on the participant's motivations for change on target health or lifestyle behaviors.

Motivational Interviewing

Motivational interviewing is a communication method shown to help facilitate an increase in adherence to numerous health behaviors through a series of person-centered strategies or skills and the motivational interviewing "way of being". The motivational interviewing "way of being" characteristics include collaboration, compassion, evocation, and acceptance [32]. The key communication principles of motivational interviewing are expressing empathy, supporting self-efficacy, rolling with resistance, and developing discrepancy. This method is in stark contrast to a provider-centered communication method where the focus is to "save the patient" and direct their behavior. These two methods are compared in **Table 1**.

Table 1. Patient-Centered vs Provider-Centered Communication

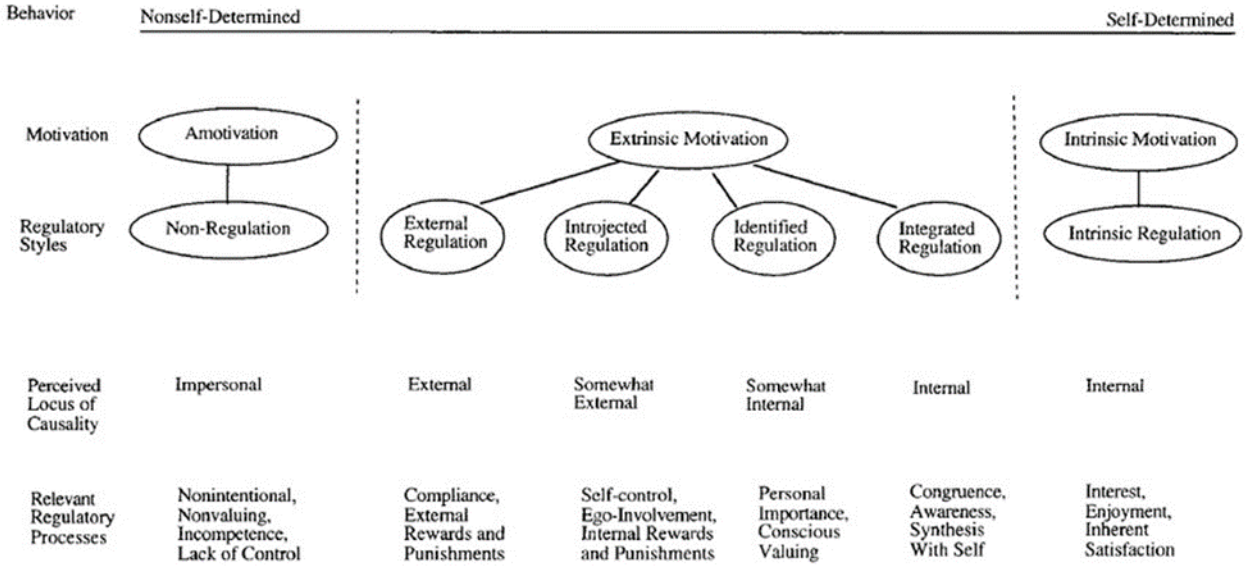
Patient-Centered	Provider-Centered
Adherence	Compliance
Help facilitate patient to make desired changes	"Save" the patient
Assess motivation	Motivate the patient
Servant	Authoritarian
Information exchange	Information giving
Understand, acceptance	Persuade, manipulate
Respect is earned	Respect expected
Resistance is information	Resistance is bad

Motivational interviewing has been applied in numerous behavioral change fields and target behaviors to increase health status according to a systematic review [33]. This review reported significant results for numerous health outcomes including BMI, total blood cholesterol, systolic blood pressure, and blood alcohol concentration. Among the potential targets for motivational interviewing includes health behaviors related to weight loss among adult and adolescent populations [34, 35]. Among adults, a meta-analysis revealed over 3.2 lbs. of weight loss in the average motivational interviewing intervention compared to control groups [34].

Self-Determination Theory

Theoretical underpinnings of motivational interviewing may be framed by self-determination theory (SDT). SDT is focused on human motivation and personality and spotlights the importance of self-determination in volitional behavior [36]. The SDT proposes there is a continuum of motivation types based on Vallerand's theory of extrinsic and intrinsic motivation [37]. **Figure 1** from Ryan and Deci in 2000 [38] details this continuum.

Figure 1. The Self-Determination Continuum Showing Types of Motivation with Their Regulatory Styles, Loci of Causality, and Corresponding Processes



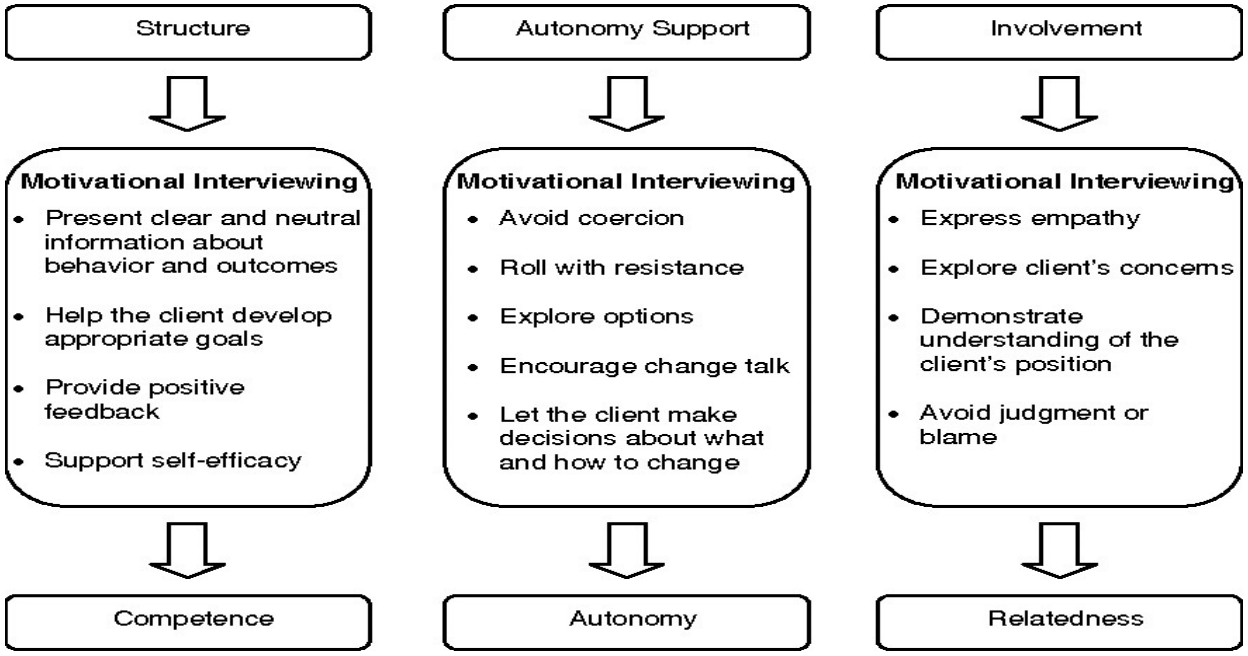
To the far left of the continuum is amotivation, which describes a missing intention for action or simply acting aimlessly. To the right of amotivation begins a spectrum of motivated behavior moving from more external motivation to internal motivation as well as, moving from an external locus of causality to more internal. External regulation occurs when actions revolve solely around external rewards or consequences. Introjected regulation occurs when actions revolve around guilt, pressure from important people, and motivation to conform to social norms. More internalization is present,and external nudging may not be required at this form of motivation. Identified regulation occurs when the action is personally valued due to its involvement with a personal goal. Integrated regulation, which is the most self-determined form of external motivation, occurs when actions are directed by an integrated form of identity built of values that have become a part of the self. To the very right of the spectrum is internal regulation which occurs when the actions are guided by enjoyment, interest, or knowledge and the action is valued for itself rather than any consequences because of the action [38]. SDT also incorporates three innate psychological needs for competence, relatedness, and autonomy [39]. The need of competence is the understanding that humans need to have mastery over their environment and feel adequate and competent. The need for autonomy refers to a need for control in one's ventures and an internal locus of causality. The need for relatedness refers to a need to feel connected and a sense of belonging [40]. When these three needs are satisfied, an environment is created that fosters self-determined behavior and intrinsic motivation [38].

Collaboration of Motivational Interviewing and Self-Determination Theory

Moving forward, there appears to be potential in bringing together the two fields of the SDT and motivational interviewing for a common cause of evoking health behavior change. There have been numerous experts in both realms that have called for exploration and collaboration of these two fields [41-44]. The overlapping natures of motivational interviewing

and SDT and the ability of one to strengthen the other call for this collaboration. Markland et al., specifically describe one method for combining these two approaches to behavioral change, which is detailed in **Figure 2**. [43].

Figure 2. Self-Determination Theory and Motivational Interviewing



The structure of motivational interviewing (information exchanging, supporting self-efficacy, and helping the subject set appropriate goals) may enhance competence. Furthermore, the autonomy support (rolling with resistance, exploring options, avoiding coercion) may enhance autonomy and the involvement of the interviewer (expressing empathy, avoiding judgment, exploring concerns) may enhance relatedness. With these specifics, Markland and colleagues make the case that on a deeper level, motivational interviewing may provide an environment that foster's personal growth and integration which is in tandem with the SDT [43].

One criticism of motivational interviewing is the lack of an integrated theoretical framework guiding its actions [45]. Miller further describes that little time was spent to explore theoretical support for motivational interviewing [46-48], thereby neglecting the mechanism of

change. Perhaps in this specific case involving college students, motivational interviewing is related to increases in more internal motivation, autonomy, relatedness, and/or competence and that change increases adherence to health behaviors that impact anthropometric status. However, there is a lack of research to support this.

Statement of the Problem

Almost 40% of college students are considered overweight or obese. With the increased weight gain, health risks increase dramatically in the short-term and long-term. The determinants of weight gain among college students are physical activity, nutrition, mental health, alcohol consumption, and sleep [1]. There also appear to be unique determinants and barriers that students face regarding adherence to health behavior by gender and personal factors [15, 16, 49]. Current research on addressing college weight gain has yet to demonstrate consistent evidence-based interventions, therefore, more rigorous, and unique solutions are needed [30]. The current literature has also used self-reported physical activity and obsolete measures of body composition (weight and BMI), which is a limitation [30]. When focusing on the small amount of research conducted among college students, it appears that tailoring interventions to the subject [30], more personal interaction, and information sharing could prove effective in anthropometric status changes [50-52]. One method that could prove effective is motivational interviewing due to its tailored nature and research using this method is severely lacking among college students.

Purpose of the Study and Study Objectives

The purpose of this intervention is to examine the impact of a motivational interviewing intervention on overweight and obese college student's body composition and SDT related constructs.

Research Questions and Hypotheses

Q1: Does motivational interviewing impact body composition when compared to electronic education among college students?

H1: We hypothesize the motivational interviewing intervention group to significantly have a higher fat mass loss, significantly higher lean mass gain, and significantly higher bone mass gain when compared to the control group measured by the iDexa.

Q2: Does motivational interviewing impact SDT constructs compared to electronic education?

H2: We hypothesize the SDT constructs of autonomy, competence, and relatedness to be significantly higher post-intervention compared to the control group measured by the Basic Psychological Needs in Exercise Scale (BPNES) and Relatedness to Others in Physical Activity Scale (ROPAS) scale. We also hypothesize the intervention group to fall closer to intrinsic motivation when compared to the control group in the self-determination continuum measured by the Behavioral Regulation in Exercise Questionnaire (BREQ-3) scale.

Limitations

There are foreseen limitations to this study. Attrition is a probable issue in this intervention. Typical attrition in motivational interviewing interventions for weight loss is between 5-15% when looking at the retained studies in a systematic review [34]. Due to this intervention being unique compared to the literature, attrition is hard to predict and could reduce the power of this study. To address this issue, we have included incentives at multiple time points for retention and have completed an a priori power analysis.

A lack of generalization is expected due to the predicted sample. Auburn University's student demographics do not represent the general population as 77.4% self-reported being white

[53]. As a result, the sample was primarily built of white college students. The results of this study may not apply to other universities with more diverse student bodies.

Delimitations

The generalizations made from this study are limited by specific boundaries. This intervention was employed among college students attending a southeastern university and compared a motivational interviewing group with a control (electronic education) group. Specifically, this study was delimited to college students; who are at low risk for medical complications from exercise, as determined by the physical activity readiness questionnaire; not currently engaging in exercise over the past three months; a BMI over 25, and not pregnant.

Significance of the Study

Currently, interventions to address college weight gain have not demonstrated large-scale success and lack scientific rigor with very few randomized controlled trials that rely on self-report measures and have low power [30]. The proposed study is a randomized controlled trial utilizing objective measures of body composition and physical activity to assess changes in student's weight status. This study will provide evidence for motivational interviewing in addressing college students' weight gain. Motivational interviewing is a relatively inexpensive intervention that does not require extended supervision. Rather than running an exercise intervention multiple times a week, conducting monthly interviews is a smaller commitment regarding both time and resources.

Providing evidence that SDT constructs have a relationship with the effect of motivational interviewing would further demonstrate potential for understanding mechanisms of change. This information could be used to inform future motivational interviewing and SDT based interventions. Due to the current criticisms of motivational interviewing lacking a theoretical framework showing a relationship with the SDT could be an important finding [45].

This study could also demonstrate potential in motivational interviewing being a tool to utilize the SDT constructs for weight management.

II. LITERATURE REVIEW

Overview

Approximately 40% of college students are overweight or obese [1], and rates among the southeast United States are higher. For example, one study found that 70% of college freshmen gained an average of 5.3 kg and the prevalence of overweight to obese grew from 18% to 31% over four years at a southeastern university [54]. This trend is concerning as it appears that, while gains in freshman year are present, these gains continue throughout college and increases the risk for health consequences associated with obesity [3-7].

Weight gain and obesity are complex health issues that can be influenced by numerous factors [55]. Alterations in physical activity and caloric intake are two primary reasons for increases in weight during college years, however, other determinants including excess alcohol consumption, mental health, and living/eating arrangements are important additional factors to consider [1]. To fully address weight gain among college students, we must fully explore the determinants identified by the literature. Specifically, the most common determinants of weight gain in college students are a lack of physical activity and proper nutrition, followed by alcohol consumption, sleep, and mental health.

Physical Activity

Current exercise guidelines for adults call for at least 150 minutes to 300 minutes a week of moderate-intensity, or 75 minutes to 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Recommendations also suggest muscle-strengthening activities of moderate or greater intensity that involve all major muscle groups on two or more days a week [13]. According to a national survey, most college students do not meet physical activity guidelines with only

46.2% of undergraduate students self-reporting meeting physical activity guidelines [1]. However, further estimates show that the percentage of students not meeting exercise recommendations may be as high as 86 % [14]. This may relate to identified determinants and/or barriers of physical activity such as lack of time, weather, facilities, social support, and motivation [15-18]. Specifically focusing on the relationship between weight and physical activity, it is understood that activity addresses weight gain by burning more calories and helping achieve energy balance or deficit, decreasing fat around the abdomen, and increasing muscle mass and thus the amount of energy required to perform daily functions [56].

Previous research has identified common motivations for college student's physical activity behavior. The most common motivations for exercise among one study were "general health," "maintain fitness," "stress reduction," "enjoyment pleasure," and "feel good/better" [17]. Another study reported that there were gender differences in motivations for exercise participation as well as sports participation [15]. The top three motives for men for exercise were strength and endurance, positive health, and appearance. For women, they were positive health, weight management, and appearance. Weight management was notable due to it being much lower in rankings in men, possibly indicating a gender difference.

Ebben and colleagues identified time as the number one barrier to physical activity participation in college students [17] and may be related to the third most common response of "other priorities" for a lack of physical activity. Based on the results of this qualitative study, it does appear that many students do not feel they can or want to commit to being physically active. The second most common response was "laziness". This may also be related to "no motivation" and "no energy/tired" responses that also ranked high [17]. Both genders specified motivation, social support, and the accessibility of on-campus options enabling exercise and a lack of time due to the strains of college life as deterring exercise. Men also discussed lack of motivation as

being a barrier to physical activity, whereas women discussed some aspects of the fitness center (too crowded, cost of exercise classes, feeling uncomfortable, etc.) that were specific barriers for them [16]. Another qualitative study that listed the barriers related to physical activity included: undesirable experiences in campus recreation facilities; weather; lack of time, lack of motivation, and social support for exercise [57].

Nutrition

Suggested eating habits for weight management from experts' center around a balanced diet of whole grains, fruits, vegetables, lean protein, low-fat and fat-free dairy products, and drinking water [20]. Recommended servings sizes for most adults include nine servings of grains, four servings of vegetables, three servings of fruits, two-three servings of dairy, and two servings of protein (meat, fish, beans, etc.) [21]. Specific issues that may be tied to freshman weight gain include fruit and vegetable consumption, junk, and fried food, dining halls, cooking and meal prep, and skipping breakfast.

Most college students do not consume adequate amounts of fruits and vegetables, with one study reporting that only 3.6% of undergraduate students ate the minimum number of recommended fruits and vegetables of five servings a day and 74.1% percent of these students ate two or fewer servings of fruits and vegetables each day [1]. This is concerning not only due to malnutrition but there also appears to be a link between fruit and vegetable consumption and weight status [59-61]. According to the CDC (Centers for Disease Control and Prevention), fruit and vegetable consumption serves as a good substitute for high energy density foods associated with weight gain. Fruits and vegetables are often high in fiber and water content thus being lower energy density than other options [62].

Cooking meals and meal preparation habits among college students are correlated with fruit and vegetable consumption as well as weight status. Among first-year students, cooking

frequency of four-seven times per week, self-instruction for the intention of healthful mealtime behavior, and self-regulation for healthful mealtime behavior were associated with fruit and vegetable intake, while cooking mostly convenient and ready-made meals were negatively associated with lower fruit and vegetable consumption [63]. Cooking from basic ingredients and self-regulation for healthful mealtime behavior were significantly associated with BMI. Furthermore, a lack of cooking and eating in all-you-can-eat dining halls contributes to weight status. Many colleges have all-you-can-eat dining halls that are full of foods that can easily contribute to weight gain such as pizza, pasta, fries, soda, etc. One study even estimated that eating in all-you-can-eat dining halls accounted for 20% of the variance of weight gain [58].

College students currently are consuming a high amount of junk (high-fat cookies, cakes, chips, and ice cream), fried, and fast food. One study found that snacking and eating high-fat junk food accounted for 20% of the variance of freshman weight gain [58]. A further study reported that a third of college students ate junk food once per day and two-thirds ate junk food one-six times per week [14].

Skipping breakfast is a common eating behavior among college students and studies show that breakfast is often the meal most skipped by college students [64, 65]. Previous research suggests there may be a correlation between skipping breakfast and weight gain. One study showed that skipping breakfast predicted weight gain among a sample of adolescents transitioning into early adulthood [65]. Another study showed consumption of breakfast may contribute to the prevention of weight gain when compared with missing breakfast among middle-aged and older men [66].

A better understanding of why college students make food choices is needed on the part of health professionals and can be useful for this intervention. Data from one study conducted among 319 students show that convenience appears to be the most important food motivation

followed by price, pleasure, health, and concern about weight [67]. Among 471 college students, lack of time was reported as the largest barrier to eating healthy [64]. The second most common barrier was a lack of money and the third most common was taste preference. The lack of time factor identified in this study may correspond to convenience being the largest motivator when it comes to college student's dietary habits [67]. Another qualitative study reported determinates that impact eating habits such as unhealthy food availability on campus, snacking, late-night eating, alcohol-related eating, stress, and boredom eating, and dorm-related living circumstances [58]. Some studies demonstrated differences between genders when making food choices. One demonstrated that in men, inconsistency in eating competence and cognitive restraint scores added to the difference between high and low health risk clusters, whereas for women, emotional eating and uncontrolled eating scores contributed to health risk classification [49]. A further qualitative study identified a unique batch of environmental, motivational, and self-regulatory determinants distinctively applicable to college students [16]. Eating habits were affected by environmental factors such as perceived lack of healthy options, meal plans, and the hectic nature of a college campus accounting for a lack of time impacted both genders. Males reported all-you-can-eat facilities as hindering and females reported the preparation of food on campus and lack of areas for cooking in dorms as hindering. Females appeared to have a higher desire to eat healthy when compared to males. It also appeared that females were more impacted by social support and parental values when compared to males. Collectively, these gender differences may suggest that an individualized approach may prove effective when discussing behavior change related to nutritional intake.

Alcohol

Alcohol consumption among college students increases compared to high school and is associated with weight gain. Alcohol has about 7.1 kcal per gram. While light to moderate

(typically defined as 1.2 - 2.2 drinks per day) drinking showed limited weight status effects, heavy drinking (typically defined as 3.5 drinks or more per day) does appear to correlate with higher weight gain [23, 24]. According to the latest national college health assessment, 38.1% of students reporting having five drinks or more during their last party, while 17.6% of these students reported having seven or more drinks, and 26.7% of respondents reported having six or more drinks in one sitting during the last two weeks on at least one occasion [1].

Mental Health

One mental health factor that has been linked with obesity is stress. Stress triggers the secretion of glucocorticoids, which increases the desire for food and insulin, and typically increases food intake as well as obesity risk [27]. This is concerning due to 45.3% of students felt that they experienced "more than average stress" over the last 12 months while 13.4% felt they experienced "tremendous stress" according to the National College Health Survey [1].

Anxiety and depression are also linked with weight status. According to a meta-analysis and systematic review, depression has a reciprocal relationship with overweight and obesity [28]. While difficult to understand which one causes the other, it appears that addressing one symptom may have a positive impact on the other. An additional meta-analysis and systematic review showed moderate evidence for a relationship between anxiety disorders and obesity, although causal claims could not be created from the data [29].

According to the latest national survey, 20% of students were diagnosed or treated for depression in the last 12 months [1]. Approximately 25.5% of students say they felt too depressed to function at least once in the last 30 days from the same survey. This is coupled with troubling statistics regarding anxiety, showing 24.3% of students reporting treatment or were diagnosed with anxiety in the last 12 months [1]. The same survey detailed that 43.6% of students say they felt "overwhelming anxiety" at least once in the last two weeks.

Sleep

There has been a consistent base of literature linking sleep and weight-related factors. A meta-analysis found that there was an increased risk of obesity in short sleepers among a diverse population of adults. There was also a consistent finding throughout all adult studies that showed a significant negative association with hours of sleep and BMI [26].

A survey study conducted on over 1000 college students concluded that 60% of students are categorized as poor sleepers, and this led to higher reported physical and psychological problems [25]. According to the latest national survey, 46.3% of students only reported getting enough sleep on two days or less per week and 45.6% reported that sleepiness during the daytime was at least more than a little problem [1].

Literature Base of Interventions among College Students

Although obesity among college students is consistently high, research utilizing interventions to reduce obesity in college students is lacking. Currently, interventions targeted at college students are primarily focused on physical activity increases or nutritional corrections. A systematic review and meta-analysis were conducted and demonstrated many notable findings in this area [30]. While 34 of the 41 studies included provided significant improvements in at least one outcome, the overall base of literature has not demonstrated adequate success. Regarding physical activity, the meta-analysis showed no significant changes in total and vigorous physical activity compared to the control groups. While there were significant changes in moderate physical activity, the effect was small, SMD (standardized mean difference) = 0.18. Half of the interventions including nutritional outcomes showed significance, mostly centering on fruit and vegetable consumption. Finally, only 3 of 11 interventions demonstrated significant changes in weight-related outcomes. It is important to mention only half of the total reviewed interventions

were RCTs and relied heavily on self-report for physical activity in addition to BMI and weight for anthropometric outcomes. These gaps in the literature highlight the need for robust and impactful studies to further advance behavioral adherence related to weight gain.

Motivational Interviewing

Motivational interviewing emerged in the early 1980s as a communication method for helping patients overcome addiction [68] but has since the early 1990s, rapidly extended to various health behaviors. Despite its relatively short lifespan, motivational interviewing has demonstrated potential in numerous health behavior change interventions including physical activity and nutrition [33]. Motivational interviewing is defined as an empathic, client-centered communication method. The "spirit" of motivational interviewing is at the heart of these qualities and can be described as evoking the subject's motivations and solutions, the act of resolving ambivalence as the client's responsibility, avoiding persuasion, communicating in a nonaggressive style, understanding that readiness to change is not a client trait but rather an everchanging product built from the communication, and the relationship between expert and client are one of equal standing. These factors represent the spirit of motivational interviewing, which is vital to maintain alongside the use of motivational interviewing skills [69].

Among college students, motivational interviewing has primarily been implemented to address excessive alcohol consumption [70-73]. Several studies showed improvement in drinking behaviors (reductions drinks per week, binge drinking), demonstrating potential among this demographic. Few studies have delved into motivational interviewing for weight-related outcomes among college students. To our knowledge, there is not an RCT that examines the impact of motivational interviewing on objective body composition measures. We have only located two interventions focused on physical activity and nutrition-based motivational interviewing among college students. A previous RCT implemented motivational interviewing

among 70 college students (mostly African American women) and detailed changes in self-reported moderate/vigorous physical activity [74]. The intervention group included one, 30minute motivational interviewing session with a 1-month follow-up. There were approximately 1-day increases in the number of 20+ minute vigorous-intensity physical activity days and the number of 30+ minute moderate-intensity physical activity days (p = .04). There were no significant differences in minutes of vigorous activity minutes per week. An additional RCT examined the impact of brief motivational interviewing intervention via phone call and its effects on self-reported physical activity after eight weeks among 40 college students with almost half being minority [75]. The intervention group received three motivational interviewing-based phone calls, as well as personal feedback regarding current exercise behavior. The control group received the exercise education information. This study demonstrated non-significant findings in moderate and vigorous physical activity and non-significant findings regarding various nutritional measures (fruits & vegetables, sugary drinks, and fast-food visits). While generalizations cannot be made about these interventions, potential areas for improvement exist. One large limitation of these two interventions is the reliance on self-reported physical activity in which social desirability bias is a large concern [31]. For the proposed intervention, utilizing accelerometers for physical activity and the iDexa scan as well as the InBody for body composition will provide more objective results than previous studies relying on older technology and self-reported measurements [76-79]. It is also evident that neither study investigated anthropometric changes or changes in obesity status. Future interventions may also benefit from a larger time span and a higher dose of motivational interviewing as the average time span of these two interventions was about six weeks.

Self-Determination Theory Literature

The SDT is a macro theory focused on determining the type of motivation, rather than simply assigning an amount of motivation [80]. The SDT addresses the social environment, specifically environments that bolster or inhibit motivation, and has identified the three psychological needs of autonomy, relatedness, and competence that are integral to self-determined action [39]. SDT also suggests there is a continuum of motivation types [38]. This continuum moves left to right, spanning from amotivation to internal motivation with external, introjected, identified, and integrated between representing various levels of internalization between these extremes [39].

SDT has been applied to physical activity and nutrition adherence. Results from a systematic review identified that more autonomous forms of motivation were related to exercise adherence, as well as competence and intrinsic motivation predicting exercise participation [81]. Less research on SDT exists regarding eating habits, although the research appears promising. One study showed self-determination and more autonomous exercise motivation predicted eating self-regulation over 12 months and mediated the relationship between physical activity and eating self-regulation [82].

Collaboration of SDT and Motivational Interviewing

There have been multiple calls for more information on the relationship between SDT and motivational interviewing from experts in both fields [41-44]. While this collaboration between SDT and motivational interviewing appears promising, few studies have explored this relationship in the realm of physical activity and nutrition. One study stated that the SDT informed their use of motivational interviewing [83]. This intervention implemented motivational interviewing sessions in addition to a standard weight loss program compared to a group receiving only the standard weight loss program among 50 adolescents. The standard

weight loss program was delivered by a medical doctor with expertise in obesity and consisted of behavioral therapy including information about exercise behavior, goal setting, self-regulation skills, and feedback regarding personal behavior. The motivational interviewing group had a BMI decrease and increases in energy expenditure as well as physical activity time when compared to the control. There was also greater perceived autonomy support from medical staff at the end of the program, a greater increase in integrated and identified regulations and a stronger decrease in amotivation for the motivational interviewing group compared to the control. Others have created a new intervention method by combining aspects of motivational interviewing and the SDT called IMove in a web-based physical activity promotion and compared it to a traditional physical activity promotion called Active Plus among over 4,000 adults [84]. IMove was based on text-based sessions that followed the principles of motivational interviewing such as asking evocative open-ended questions that produced self-determined behavior change. Active plus was a web-based program providing messages regarding correct behaviors, discussions of pros and cons, and inviting the participant to monitor the behavior and formulate action. IMove was more of an eliciting interaction whereas Active Plus was more of a directive interaction. At 12 months from baseline, IMove was found to be effective in increasing weekly minutes of moderate to vigorous physical activity while Active Plus was not. Active Plus was found to be effective in increasing weekly days with ≥ 30 min PA at 12 months, while IMove was not. These interventions, while very different from one another, demonstrate potential in collaboration between motivational interviewing and SDT, however, more research is needed.

Summary of the Literature

College students face many issues that are related to negative changes in anthropometric status. A lack of physical activity and healthy eating habits are linked with obesity prevalence.

Further determinants such as time, motivation and support, access to opportunities for physical activity, and healthy eating opportunities, among other factors are key in adherence to physical activity and healthy eating habits. While nutrition and physical activity habits appear to be the most directly related, other issues such as mental health and sleep are also important to address and appear to contribute to weight status in college students. Barriers to physical activity and healthy food consumption appear to be mainly anchored by time. College students feel they lack adequate time to engage in adequate, consistent health behavior. Other barriers exist, but with time being so recurrent, focusing on time-conscious solutions may prove beneficial. It is also important to keep in mind the gender differences for various determinants indicating an opportunity for tailored interventions.

Adherence to healthy behaviors can be difficult to achieve and health professionals have conducted numerous interventions to address adherence. There are numerous literature bases to keep in mind that all lend themselves to the creation of this intervention. These literature bases include interventions addressing physical activity/nutrition/weight among college students, motivational interviewing, SDT, and interventions utilizing both motivational interviewing and SDT. The literature base of all interventions targeted at college students to address weight focuses on physical activity, anthropometric status, and/or nutrition habits, however, interventions lack rigor and objective measures of body composition and physical activity. Both motivational interviewing and SDT have demonstrated success in various aspects of physical activity and nutrition, however, college students, have not been a focus of these interventions. Therefore, the purpose of this intervention is to examine the impact of a motivational interviewing intervention on overweight and obese college students' body composition and SDT constructs.

III. METHODS

Human Subjects Approval

To begin recruitment for this intervention a full-board research protocol review form was submitted to the Auburn University Institutional Review Board for Research Involving Human Subjects (IRB). This randomized controlled trial (RCT) was approved by the University Institutional Review Board (IRB) for Research Involving Human Subjects and followed the standards set by the Declaration of Helsinki. The registered clinical trial number is NCT04130386. Each participant read and signed a written informed consent and completed the Physical Activity Readiness Questionnaire (PAR-Q). Participants had to answer "no" to all questions on the PAR-Q to participate in the intervention.

Participants and Setting

From January 6th to January 24, 2020, Auburn University students were recruited from the campus via flyers, email blasts, and social media (Appendix B). Participants who met the following inclusion criteria were enrolled in the study: classified as a college student, low risk for medical complications from exercise (as determined by physical activity readiness questionnaire - PARQ), not consistently exercising over the last three months (two days per week or less), be considered overweight based on BMI (BMI at or above 25), and not pregnant via self-report. All participants who met the inclusion criteria completed the informed consent process.

According to a power analysis, with a power of .8, an alpha of .05, and the effect size (.51) from a meta-analysis of motivational interviewing for weight loss among adults [34], the suggested sample size for 90% effectiveness was 68 [85]. This intervention planned to recruit and screen 80 participants. This allowed room for the expected 5-15% attrition rate commonly found within the literature. The maximum number of participants allowed for screening was 80, due to the availability of personnel. It is important to note that this calculation was based on an

effect size from a meta-analysis among adult's ages ranging from 41 to 62 years and there were only 12 studies included.

Recruitment and Retention

College students were contacted through campus email, flyers in numerous departments, social media blasts, word of mouth, and campus newspaper advertisement. Attrition presented a concern for this intervention due to the specific classification of students needed to address our hypothesis. As a proactive approach, incentives were provided for participation in this study. We provided gift cards to all participants who attended post-testing. The original plan before the pandemic was to raffle four $25 gift cards at pre-testing (week 0), week one intervention, week four intervention, week seven intervention, week 10 post-testing, week 11 accelerometer drop off, and qualitative interview. In total, $550 worth of gift cards were rewarded to the 22 participants who completed the study. These incentives were utilized to encourage participation from various backgrounds, especially students who may not be initially intrigued by a weight management study.

Procedures

Participants who qualified for the study and completed the informed consent process were randomized to either the motivational interviewing group or the electronic education group. The intervention group received three in-person MI sessions and three video chat MI sessions all lasting 30 minutes over six months. Three video chat sessions were added as the study setting transitioned to COVID-19 restrictions and the participants could not return to campus for in-person encounters or post-testing. The MI sessions were conducted by a trained exercise physiologist. Sessions were rooted in the spirit of MI approach with a focus on eliciting change talk and goal setting for weight management behaviors while remaining person-centered [32].

Topics ranged from physical activity, nutrition, stress management, alcohol consumption, and sleep. It is important to note that since the sessions were person-centered, the interviews revolved around the subject's concerns, motivations, life routine, and goals. **Table 2** lists several motivational interviewing skills and examples of how each can be utilized.

Table 2. Motivational Interviewing Skills and Examples

Motivational Interviewing Skill	Example
Express Empathy	I'm sorry to hear you lost a loved one recently. It sounds like that has been a burden on you lately and has been impacting your eating.
Agenda Setting	Two areas that I can help you today are with your eating habits and physical activity, which would you like to discuss first?
Developing Discrepancy	So, on one hand, your current exercise habits are supporting your goal of weight loss, but your current eating habits are interfering with that goal?
Assessing Readiness	On a scale of 1 to 10, with 1 being not confident at all and 10 being extremely confident, how would you rate your likeliness to adherence to your goal of exercising after your morning classes for 30 minutes?
Evoking Change Talk	Imagine being consistent with your eating, sleeping, and physical activity goals for the next few months. What benefits do you see and how does that make you feel?
Asking Open-Ended Questions	Before we move on to talking about alcohol consumption, what additional questions do you have for me about stress management?
Rolling with Resistance	It is your decision on whether you increase your vegetable consumption or not. You have full control over that. In the future, if you have any additional questions or concerns about this, I am always available to talk.
Supporting Self-Efficacy	That is great you increased your steps over the weekend!

Establishing Risk/Susceptibility	Tell me what your current weight puts you at risk for?
Asking permission to give information	May I share with you want concerns me about your current sleep schedule?
Incremental Change	In what ways could you make small changes to your late-night snacking habits?

The control group consisted of monthly education materials sent via email for six months. Topics covered in the first three months included: physical activity, nutrition, stress management, managing alcohol intake, and time management. After the onset of restrictions related to the COVID-19 pandemic (final three months), educational material centered on various forms of physical activity that could be performed at home.

COVID-19 heavily impacted this intervention. Details regarding the intervention timeline before quarantine restrictions can be found in **Table 3**. Details regarding the intervention timeline after quarantine restrictions, which represents our actual intervention structure can be found in **Table 4**.

Intervention Timeline

Table 3. Pre-Quarantine Intervention Timeline

Pre-Quarantine	**Motivational Interviewing Group**		**Electronic Education**	
	Action	**Duration and Delivery**	**Action**	**Duration and Delivery**

Week 0	Pre-Testing BREQ-3, BPNES, ROPAS, DEXA, WC, Wt, Accel, 3-day food record.	60 minutes Tiger Fit Lab	Pre-Testing BREQ-3, BPNES, ROPAS, DEXA, WC, Wt, Accel, 3-day food record.	60 minutes Tiger Fit Lab
Week 1	Motivational Interview/ Accelerometer Drop Off	30 minutes KINE 149	Physical Activity Education/ Accelerometer Drop Off	15 minutes Email
Week 4	Motivational Interview	30 minutes KINE 149	Nutrition Education	15 minutes Email
Week 7	Motivational Interview	30 minutes KINE 149	Alcohol/Mental Health/Sleep Education	15 minutes Email
Week 10	Post-Testing BREQ-3, BPNES, ROPAS, DEXA,, WC, Wt, Accel, 3-day food record.	60 minutes Tiger fit Lab	Post-Testing BREQ-3, BPNES, ROPAS, DEXA, WC, Wt, Accel, 3-day food record.	60 minutes Tiger fit Lab
Week 11	Accelerometer Drop Off/Qual Int	20 minutes KINE 149	Accelerometer Drop Off/Qual Int	20 minutes KINE 149

Table 4. Pre-Quarantine Intervention Timeline

Post-Quarantine	Motivational Interviewing Group		Electronic Education	
	Action	Duration and Delivery	Action	Duration and Delivery
Week 0	Pre-Testing BREQ-3, BPNES, ROPAS, DEXA, Wt	60 minutes Tiger Fit Lab	Pre-Testing BREQ-3, BPNES, ROPAS, DEXA, Wt	60 minutes Tiger Fit Lab
Week 1	Motivational Interview/ Accelerometer Drop Off	30 minutes KINE 149	Physical Activity Education/ Accelerometer Drop Off	15 minutes Email
Week 4	Motivational Interview	30 minutes KINE 149	Nutrition Education	15 minutes Email
Week 7	Motivational Interview	30 minutes KINE 149	Alcohol/Mental Health/Sleep Education	15 minutes Email
Week 11	Motivational Interview	30 minutes Zoom	Home Based Exercise Education	15 minutes Email

Week 15	**Motivational Interview**	**30 minutes Zoom**	**Home Based Exercise Education**	**15 minutes Email**
Week 19	**Motivational Interview**	**30 minutes Zoom**	**Home Based Exercise Education**	**15 minutes Email**
Week 24	**Post-Testing BREQ-3, BPNES, ROPAS, DEXA, Wt, Qual Int**	**60 minutes Tiger fit Lab**	**Post-Testing BREQ-3, BPNES, ROPAS, DEXA, Wt, Qual Int**	**60 minutes Tiger fit Lab**

Interventionist Training

Training is a necessary component of maintaining the spirit of motivational interviewing. Those delivering motivational interviewing were trained by a doctoral level, behavior scientist who has an extensive background with motivational interviewing, having trained health care providers across professions, health professions students, and interventionists for over two decades, as well as conducting multiple systematic reviews of motivational interviewing as an intervention strategy impacting outcomes [86-88]. Matching standards from within these reviews, and those espoused by MI originator William Miller and other MI training scholars, the training took place with the equivalence of two-day workshop over time, and included interactive conceptual overview with real play practice, watching and critiquing motivational interviewing videotape examples, role-playing in simulated motivational interviewing sessions

with MI-expert facilitation and coaching/feedback, and group-based feedback provision among peers during role play.

Fidelity

The fidelity of the intervention, i.e. the consistency or adherence of the interaction to motivational interviewing principles and concepts, was determined by analysis of audio recordings of a session every month. Recorded sessions were transcribed and analyzed using the validated Motivational Interviewing Skills in Health Care Encounters (MISHCE) [89]. Coding was completed by an experienced motivational interviewing expert who was also familiar with the scoring technique. The MISHCE is a rubric with four weighted domains including motivational interviewing philosophy, health interviewing/eliciting patient perspective, change talk elicitation, and interpersonal process. In addition, during the first month of interviews, feedback and coaching were provided after session evaluations for potential corrections and suggestions for future sessions. This added another layer of support for the interviewers. In addition, this intervention established an open line of communication so that those who deliver the intervention could share experiences and challenges.

Anthropometric Measures

Height was measured to the nearest 0.25 cm, and weight was assessed using a stadiometer (SECA Model 769, Seca gmbh & Co.kg., Hamburg, Germany) to the nearest 0.1 kg. Waist circumference (WC) was measured at the top of the right iliac crest and placing a Gulick tension rod measuring tape in a horizontal plane around the abdomen and level of the iliac crest. Before reading the tape measure we ensured that the tape was snug but did not compress the skin and was parallel to the floor [90]. Weight and WC are the most common anthropometric measures collected in the literature of interventions among college students [30], motivational interviewing [34], and the self-determination theory [91] and were therefore included.

Body Composition

The iDexa measures body composition and bone density by dual-energy X-ray absorptiometry which provides accurate data related to body composition in terms of BMI, body fat, lean mass, bone mineral density, and exact data from sections of the body if necessary [76, 77].

Specifically, variables of interest for this study include lean mass (lbs), fat mass (lbs), and bone mineral density (g/cm^2). iDexa measures the diffusion of X-rays through the body at high and low energies. The X-ray beam energy is diminished with the passage through the three human body components that are distinguishable by their X-ray attenuation properties: bone mineral, fat tissue, and lean soft tissue [92]. Participants arrived in a fasting state (no food for eight hours) and were asked to lie flat face-up on the iDexa table within the scanning area. The arm of the scanner passed over the individual to assess body composition and bone density. The scan took approximately 7-13 minutes depending on the size of the individual. According to previous studies the precision error for total body mass is 0.9%, total body lean mass 0.4 to 0.5%, total bone mineral content 0.6%, fat mass 0.7 to 0.8%, and percent body fat 0.6 to 0.9% [93-95]. All iDexa measurements were carried out by certified and trained personnel.

Bio-Electrical Impedance Analysis (BIA) was used to measure hydration levels and body composition. Specifically, hydration level percentage and body fat percentage were variables of interest. BIA is a non-invasive measure that determines the flow of an electrical current in the body. Research has shown that the InBody has 99% accuracy when compared to the iDexa among adults [78]. The InBody has also demonstrated accuracy when measuring hydration levels, regardless of body size [79]. The device measures how this signal is impeded through different types of tissue. Tissues that contain large amounts of fluid and electrolytes, such as

blood, have high conductivity, but fat and bone slow the signal down. As BIA determines the resistance to flow of the current as it passes through the body, it provides estimates of body water from which body fat is calculated using selected equations. The InBody BIA provides four contact points (two upper body with the hands and two lower body with the feet) to measure body composition. Participants removed shoes, socks, and outer clothing before the measurement. The participant stood on the scale while holding the handles and with the feet on the sensor for approximately 30 seconds. All measurements were carried out by certified and trained personnel.

Physical Activity

Data on physical activity had to be dropped from statistical analysis in this intervention due to complications from COVID-19 impacting post-testing data collection. The following information represents our plan before COVID-19 and represents how we collected data for pre-testing. An accelerometer measured physical activity changes from pretest to posttest. An accelerometer is a small device (1" by 1.5") validated to record activity counts and step counts. The number of counts accumulated over a minute is used to determine sedentary, light, moderate, or vigorous activity based on previously validated cut-off values. For this study, an accelerometer was worn on the hip over seven days at baseline (week 0-1) and post-testing (week 10-11) for seven days. An accelerometer log was given to the participants to record wear times. Based on previous studies [96, 97] an epoch length of 60 seconds was chosen as the standard for the current study with a sampling rate of 30 Hz. Additional criteria for analysis included a minimum of 10-hour daily wear time and three-five days of monitoring. A minimum of 10 hours per day of wear time was needed for sampling wake-time behavior with three-five days of monitoring required to achieve 80% reliability for total and moderate-to-vigorous intensity

physical activity [98-100]. Non-wear time was identified based on the algorithm from Choi et al. (2011) and removed from the analysis [101]. After each assessment, accelerometers were collected, and the data was downloaded to the Actigraph Actilife software. Previously validated cut points classified accelerometer data as sedentary (<100 counts/minute), light (100-2019 counts/minute), moderate (2020-5998 counts/minute), and vigorous (≥5999 counts/minute. Based on these cut points, data were divided into four activity categories: sedentary, light, moderate, and vigorous.

Nutrition

Data on nutrition had to be dropped from statistical analysis in this intervention due to complications from COVID-19 impacting post-testing data collection. The following information represents our plan before COVID-19 and represents how we collected data for pre-testing. A three-day dietary diary was given to the participants to determine nutrition over two weekdays and one weekend day. The three-day dietary diary has been validated with the correlations between the methods for most foods and nutrients are in the range of 0.4 to 0.7 [102]. Participants were asked to record all food and beverages consumed and approximate the amount consumed. The two variables of concern were fruit and vegetable consumption and total calorie consumption; both of which were calculated from the food logs.

SDT Constructs

Questionnaires were given to subjects measuring various SDT constructs regarding physical activity. These questionnaires can all be found within the attached IRB in Appendix C2-C4. Questions regarding demographics, income, living status, and contact information resided in the base questionnaire Appendix C.6. Numerous SDT constructs were measured before and after

the intervention to detail changes. These constructs included behavioral regulation, autonomy, relatedness, and competence.

The BREQ-3 was used to detail where participants fall on the continuum of behavioral regulation regarding physical activity. This version newly added both introjected regulation and amotivation [103, 104]. There are 24 questions, with four questions being a part of each subscale (amotivation, external, introjected, identified, integrated, and intrinsic). Previous researchers have identified psychometrics of the questionnaire and showed that the hypothesized five-factor model did not differ significantly from the data (Satorra-Bentler χ^2 = 136.49 [125], p = .23). The other fit indices also indicated an excellent fit (RMSEA = .02, 90% CI = .00–.04; CFI = .95; NNFI = .94; SRMR = .05). Standardized factor loadings were all significant and moderate to strong (M = .76; range .53–.90; p's < .001 Cronbach's alpha reliability coefficients were reported as .86 for intrinsic, .73 for identified, .80 for introjected, .79 for external, and .83 for amotivation. Wilson et al., added integration to the BREQ in a later study and found that internal consistency reliability estimates ranged from .83 to .96 [104]. Reliability estimates ranged from .78 to .93 [104].

The BPNES was utilized to measure autonomy, competence, and relatedness regarding physical activity [105]. The basic psychological needs are an integral part of the self-determination theory and this scale focuses on whether these needs are satisfied in exercise. This scale has 12 items with four items being assigned to each need. BPNES scale scores have been validated among an adult population and Cronbach's alpha was reported as .84 for Autonomy, .81 for Competence, and .92 for Relatedness. Factor loadings ranged from .60 to .86 for Autonomy, from .59 to .78 for Competence, and from .80 to .91 for Relatedness.

ROPAS was utilized to measure the psychological need of relatedness specifically focusing on physical activity [106]. While the BPNES scale also measures relatedness, it focuses

on structured exercise exclusively and whom the participant exercise with; however, relatedness experienced in exercise may be served in other ways. For example, the ROPAS scale inquires "I am supported by others in this activity" and "I have a close bond with others". These questions do not rely on an exercise partner as relatedness can be fulfilled by those not physically exercising with the participant. The ROPAS scale used in this intervention contains 6-items, all gauging relatedness regarding physical activity. Internal consistency reliability values from previous studies ranged from 0.70 to 0.97 [106].

HCCQ was utilized post study among the intervention group to assess the extent the interviewer provides an autonomy supportive climate. While typically used for health care research, it has been used in non-health care interventions [91] including weight management [107, 108]. While demonstrating an increase in autonomy among the participants is useful, this scale provides more information on the motivational interview sessions and the interviewer, and its impact on the participant's perception. This scale has 15 items, all rating the perceived autonomy support of the motivational interview sessions and interviewer. HCCQ scores showed excellent internal consistency ($\alpha = .91$), and construct validity (92.31% of hypothesized correlations with other measures confirmed). Acceptable 3-month test–retest reliability was observed ($r = .55$, $p < .001$; intraclass correlation coefficient (A,
1) = .54, $p < .001$) [109].

Qualitative Interview

After the study's conclusion, qualitative interviewing was conducted among the motivational interviewing group and the electronic education group to better understand their experiences. The semi-structured interviews followed a script that can be found within the attached IRB in Appendix C.10. The interviews were conducted one-on-one, were audio recording, transcribed, and analyzed using interpretive phenomenological analysis (IPA).

Statistical analysis

Mixed ANOVAs were implemented to detect the differences between the intervention and control groups regarding physiological, psychological, physical activity, and nutritional measures from pre- to post-intervention (SPSS v25) [110]. $p < 0.05$ was considered as significant.

IPA was utilized as a methodology to examine how the participants made sense of their experiences within this weight management intervention, as most of it took place during the COVID-19 pandemic [111]. Previous interventions have utilized this method to better understand exercise habits [112, 113]. To achieve this, transcripts were read multiple times, coded line-by-line for significant findings on one margin, then once again for emerging themes on the opposite margin. A summary table was then written for each participant to compare across all participants for themes. Finally, a master table was created with all major themes. A discussion between co-authors took place to examine the data alongside transcripts to further hone the themes.

Impact of COVID-19

Due to restrictions put forth due to the COVID-19 pandemic, many of the methods for our original plan had to be altered to adapt to restrictions created by the pandemic. COVID-19 shut down Auburn's campus beginning on March 16, 2020. This impacted numerous aspects of the study and created a need to extend the study. The campus was still shut down during the targeted end date for the original study (April), and post-testing data collection could not occur. Therefore, we extended the study throughout the summer and collected data in August. This brought about many unforeseen challenges that resulted in several changes, including the need for an updated IRB protocol which can be found in Appendix A**.** These changes are reflected in chapter four of the manuscript and are highlighted below:

- Study duration extended.

- Increased dosage for both interventions.
- Delivery of motivational interviewing via zoom after COVID-19.
- Updated informed consent.
- Dropping accelerometer and food intake data.
- Incentive structure change.
- Qualitative questions change.

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V. RESULTS

Physiological and Psychological outcomes of Motivational Interviewing for Weight Management among College Students during COVID-19: A Randomized Controlled Trial

Keywords: Motivational Interviewing; Obesity; Covid-19; College Students; Body Composition

Introduction

Obesity is a consistent health concern among college students in the United States. According to the most recent national survey, 38.7% of undergraduates are overweight or obese according to self-reported height and weight [1]. Furthermore, comparing data from 2003–2004 and 2013–2014, shows childhood obesity rates remained stable (17.1% to 18.5%), while adults showed an increasing trend (32.2% to 39.6%) [2]. Unfortunately, it is likely obesogenic behaviors have been exacerbated during COVID-19 quarantine restrictions resulting in decreases in physical activity and increases in weight [3, 4]. This is concerning as obesity is associated with an increased risk for cardiovascular disease and diabetes, which are two of the leading causes of death in the United States [5]. Since almost two-thirds of adults attend college by age 30 in the United States [6], college campuses may be an ideal setting for obesity prevention interventions.

Prior to the pandemic, previous literature has pointed to mixed results for weight management interventions among college students. A systematic review and meta-analysis showed that while 34 of the 41 retained studies reported significant improvements in at least one outcome, the overall base of literature has not demonstrated adequate success [7]. For the physical activity outcomes in the meta-analysis retained studies, no significant changes in total and vigorous physical activity were reported in intervention groups compared to control groups.

While there were significant changes in moderate physical activity, the effect was small (SMD = 0.18). Half of the retained study interventions that included nutritional outcomes showed statistical significance, with most centering on fruit and vegetable consumption. Finally, only 3 of 11 interventions demonstrated statistically significant changes in weight-related outcomes. It is important to mention that only half of the total reviewed interventions were RCTs, and studies relied on weight and BMI for anthropometric status rather than body composition measures. These gaps in the literature highlight the need for robust and impactful studies to further advance behavioral adherence related to weight gain.

Motivational interviewing (MI) is an empathetic and person-centered communication approach [8] that has demonstrated success in increasing adherence to various health behaviors [9-11], including weight management for overweight children [12], overweight adults in primary care [13] and overweight women [14]. However, there is very little research on MI-based weight management interventions in college students.

Therefore, the original objective of this study was to examine the effectiveness of MI on physiological and psychological outcomes after a 3-month long intervention. However, as the pandemic emerged across the country our study protocol was altered (extension to 6-months) and the adapted intervention offers a unique perspective into how MI can impact weight management across environments and during a pandemic that included social distancing and quarantine. When COVID-19 restrictions were enacted, most adults were confined to stay at home for varying lengths during the pandemic [15]. Universities and colleges across the country were closed or converted to online/virtual learning only, resulting in many college students losing their current homes and having to move back home to their prior living arrangements. It is unclear how this disruption may have impacted various health behaviors including those related to weight management (loss of gyms, eating arrangements, social interaction, and support, etc.).

In addition to investigating physiological impact, the second objective of this research was to explore the potential impact of MI on psychosocial factors derived from self-determination theory (SDT) related constructs. It has been theorized that MI may have a relationship with SDT by integral figures from both fields [16-18]. More specifically, Markland and colleagues [16] suggest that MI may provide an environment in which the three psychological needs of autonomy, competence, and relatedness are satisfied, and therefore, more self-determined behavior may occur. There are currently few studies that measure SDT related constructs after an MI intervention and the theory-based investigation is warranted.

Methods

This randomized controlled trial (RCT) was approved by the University Institutional Review Board for Research Involving Human Subjects (IRB) and followed the standards set by the Declaration of Helsinki; the registered clinical trial number is NCT04130386. Each participant read and signed a written informed consent and completed the Physical Activity Readiness Questionnaire (PAR-Q). Participants had to answer "no" to all questions on the PARQ to participate in the intervention.

College students were recruited by word of mouth, e-mail, flyers, and social network blast within the university community in advance with a three-week window to join the study. To be eligible for this study, participants had to be: a college student, low risk for medical complications from exercise (as determined by the PAR-Q), currently not exercising, over 25 BMI, and not pregnant.

Incentives

This intervention had an incentive plan in place to be delivered at various times during the intervention. The COVID-19 pandemic created numerous struggles and a gift card lottery

was unfeasible during the pandemic. Instead, every participant was given a $25 amazon gift card that attended post-testing after being notified of this change when the pandemic began.

Assignment

Participants who qualified for the study were randomized to either the MI group or the electronic education (control) group. The intervention group received three in-person MI sessions and three video chat MI sessions all lasting 30 minutes over six months. Three video chat sessions were added as the study setting transitioned to COVID-19 restrictions and the participants could not return to campus for in-person encounters or post-testing. The MI sessions were conducted by a trained exercise physiologist. Sessions were rooted in the spirit of MI approach with a focus on eliciting change talk and goal setting for weight management behaviors while remaining person-centered. Topics ranged from physical activity, nutrition, stress management, alcohol consumption, and sleep. It is important to note that since the sessions were person-centered, the interviews revolved around the subject's concerns, motivations, life routine, and goals.

Training and Fidelity

Because MI is complex and person-centered, adequately training the interventionist in MI and conducting intervention fidelity assessment of the intervention is standard practice [19]. The interviewer in this intervention underwent an extensive, evidence-based 16-week training with significant conceptual development before engaging in skills application exercises. The training involved learning the origins and philosophy of MI, watching and critiquing example videos, written dialog exercises, and extensive group-based role-play with MI-expert feedback, along with coaching from peers and an MI expert. Additional follow-up MI exposures were gained over the next 12 months through four supervised 4-hour experiences facilitating the role play and

feedback processes in MI training for others. Feedback was given throughout the additional follow-up.

Fidelity measures post-training and during the intervention were employed to support claims for MI-adherent implementation. To assess MI fidelity post-training, an 8-minute simulated encounter with a trained standardized patient was conducted; at the start of the study, the first five interviews were also coded, and direct feedback and coaching was then provided to the interventionist to identify strengths and areas for improvement. During the intervention, all participant encounters were audio-recorded and 30% were randomly selected (stratified to four sessions at each of the six study time points) for fidelity assessment by a MI expert experienced in using the MI Skills in Health Care Encounters (MISHCE) [20]. According to MI experts, including MI originator (Miller), achieving at least 90% MI-adherence is a key threshold to strive for in intervention studies [19].

Electronic Education Control Group

The control group consisted of monthly education materials sent via email for six months. Topics covered in the first three months included: physical activity, nutrition, stress management, managing alcohol intake, and time management. After the onset of restrictions related to the COVID-19 pandemic (final three months), educational material centered on various forms of physical activity that could be performed at home.

Physiological Measures

The iDexa was utilized to measure body composition on participants in a fasted state (no nutritional intake for the prior eight hours) by trained personnel. iDexa measures body composition and bone density by dual-energy X-ray absorptiometry which provides accurate data related to body composition in terms of BMI, body fat, lean mass, bone mineral density, and exact data from sections of the body if necessary [21, 22]. Specifically, variables of interest for

this study include lean mass (kg), fat mass (kg), and bone mineral density (g/cm^2). According to previous studies, the precision error for total body mass was 0.9%, total body lean mass was 0.4 to 0.5%, total bone mineral content was 0.6%, fat mass was 0.7 to 0.8%, and percent body fat was 0.6 to 0.9%, which are all considered to be excellent [23-25].

Psychological Measures

Questions regarding demographics resided in the base questionnaire and included race, sex as assigned at birth, and age. Psychological constructs falling under the realm of SDT included behavioral regulation, autonomy, relatedness, and competence were completed pre and post. The Behavioral Regulation Exercise Questionnaire version 3 (BREQ-3) is a 24 item 5-point Likert-type scale used to detail where participants fall on the continuum of behavioral regulation [26]. The questionnaire consists of 24 items with 4 questions for each subscale (amotivation, external, introjected, identified, integrated, and intrinsic). Previous researchers provided evidence of content and criterion validity and found strong score reliability [26-28]. In the current study, reliability scores of the scales within the BREQ-3 ranged from $\alpha = .76$ to .97.

The Basic Psychological Needs Exercise Scale (BPNES) is a 5-point Likert-type scale that measures autonomy and competence satisfied in exercise [29] scale includes 8 items, 4 each representing autonomy and competence. Previous researchers provided evidence of content and criterion validity and found strong score reliability [29, 30]. Within the current study, the reliability scores of autonomy and competence were $\alpha = .96$ and .97 respectively.

The Relatedness to Others in Physical Activity Scale (ROPAS) is a 6-point Likert-type scale that assesses the psychological need of relatedness, specifically focusing on physical activity [28]. Previous researchers provided evidence of structural and criterion validity and found strong score reliability [28]. In the present study, the reliability score for the ROPAS scale

was α = .99. While the BPNES scale also measures relatedness, it focuses on structured exercise exclusively and with whom the participant exercises; however, relatedness experienced in exercise may be served in other ways. For example, the ROPAS scale inquires "I am supported by others in this activity" and "I have a close bond with others". These questions do not rely on an exercise partner as relatedness can be fulfilled by those not physically exercising with the participant.

Data Analysis

Mixed ANOVAs assessed for statistically significant differences in variables. The mixed ANOVA allows for testing at the interaction of a between-subjects factor (MI versus control group in the present study) and a within-subjects factor (pre-and post-test in the present study). Although the sample size under analysis was smaller than is typically expected in an ANOVA design, it was still the appropriate choice as the model's statistical assumptions were met [31, 32]. G*power indicated a required sample size of 68 [33]. Probability values of $p < 0.05$ were considered significant.

Results

Participants

A total of 40 college students were randomly assigned to groups. Information describing participants can be found in **Table 1**. Demographic characteristics and BMI were not statistically significantly different at baseline between experimental conditions. See **Figure 1** for the trial flow diagram of participant recruitment, participation protocol, and attrition. Attrition was much larger than expected compared with that for weight loss-based MI interventions reported in a meta-analysis where 55% were retained at six months [13]. The larger attrition rate in this study appeared to be related to complications arising from the COVID-19 pandemic. Four of the 18

participants who had been randomized to the intervention group dropped out of the intervention before the first session of MI. Eight participants declined to sign the updated consent form with the approved extension due to the pandemic. Another six participants declined to attend the post-testing appointment. The major reasons participants gave for declining to continue with the study were issues with the extended protocol (moving/graduation, lack of time, etc.) and lack of ability to attend post-testing protocol during the pandemic. The latter reason often included participants that no longer lived in the area due to an exclusive online schedule for the fall semester. The final sample size included 12 participants in the intervention and 10 in the control group.

Body Composition

Table 2 displays mean scores for pre- and post-testing variables by treatment condition. A significant interaction was noted for fat mass $F(1, 20) = 5.52$, $p = .03$, $\eta^2 = .22$ by group by time. The MI group gained fat mass ($M = .23$ kg) compared to the much larger gain within the control group of ($M = 2.32$ kg). A significant interaction for group by time was also noted for lean mass, $F(1, 20) = 4.51$, $p < .05$, $\eta^2 = .18$. The MI group gained lean mass ($M = .37$ kg) compared to the loss of ($M = -.59$ kg) within the control group. There was no significant interaction found with bone mineral density (BMD), $F(1, 20) = 2.44$, $p = .134$, $\eta^2 = .11$. Observed power for group by time interactions ranged from .32 to .61, indicating less power than the recommended .80 in all measures of body composition.

Figure 1: A CONSORT 2010 Flow Diagram

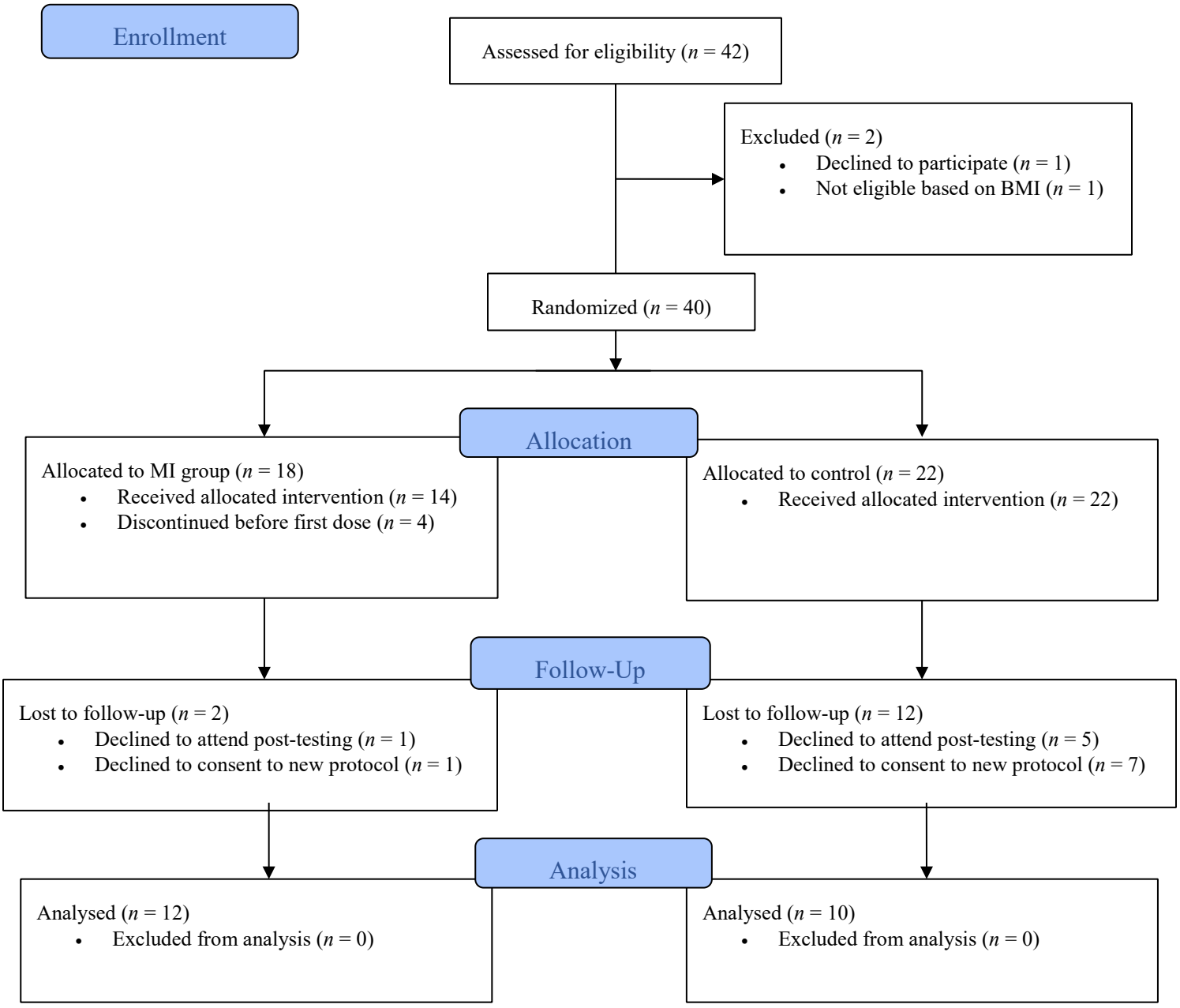
Enrollment
Assessed for eligibility (n = 42)
Excluded (n = 2)
Declined to participate (n = 1)
Not eligible based on BMI (n = 1)
Randomized (n = 40)
Allocation
Allocated to MI group (n = 18)
Received allocated intervention (n = 14)
Discontinued before first dose (n = 4)
Allocated to control (n = 22)
Received allocated intervention (n = 22)
Follow-Up
Lost to follow-up (n = 2)
Declined to attend post-testing (n = 1)
Declined to consent to new protocol (n = 1)
Lost to follow-up (n = 12)
Declined to attend post-testing (n = 5)
Declined to consent to new protocol (n = 7)
Analysis
Analysed (n = 12)
Excluded from analysis (n = 0)
Analysed (n = 10)
Excluded from analysis (n = 0)

Table 1: *Means (standard deviations) and percentages for demographic variables at baseline*

Variable	MI (n = 18)	EE (n = 22)	Total (n = 40)
Age (yrs)	20.87 (1.92)	21.24 (2.88)	21.70 (2.47)
BMI kg/m^2	30.28 (6.28)	27.92 (3.31)	28.99 (4.95)
% Female	66.7%	81.8%	75.0%
% Male	33.3%	18.2%	25.0%
% White	88.9%	77.3%	82.5%
% Black	5.6%	18.2%	12.5%
% Hispanic	5.6%	4.5%	5.0%

MI = Motivational Interviewing, EE = Electronic Education, BMI = Body Mass Index

Table 2: *Mean scores (standard deviations) by treatment condition*

Variable	**MI Pre**	**MI Post**	**EE Pre**	**EE Post**	***p***	***Effect Size*** (η_p^2)
Body Composition						
Fat Mass (kg)	28.57 (16.41)	28.80 (16.77)	25.52 (12.97)	27.84 (13.53)	0.029*	.22
Lean Mass (kg)	49.47 (8.39)	49.84 (8.29)	50.48 (11.58)	49.89 (11.35)	0.047*	.18
BMD	1.24 (.13)	1.24 (.14)	1.29 (.10)	1.28 (.10)	0.134	.11
Psychological Variables						
Autonomy	12.58 (4.64)	15.08 (3.34)	15.20 (3.12)	11.40 (3.72)	0.002*	.38
Competence	12.33 (4.19)	12.08 (3.00)	13.20 (3.26)	10.10 (3.35)	0.107	.13
Relatedness	24.42 (9.08)	26.00 (6.25)	26.30 (8.68)	20.20 (6.78)	0.001*	.41
Amotivation	-5.00 (7.82)	-2.75 (5.35)	-3.90 (5.49)	-5.40 (7.59)	0.010*	.29
External	-12.33 (8.73)	-9.83 (7.31)	-12.60 (9.57)	-16.40 (10.41)	0.023*	.23
Introjected	-9.58 (3.50)	-8.00 (5.01)	-10.60 (2.22)	-11.10 (2.23)	0.078	.15
Identified	10.42 (2.68)	12.33 (2.31)	11.00 (2.94)	10.20 (2.78)	0.017*	.25
Integrated	14.00 (7.19)	19.00 (5.49)	18.40 (6.98)	13.40 (3.13)	0.001*	.49
Intrinsic	23.50 (12.78)	30.17 (10.95)	23.40 (11.47)	17.40 (11.03)	0.014*	.27

*MI=Motivational Interviewing, EE = Electronic Education, *Denotes a significant change ($p < 0.05$).*

Psychological

Statistically significant interactions for group by time were found for several variables. A significant effect between groups was noted for autonomy, $F(1, 20) = 12.28$, $p = .002$, $\eta^2 = .38$. The MI group reported an increase in mean autonomy ($M = 2.50$) as compared to the decrease ($M = -3.80$) in the control group. A significant effect between groups was found for relatedness, $F(1, 20) = 13.77$, $p = .001$, $\eta^2 = .41$. An increase in mean relatedness ($M = 1.58$) was found in the MI group when compared to the decrease ($M = -6.10$) in the control group. A significant effect between groups was found for amotivation, $F(1, 20) = 8.22$, $p = .010$, $\eta^2 = .29$. The MI group had a decrease in mean amotivation ($M = -2.25$) compared to the decrease ($M = -.90$) in the control group. A significant effect between groups was noted for external regulation, $F(1, 20) = 6.04$, $p = .023$, $\eta^2 = .23$. There was a decrease in the MI group regarding mean external regulation ($M = 1.67$) when compared to the increase ($M = 3.00$) in the control group. A significant effect between groups was found for identified regulation, $F(1, 20) = 6.79$, $p = .017$, $\eta^2 = .25$. The MI group had an increase in mean identified regulation ($M = 1.92$) compared to the decrease ($M = .82$) in the control group. A significant effect between groups was also noted for integrated regulation, $F(1, 20) = 19.27$, $p = .001$, $\eta^2 = .49$. There was an increase for mean integrated regulation ($M = 5.00$) within the MI group compared to the decrease ($M = -5.00$) in the control group. Finally, a significant effect between groups was found for intrinsic regulation, $F(1, 20) = 7.26$, $p = .014$, $\eta^2 = .27$. The MI group had an increase ($M = 6.67$) in mean intrinsic regulation compared to the decrease ($M = -6.00$) in the control group. No significant change across groups was found for competence $F(1, 20) = 2.85$, $p = .107$, and introjected regulation $F(1, 20) = 3.45$, $p = .078$. **Table 2** provides results for all psychological variables. Observed power for group by

time for psychological variables ranged from .36 to .99, with competence, amotivation, external regulation, introjected regulation, identified regulation, and intrinsic regulation having less than .80 power.

MI Intervention Fidelity Results

For the initial fidelity assessment, the post-training fidelity assessment in the simulated encounter with a trained standardized patient, the interventionist was 97.2% MI-adherent. Fidelity results for analyses of the randomly selected study participant sessions per study time point include means per each sample of sessions 1-6, and total mean MISHCE scores of the percentage of MI-adherence. The following were the mean MI-adherence percentage scores per samples from sessions 1-6: Session 1 = 93.65%, Session 2 = 92.63%, Session 3 = 93.95%, Session 4 = 94.83%, Session 5 = 96.43%, Session 6 = 94.84%. The total mean fidelity across all sessions evaluated was 94.33%, which is 4.33% above the previously noted 90% threshold established by MI assessment scholars [19]. None of the sessions exhibited MI-adherence below 90%, with 91.0% being the lowest individual score and 97.2% being the highest.

Discussion

The purpose of this study was to determine the effect of a MI intervention on body composition and SDT variables in overweight/obese college students. As most of this study occurred during the COVID-19 pandemic, this study offers insight into how MI effects are sustainable in varying environments and delivery modes.

When looking at the literature for weight loss inventions among college students, a previous systematic review showed only 3 of 11 interventions reported significant anthropometric changes among college students [7]. These interventions relied on weight or BMI

as the measure of anthropometric outcomes, although since this review was completed, two interventions have emerged that utilized more advanced anthropometric measures. Mustedanagic' and team [34] utilized skinfolds to measure body composition and found that after 36 aerobic and resistance training sessions over 12 weeks lasting 60 minutes, there was a significant decrease in body fat percentage and a significant increase in lean mass percentage. Another study utilized biological impendence to measure body fat percentage and skeletal muscle after a very intensive intervention of 60 aerobic and 60 resistance training sessions over 12 weeks and found significant decreases in body fat percentage and a significant increase in skeletal muscle pre to post [35].

The current study used six, 30-minute interviews over six months, which is a much less intensive intervention comparatively, and found a difference of 2.43% in body fat between the two groups at the end of the study, which is similar to the difference of 2.5% reported by Mustedanagic et al., [34] though less than the 5.5% loss from pre to post among the intervention conducted by Kim & Han [35]. Most of the interventions addressing weight status among college students also appear to be short-term interventions (10-12 weeks) versus the 6-month intervention in this study. Future interventions are needed among college students that demonstrate an impact on anthropometric status. Interventions that utilize follow-up periods and measure body composition would make beneficial contributions to the current literature.

Two meta-analyses have measured anthropometric changes of MI interventions. Armstrong et al., (13) found that in MI RCT's obese or overweight patients in the MI groups lost about 1.47kg and .25kg/m2 BMI more than control groups. Suire and team (14) found that among adult women, MI RCTs reported that participants receiving the MI intervention lost about 1.36kg and -1.22kg/m2 in BMI more than control groups. The intervention in the current study demonstrated comparable results with the MI group showing about 1.80 kg and .70 kg/m2 less

compared to the control. These results demonstrate similar effectiveness to that reported in the literature, even during restrictions from a pandemic. As most MI interventions measuring anthropometric outcomes rely on weight or BMI [12-14], this study provides further information on body composition changes. While useful and often more feasible, weight and BMI measures give very little information about the effects of the intervention on actual body composition. It is important to note that in this study there were significant differences between MI and electronic education groups for both fat mass and lean mass, in addition to a non-significant, yet positive trend for BMD. These differences would not have been detected by relying on weight or BMI and may signal a need for future studies to incorporate more objective measures of body composition. This would propel the literature forward and provide health professionals with vital information due to the link between fat mass and lean mass with mortality [36].

This research acted upon gaps in the literature identified in previous research [13, 14] which was the lack of training and fidelity information. This information is imperative to establish future standards for ensuring that MI was delivered at an adherence threshold determined to be effective by MI experts. Detailed training and fidelity procedures were reported within this research report and demonstrated consistent fidelity across the study encounters, even after the transition from in-person to virtual nature of the encounters. As per fidelity scores, MI was delivered during the intervention, supporting claims for validity that MI was the core component of this intervention that impacted the outcomes as described. Future interventions should report both detailed training information and fidelity results to strengthen MI interventions and provide a base of evidence.

Literature assessing SDT-related constructs in MI weight management interventions is still in the early stages. One prior intervention reported decreases in participant-reported amotivation while showing increases in identified and integrated regulation [37]. Another study

found that an intervention combining principles from SDT, and MI had higher psychological basic need support when compared to a control group, and that perceived competence mediated results [38]. In addition, two interventions demonstrated MI participants had increases in autonomous motivation as well as weight loss [39, 40]. Webber and collaborators [39] assessed autonomous motivation in an 8-week internet-based intervention comparing MI to MI plus a discussion of values. Autonomous motivation increased in both groups and higher autonomous motivation at follow-up was associated with greater weight loss. It also was found that more change talk during the MI sessions was correlated with higher autonomous motivation. West and team [40] directly mentioned SDT as a part of a theoretical framework for a motivation-focused approach which included an autonomy-driven component based on MI. This was compared to a skills-based approach as well as a control group for effect on weight loss maintenance among overweight women at follow-up after a 6-month weight loss intervention. Both the motivation (5.34 kg) and skills-focused (-5.22 kg) groups lost a statistically significant amount of weight compared to the control, while not being significantly different from each other. Participants in the motivational group had significantly higher autonomous motivation for weight control than the skills-based group at the mid-point of the follow-up time point. Taking these findings into consideration along with our findings that demonstrate significant increases in the psychological needs of autonomy and relatedness in addition to identified motivation, integrated motivation, and intrinsic motivation when compared to the control group, future researchers may benefit from measuring SDT related constructs in MI interventions. These findings could prove beneficial due to the literature demonstrating a relationship with SDT constructs and weight loss and related behaviors [41-43].

Emerging evidence shows increases in weight during the COVID-19 pandemic. One recent study reported that adults gained about 1.5kg via survey in Italy only after 1 month of the lockdown [44]. Another study reported that after 45 days, 42% of type 2 diabetes patients reported exercising less and 19% reported gaining weight [3]. An additional study reported that after 5 weeks, both females (2.2 kg) and males (1.7kg) with BMI < 24 gained weight, males with BMI ≥ 24 lost weight (0.9 kg), and females with a BMI ≥ 24 gained weight (0.9 kg). It was also found that there were significant declines in the number of steps and moderate and vigorous physical activity [4]. In the current study, the control group showed overweight college students gained an average of 2.33 kg of fat mass during a 6-month span (most of which was during the onset of the pandemic). Whereas, the MI group was able to maintain their fat mass and lean mass providing support that MI may be an effective intervention strategy to prevent weight gain in limited access environments.

Limitations

Steps were taken to minimize threats to validity in the study design, but potential limitations should be noted. Perhaps the most significant limitation of this study was the small sample size. While small sample sizes are not uncommon in this type of research, this resulted in low statistical power which could have impacted the ability to detect the difference between the intervention and control groups. The post-test sample size was much smaller than the suggested power analysis sample size of 68 from G*power. Related to this challenge was the unusually high attrition rate. With the COVID-19 pandemic spreading in the middle of this intervention, many participants dropped out of the study for a variety of reasons including graduation, not returning to campus, or passively withdrawing from the intervention. We employed incentives as a proactive measure to increase retention, but it appears incentives may not be enough to combat these COVID-19 related struggles. It is also important to mention due to the low initial sample

size and attrition issues, self-selection bias may have impacted the results. In addition, the generalizability of the findings may be limited due to not only these challenges but that the study was conducted at one university. Another limitation was the lack of blinding of the researchers to the group assignment of participants. Blinding cannot truly occur with a MI intervention due to the personal interaction between the subject and MI deliverer. In addition, participants may have responded to self-reported surveys of SDT and behavior adherence with social desirability bias and/or recall bias. Another limitation related to the SDT constructs is while the MI discussions focused on multiple health behaviors, the surveys utilized centered solely physical activity. The final limitation was the lack of measurements on weight-related behaviors, such as physical activity and nutrition throughout the study. Measuring these behaviors during the pandemic proved to be problematic and future studies would benefit from including them.

Conclusion

MI demonstrated strong potential for impact on body composition maintenance when compared to an electronic education control treatment during a national pandemic among college students at one university. In the well-trained interventionist, MI-adherence was maintained across the study time points and through the transition from in-person to virtual encounters. MI also appears to have increased several SDT related constructs, thus adding to potential future interventions that include combinations of MI and SDT. While more research is needed, health professionals may consider MI as a flexible intervention that can be delivered for weight management while participants have limited access to resources, such as during the pandemic. Participants in the control group gained a substantial amount of fat mass while losing lean mass, potentially signaling additional health impacts from large shutdowns. Future research investigating the impact of the COVID-19 pandemic would benefit from focusing on larger samples and including measurements on physical activity and nutrition. Future studies utilizing

MI would enhance the literature by further investigating the relationship between MI and SDT and measuring body composition.

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Weight Management among College Students during the COVID-19 Pandemic: A Qualitative Analysis.

Keywords: COVID-19, motivational interviewing, weight, physical activity, college students

Introduction

Obesity continues to impact millions of adults, with no signs of improvement over the last several years [1]. This is concerning for health professionals due to the various health consequences of obesity [2]. College students are not excluded from this issue with the American College Health Association-National College Health Assessment II reporting almost 39% of college students are considered overweight or obese using self-reported height and weight [3]. Furthermore, this survey also highlighted a lack of physical activity and proper nutritional intake as factors related to weight gain in college students. Unfortunately, few interventions have demonstrated success in improving anthropometric status among college students [4]. As many college students changed environments and/or had restricted access to physical activity and nutritional intake, the COVID-19 pandemic may have negatively influenced the weight status of college students.

COVID-19 greatly impacted society during 2020. As of January 2021, there have been over 25 million cases of COVID-19 in the United States [5]. About 90% of adults were confined to stay at home during the COVID-19 pandemic [6]. This resulted in a shutdown across the country, which included integral aspects of almost every community in the country. Universities and colleges across the country closed, which often resulted in college students losing their living space and having to move back home to their prior living arrangements. It is unclear how this disruption may have impacted various health behaviors, including those related to weight management.

Motivational Interviewing (MI) is an empathetic and patient-centered communication approach that may provide a feasible and low-cost solution to address weight management among college students [7]. MI has demonstrated success in increasing adherence to various health behaviors [8-10] including weight management across various populations [11-13]. Unfortunately, these reviews/meta-analyses for weight management-based MI include few studies with adequate rigor, therefore more research is needed, especially among college students. As MI can be provided via video chat (e.g. zoom), the weight loss intervention continued throughout the pandemic, which provides a unique insight into MI as a weight management intervention tool across environmental changes. Therefore, the purpose of this study is to report the experiences of college students engaged in a weight management intervention during the COVID-19 pandemic.

Methods

Participants

College students were recruited by word of mouth, e-mail, flyers, and social network blast within a large university located in the southeast. To be eligible for this study, participants had to be: a college student, low risk for medical complications from exercise (as determined by the Physical Activity Readiness Questionnaire (PAR-Q)), currently not exercising, over 25 body mass index (BMI), and not pregnant. A total of 40 college students met qualifications and were randomized. Experimental conditions did not differ significantly at baseline in demographic characteristics or BMI. Twenty-two participants participated in final data collection and were included in a separate quantitative analysis. Of these 22 participants, 19 completed an exit interview. Of the 19 participants, 12 underwent the MI intervention while seven underwent the

electronic education condition. Participant details as a whole and by group allocation can be seen in Table 1.

Table 1

Means, percentages, and standard deviations for demographic information for participants included in qualitative analysis.

Variable	MI (n = 12)	EE (n = 7)	Total (n = 19)
Age	21.28 (1.95)	23.43 (3.44)	22.07 (2.72)
BMI	29.87 (6.88)	29.67 (4.55)	29.80 (5.98)
% Female	75.0%	71.4%	73.7%
% Male	25.0%	28.6%	26.3%
% White	91.7%	57.1%	73.7%
% Black	8.3%	28.6%	21.1%
% Hispanic	0%	14.3%	5.2%

MI = Motivational Interviewing, EE = Electronic Education, BMI = Body Mass Index

Intervention

This randomized trial was approved by the University Institutional Review Board for Research Involving Human Subjects (IRB) and followed the standards set by the Declaration of Helsinki under protocol number 19-388 AR 1810. Each participant read and signed a written informed consent and completed the PAR-Q. Participants who qualified for the study were randomized to either the MI group or the electronic education (control) group in January 2020.

The intervention group received three in-person MI sessions before the onset of COVID19 (January-March 2020) and three video chat MI sessions after quarantine restrictions were enacted (April-June 2020), which all lasted 30 minutes in duration over six months. MI sessions were conducted by a trained exercise physiologist. Sessions were rooted in the spirit of MI, remaining empathetic and subject centered. Topics ranged from physical activity, nutrition, stress management, alcohol consumption, and sleep. It is important to note that since the sessions were subject-centered, the interviews revolved around the subject's concerns, motivations, and goals.

The control group received six, monthly education materials sent via email. Topics covered included physical activity, nutrition, stress management, excessive drinking/behaviors, and time management. After the onset of the COVID-19 pandemic, educational material adjusted to various forms of physical activity that could be performed at home.

Measures/Procedures

A semi-open interview one month after the final dose of the respective intervention was delivered to collect qualitative data. There were seven questions read in every interview and potential follow-up questions were asked to probe on a topic if needed. Interview questions can be found in Table 2.

Table 2

Interview Questions

Question 1	How do you feel you did during the study?
Question 2	Do you feel that the interviews or educational material helped you? Describe how.
Question 3	How did Covid-19 impact your health behavior?

Question 4	What struggles did you have related to Covid-19?
Question 5	What was a typical exercise routine for a week?
Question 6	Did the interviews or educational material help you during the outbreak of Covid-19?
Question 7	If a similar situation (pandemic) were to happen in the future, would you be better prepared in regard to managing your weight?

Data analysis

Interpretative phenomenological analysis (IPA) was utilized as a methodology aiming to examine how the participants made sense of their experiences within this weight management intervention, as most of it took place during the COVID-19 pandemic [14]. Previous interventions have utilized this method to better understand exercise habits [15, 16]. To achieve this, transcripts were read multiple times, coded line-by-line for significant findings on one margin, then once again for emerging themes on the opposite margin. A summary table was then written for each participant to compare across all participants for themes. Finally, a master table was created with all major themes. A discussion between co-authors took place to examine the data alongside transcripts to further hone the themes.

Results

Analysis of the interview data revealed several emerging themes. There were four themes related to the overarching struggles of COVID-19's impact: Loss of gym access, mental struggles, boredom/stress eating, and loss of structure/living conditions. There were also four themes related to the weight management intervention: MI was more effective, MI was particularly useful during the shutdown, subjects receiving MI enjoyed the autonomy focus, and subjects receiving MI felt comfortable to share information and trusted the MI interventionists.

Themes

Loss of gym. Numerous participants in both groups mentioned that losing access to a gym presented difficulty during the shutdown. In fact, 58% of the subjects discussed this fact in the interview. Participant 10 mentioned: "*Honestly, the biggest change was not being able to go to the gym*." Since the first several weeks of the study started before COVID-19, it appears that losing access to the gym also derailed current progress and routine. Participant 25: "*I was unable to go to the gym, so I lost my typical routine, and this really stopped my progress*." It was also evident that this created a major roadblock due to the participants needing to come up with new forms of exercise. Participant 9: "*Losing the gym was massive. That was my favorite form of exercise and I felt lost without it*."

Boredom/stress eating. Many of the participants reported that they noticed they were eating differently due to various emotions. About 33% of the subjects mentioned some form of emotional eating. Participant 32: "*Eating wise, I started eating even more as well. I did a lot of emotional eating, lots of eating out of pure boredom*." This was likely a result of being quarantined and staying within their living space for much longer durations of time. There were also other emotions mentioned other than boredom with Participant 22: "*I ate more sugar/dessert than normal, maybe due to feelings of depression at times*." Once again, being forced to stay inside their home and the abrupt change in their daily lives appeared to result in various emotions that the participants felt changed their eating habits.

Mental struggle. The most common struggle mentioned related to COVID-19 was mental struggles, which was discussed by 44% of the participants. Participant 13: "*It was just hard to get my brain around what was going on. I spent a lot of time early on just wandering around the house, I just wasn't fully present mentally*." Many of the participants felt like they

were stuck in a cycle of low production and couldn't get over being stuck inside. Participant 1: "*Mentally tough for sure. I was just pacing back in forth in the house or laying around for what felt like months. I hated it*." While the physical barrier of losing access to fitness facilities and opportunities was a massive hindrance, the sudden change brought about by quarantine restrictions took a major, mental toll on these participants.

Loss of structure. For these participants, they were notified during Spring Break that face-to-face classes were being canceled and the campus was being closed. Many of the participants were forced to go back home with their parents on short notice and completely change the way they planned to live for the rest of the semester. Participant 3: "*I had lost my method of exercise and I was having to stay surrounded by food all day, whereas, I typically was at school for large parts of the day.*" Many also mentioned that they had more on their mind than just managing their weight due to the sudden, life-altering situation. Participant 25: "*I exercised a lot less and less intensely and my eating habits were all over the place after school was canceled. I lost access to my apartment and was sent home, so I had so much other stuff to deal with*." The loss of structure greatly derailed the progress that was made during the early portions of the intervention was an intense moment for the participants.

MI more remarkable compared to electronic education. The participants receiving MI were much more positive on the intervention when compared to the electronic education group. Participant 2: "*The interviews were very helpful. I was asked some really interesting questions and I really had to dig deep to talk about why I wanted to exercise and eat better*." Many of the participants noted that the interviews made them think and reflect about why they actually wanted to exercise. Participant 28: "*The interviews were useful. I felt like I was able to ask a lot of questions and I was definitely asked some questions that I really had to think about. I initially*

just thought I wanted to lose weight, but after thinking on it, I wanted to add some lean mass as well. I wanted to look and feel better."

There were a small number of participants who felt the educational material was helpful but were often lukewarm on the impact. Participant 32: "*The educational material was good. I don't think it helped me all that much though. I didn't really use the information*." Most of the participants felt that the educational material was ineffective as an intervention. Participant 27: "*The educational material really didn't do much. The content was useful for sure, but after reading it, it didn't cause me to act*."

MI even more impactful during COVID-19 when compared to electronic education. The participants receiving MI mentioned that the sessions were particularly impactful during the pandemic due to the need to strategize a new plan for exercise. Participant 35: "*Yes the interviews were a big deal, especially for the banded exercises at home during the shutdown*". It was also evident that the participants often were not sure that smaller doses of exercise compared to what they previously were doing would still be beneficial and that the sessions were useful in addressing questions related to changes in exercise habits. Participant 7: "*The interviews really were a big help. I don't know if I would have started walking otherwise. I probably wouldn't have thought it would have made a big difference*."

The electronic education during the pandemic was centered around home workout options. Many of the participants enjoyed the information but did not actually engage in the workouts. Participant 18: "*The educational material was cool, but I didn't do any of the at home workouts. I never felt like I could actually do it*." Participants often noted that they would have needed something more extensive or would need help to actually feel comfortable with it.

Participant 22: "*The educational material was good. It obviously didn't help a lot. The information was useful, but it didn't really budge me. Something more extensive was needed*."

Autonomy increase. One of the themes that were consistent among the MI group was the enjoyment of the autonomy focus of the sessions. Participant 3: "*I thought this was going to be a motivating interview where I was told what to do. Instead, I had a chance to focus on my struggles and ideas that work for me*." The participants appeared to like the flexibility of the options, as well as, the focus on realistic changes, even if they were incremental. Participant 13: "*It felt like I was almost talking to myself instead of an expert. This was good though because I got to think a little bit about what was realistic. What I liked to do for exercise, what I actually could do eating wise*."

Trust/comfort. The participants receiving MI felt comfortable sharing personal information even when discussing touchy subjects, like weight. Participant 19: "*It was also really nice to not feel judged when we were talking. I usually don't like talking about my weight, but in the interviews, I felt like I could talk about it without feeling bad*." This was also particularly useful when discussing struggles, which is often important to improving behavior. Participant 30: "*I also felt really comfortable talking about struggles I had, it was nice to get that stuff off my chest so I could move past it*."

Discussion

COVID-19 pandemic

Despite the COVID-19 pandemic being a recent occurrence, there are a few studies that have already shown weight gain among those in quarantine [17, 18]. This is in addition to our findings that subjects in the control group gained about 2.28kg over 6 months (most of which took place

during COVID-19). Only one study currently exists that explores the struggles with weight maintenance for adults during the pandemic [19]. This study was implemented with older adults that were a part of a physical activity program in France. Findings suggest that the pandemic made physical activity adherence harder to accomplish due to a lack of resources, social interaction, and lack of interest in electronic, exercise content. Despite being conducted amongst a different population, the results of this study also reflect some of the same results, with a lack of resources (gym and campus) being a large barrier for most of these students as well as the participants in the control group stating that the electronic education material for at-home workouts not being enticing enough to engage in consistent exercise. This is notable due to the importance of campus recreation opportunities for college students. It has been estimated about 95% of college students engage in some form of campus recreation multiple times per week [20]. Unsurprisingly, it has also been demonstrated that users of campus recreation facilities report lower BMI [21].

Several of the participants in our study mentioned having eating struggles related to boredom or emotional eating. Boredom eating is an issue established in the literature and may be a major factor during quarantine due to the extended period at home [22]. There is also support in the literature on other various forms of emotional eating from feelings such as stress or anxiety [23]. Research on the psychological impact of COVID-19, while in its infancy, has already begun to outline anxiety, stress, and depression increases [24]. Another study trying to better understand the impact of COVID-19 specifically targeted college students of various ethnic backgrounds and reported several disruptions from finances, living situation, and academics [25]. There were also mental health challenges such as stress, anxiety, and depression. These results mimic many of our findings in that COVID-19 was a massive moment for college students. Future interventions

are needed to better understand the struggles related to health behavior adherence during the COVID-19 pandemic so that solutions can be devised to react to the current situation properly.

Autonomy increase

Results from multiple interventions substantiate the finding that participants respond positively to the autonomy-driven focus of MI [26-28]. Some of the findings are that self-determination increased within the patients [26], participants felt complete freedom to share without coercion and enjoyed that they were not told what to do [27] and that the participants felt they actually had a choice and control over their own behavior. [28]. These findings substantiate our findings that the participants within the MI intervention perceived autonomy from the MI sessions. It does appear that this is currently the only qualitative analysis of MI utilized among college students for anthropometric status. Future interventions can strengthen the literature by focusing on measuring autonomy in weight loss/MI interventions as well as utilizing qualitative analysis in MI studies to investigate participant's experiences.

Trust and comfort

Previous literature substantiates our findings that the participants receiving MI felt comfortable sharing information and had a trusting relationship with the interviewer. One intervention stated that the participants' trust with their registered nurse delivering MI was crucial for the confidential relationship where true feelings could be shared [26]. Another study demonstrated that the subjects felt that the interviewer was caring, non-threatening, trustworthy, and made them feel comfortable [27]. One intervention found that while discussing a sensitive topic in antiretroviral therapy adherence for HIV, 80% of the subjects felt very comfortable discussing their health behavior during the MI sessions [28]. The final study was conducted among HIV/AIDS-positive patients regarding safe sex practices [29]. This intervention walked

the participants through a new method of communication based on MI via focus group to gather feedback and thoughts. The participants mentioned negative experiences with counseling and felt they were not trusting of the practitioner and therefore, were unable to have effective discussions in the past. One of the largest themes found was the desire for a more trustful and nonjudgmental connection with a health professional and many of the participants felt that those delivering MI had high potential to deliver on that desire. Our intervention and these previous findings support MI as an empathetic communication method that drives effective discussion, even when talking about sensitive topics. It appears that for many of the participants in this intervention, the empathetic nature and focus on building trust is noteworthy.

Conclusion

The COVID-19 pandemic had an impact on college students trying to manage their weight. Within this sample, the loss of a fitness facility, the loss of their structured way of life, and boredom/emotional eating were large barriers to their behavior. It also appears that the lockdown taxed the participants mentally and was often noted as the largest struggle during COVID-19. Participants reported MI as being more effective than the electronic educational material (especially during COVID-19), the autonomy-supportive nature of MI being enjoyable, and described feeling comfortable discussing weight-related topics and trusting of the MI interventionist. MI has demonstrated potential among college students for weight management, even during a global pandemic. This qualitative analysis provides information for future researchers regarding the impact of COVID-19 on overweight, college students trying to manage their weight. Future researchers may also benefit from employing a flexible, empathetic, and autonomy-driven solution among college students, especially while COVID-19 is still impacting America.

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V. Discussion

Before the COVID-19 pandemic, this project aimed to address weight gain among college students. The latest national survey showed that approximately 40% of college students were overweight or obese [1]. Emerging evidence shows that obesity and weight-increasing behaviors are exacerbated by the pandemic and subsequent necessary lockdowns [2-4]. While the consequences of COVID-19 are serious and various actions were required to prevent the spread of the virus, the lasting impact of quarantine on health behaviors is fully unknown. This study provides evidence of the impact of a MI intervention on body composition outcomes in overweight college students primarily during quarantine and provides unique insight through quantitative and qualitative data.

The body composition changes within the control group were staggering. The control group gained over 5lbs of fat mass while also losing about 1.3lbs of lean mass, resulting in an increase of approximately 2.2% in body fat percentage. These changes occurred 6 months, 4 months of which took place during the onset of the pandemic in the United States. A previous meta-analysis examining MI RCTs for weight management among women revealed the average weight change of control groups was -1.5 kg [5]. In this intervention, the control group gained about 2.2 kg, which is 3.7 kg more than expected in reference to the literature. While comparing changes to other literature is difficult due to the unique circumstance, these results are concerning as this population was already overweight at the onset of this study (*M* BMI = 28.85).

The control group also showed changes in psychological outcomes with decreases in autonomy, competence, relatedness, and amotivation. According to the SDT, the three psychological needs are important in determining self-determined behavior [6], and a decrease in all three needs satisfaction points to a decrease in self-determination.

To provide context to these findings the campus of Auburn University completely shut down and notified students to not return to campus during spring break. This caused many students to lose their living space and therefore required them to have to find other arrangements with little notice. Alongside living space, many students also lost access to walkable areas around campus, the student recreational center, campus dining, among other aspects of campus life. The results of the qualitative analysis also demonstrate these findings pointing to numerous unique challenges brought about by COVID-19 and actions taken to prevent the spread of the virus. The loss of gyms, loss of structure/living space, mental hardships dealing with extensive quarantine, among others were all notable findings from the exit interviews.

Barriers related to the pandemic dominated the interviews and participants in the control group were not able to overcome these barriers. Participant 32: "*I really haven't been doing any exercise lately. I don't feel I can even go outside and walk due to where I lived during all this*." Many of the participants in the control noted how the mental toll of quarantine hindered them. Participant 18: "*It was really all mental. I felt like garbage all the time and I didn't feel like doing anything*." Participants in the control group reported the electronic education to be unremarkable in terms of weight-related behaviors. Participant 9: "*The educational material didn't do a lot for me. It was mostly a reminder to get back on track. The content didn't really push me*."

In contrast, the MI intervention group was able to maintain their body composition during the pandemic. In fact, due to the increases in lean mass, the MI group actually had a small (non-significant) decrease in body fat percentage (-0.2%). This points to the potential of personalized communication during extended quarantine and shutdown. This is further supported by qualitative findings as 50% of the participants stated that the interviews after the onset of COVID-19 pulled them "back in" to their weight loss journey. Participant 13: "*Without the*

interviews, I may have just forgot about exercise until I noticed gaining weight honestly." Specifically, the problem-solving and trouble-shooting that took place during the MI sessions to address the changing environment were helpful for this sample.

The MI group reported the autonomy focus of MI was impactful in helping them reach their goals by keeping the focus on them and adjustments they could make during this unprecedented time. Participant 3: "*I thought this was going to be a motivating interview where I was told what to do. Instead, I had a chance to focus on my struggles and ideas that work for me*." In contrast, the participants in the control group felt they had their choice stripped from them and couldn't overcome this. Participant 27: "*Dramatically negative. I went on spring break and then came back to a whole different world. I couldn't come back to school, exercise on campus, eat the way I planned."* This may help support the quantitative findings for autonomy where the MI group reported an increase in autonomy whereas the control reported a decrease, $F(1, 20) = 12.28$, $p = .002$, $\eta 2 = .38$. It also appeared that the participants felt comfortable to share information within the MI group. Participant 19: "*It was also really nice to not feel judged when we were talking. I usually don't like talking about my weight, but in the interviews, I felt like I could talk about it without feeling bad*." A distinction was found within the control group where there were feelings of isolation. "Participant 18: "*I missed working out with my friends too. I could have done it alone but it just didn't feel right*". This may help support the quantitative findings for relatedness where the MI group reported an increase in relatedness whereas the control reported a decrease in relatedness, $F(1, 20) = 13.77$, $p = .001$, $\eta^2 = .41$.

Moving forward, health professionals should refocus attention on the growing weight management problem among college students. While the CDC still recommends actions to prevent the spread of COVID-19, physical activity and correct eating habits can still occur.

Specific focus on at-home physical activity and cooking are health promotion options that can occur even during a pandemic. Universities may consider providing personalized counseling, such as motivational interviewing, to keep contact with students and aid in weight management behaviors. The repercussions of the pandemic and the extended quarantine are still unknown, yet these findings point to a concerning problem. Future research should continue to investigate.

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APPENDICES

APPENDIX A: IRB PROTOCOL

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD for RESEARCH INVOLVING HUMAN SUBJECTS

RESEARCH PROTOCOL REVIEW FORM

FULL BOARD or EXPEDITED

For Information or help contact **THE OFFICE OF RESEARCH COMPLIANCE (ORC),** 115 Ramsay Hall, Auburn University
Phone: 334-844-5966 **e-mail:** IRBAdmin@auburn.edu **Web Address:** http://www.auburn.edu/research/vpr/ohs/index.htm

Revised 2.1.2014 **Submit completed form to IRBsubmit@auburn.edu or 115 Ramsay Hall, Auburn University 36849.**

Form must be populated using Adobe Acrobat / Pro 9 or greater standalone program (do not fill out in browser). Hand written forms will not be accepted.

1 **PROPOSED START DATE of STUDY**: 01/06/2020

PROPOSED REVIEW CATEGORY (Check one): ☑ **FULL BOARD** ☐ **EXPEDITED**

SUBMISSION STATUS (Check one): ☑ **NEW** ☐ **REVISIONS (to address IRB Review Comments)**

2. PROJECT TITLE: Motivational Interviewing to Address Freshman Weight Gain

3. Danielle Wadsworth	Assoc	Kine	wadswdd@auburn.edu
PRINCIPAL INVESTIGATOR	**TITLE**	**DEPT**	**AU E-MAIL**
301 Wire Rd.		844-1836	
MAILING ADDRESS		**PHONE**	**ALTERNATE E-MAIL**

4. FUNDING SUPPORT: ☐ N/A ☑ Internal ☐ External Agency:_____ ☐ Pending ☐ Received

For federal funding, list agency and grant number (if available). _____

5a. List any contractors, sub-contractors, other entities associated with this project:

None

b. List any other IRBs associated with this project (including Reviewed, Deferred, Determination, etc.):

None

PROTOCOL PACKET CHECKLIST

All protocols must include the following items:

- ☑ Research Protocol Review Form (All signatures included and all sections completed)
  (Examples of appended documents are found on the OHSR website: http://www.auburn.edu/research/vpr/ohs/sample.htm)
- ☑ CITI Training Certificates for all Key Personnel.
- ☑ Consent Form or Information Letter and any Releases (audio, video or photo) that the participant will sign.
- ☑ Appendix A, "Reference List"
- ☑ Appendix B if e-mails, flyers, advertisements, generalized announcements or scripts, etc., are used to recruit participants.
- ☑ Appendix C if data collection sheets, surveys, tests, other recording instruments, interview scripts, etc. will be used for data collection. Be sure to attach them in the order in which they are listed in # 13c.
- ☑ Appendix D if you will be using a debriefing form or include emergency plans/procedures and medical referral lists (A referral list may be attached to the consent document).
- ☐ Appendix E if research is being conducted at sites other than Auburn University or in cooperation with other entities. A permission letter from the site / program director must be included indicating their cooperation or involvement in the project. NOTE: If the proposed research is a multi-site project, involving investigators or participants at other academic institutions, hospitals or private research organizations, a letter of IRB approval from each entity is required prior to initiating the project.
- ☐ Appendix F - Written evidence of acceptance by the host country if research is conducted outside the United States.

FOR ORC OFFICE USE ONLY

DATE RECEIVED IN ORC:_____ **by**_____ **PROTOCOL #** _____
DATE OF IRB REVIEW:_____ **by**_____ **APPROVAL CATEGORY:** _____
DATE OF IRB APPROVAL:_____ **by**_____ **INTERVAL FOR CONTINUING REVIEW:** _____
COMMENTS:

The Auburn University Institutional Review Board has approved this Document for use from 10/14/2019 to 09/17/2020
Protocol # 19-388 AR 1910

6. GENERAL RESEARCH PROJECT CHARACTERISTICS

6A. Research Methodology

Please check all descriptors that best apply to the research methodology.

Data Source(s): ☑ New Data ☐ Existing Data

Will recorded data directly or indirectly identify participants?
☑ Yes ☐ No

Data collection will involve the use of:

- ☐ Educational Tests (cognitive diagnostic, aptitude, etc.)
- ☑ Interview
- ☐ Observation
- ☐ Location or Tracking Measures
- ☑ Physical / Physiological Measures or Specimens (see Section 6E.)
- ☑ Surveys / Questionnaires
- ☐ Internet / Electronic
- ☑ Audio
- ☐ Video
- ☐ Photos
- ☐ Digital images
- ☐ Private records or files

Other: _____

6B. Participant Information

Please check all descriptors that apply to the target population.
☑ Males ☑ Females ☑ AU students

Vulnerable Populations
☐ Pregnant Women/Fetuses ☐ Prisoners ☐ Institutionalized
☑ Children and/or Adolescents (under age 19 in AL)

Persons with:
☐ Economic Disadvantages ☐ Physical Disabilities
☐ Educational Disadvantages ☐ Intellectual Disabilities

Do you plan to compensate your participants? ☑ Yes ☐ No

6C. Risks to Participants

Please identify all risks that participants might encounter in this research.

- ☑ Breach of Confidentiality*
- ☐ Deception
- ☑ Psychological
- ☐ None
- ☐ Other:
- ☐ Coercion
- ☑ Physical
- ☐ Social

*Note that if the investigator is using or accessing confidential or identifiable data, breach of confidentiality is always a risk.

6D. Corresponding Approval/Oversight

- Do you need IBC Approval for this study?
  ☐ Yes ☑ No

  If yes, BUA #_____ Expiration date_____

- Do you need IACUC Approval for this study?
  ☐ Yes ☑ No

  If yes, PRN #_____ Expiration date _____

- Does this study involve the Auburn University MRI Center?
  ☐ Yes ☑ No

  Which MRI(s) will be used for this project? (Check all that apply)
  ☐ 3T ☐ 7T

  Does any portion of this project require review by the MRI Safety Advisory Council?
  ☐ Yes ☑ No

  Signature of MRI Center Representative: _____
  Required for all projects involving the AU MRI Center

  Appropriate MRI Center Representatives:
  Dr. Thomas S. Denney, Director AU MRI Center
  Dr. Ron Beyers, MR Safety Officer

A. PRINCIPAL INVESTIGATOR'S ASSSURANCES

1. I certify that all information provided in this application is complete and correct.
2. I understand that, as Principal Investigator, I have ultimate responsibility for the conduct of this study, the ethical performance this project, the protection of the rights and welfare of human subjects, and strict adherence to any stipulations imposed by the Auburn University IRB.
3. I certify that all individuals involved with the conduct of this project are qualified to carry out their specified roles and responsibilities and are in compliance with Auburn University policies regarding the collection and analysis of the research data.
4. I agree to comply with all Auburn policies and procedures, as well as with all applicable federal, state, and local laws regarding the protection of human subjects, including, but not limited to the following:
    a. Conducting the project by qualified personnel according to the approved protocol
    b. Implementing no changes in the approved protocol or consent form without prior approval from the Office of Research Compliance
    c. Obtaining the legally effective informed consent from each participant or their legally responsible representative prior to their participation in this project using only the currently approved, stamped consent form
    d. Promptly reporting significant adverse events and/or effects to the Office of Research Compliance in writing within 5 working days of the occurrence.
5. If I will be unavailable to direct this research personally, I will arrange for a co-investigator to assume direct responsibility in my absence. This person has been named as co-investigator in this application, or I will advise ORC, by letter, in advance of such arrangements.
6. I agree to conduct this study only during the period approved by the Auburn University IRB.
7. I will prepare and submit a renewal request and supply all supporting documents to the Office of Research Compliance before the approval period has expired if it is necessary to continue the research project beyond the time period approved by the Auburn University IRB.
8. I will prepare and submit a final report upon completion of this research project.

My signature indicates that I have read, understand and agree to conduct this research project in accordance with the assurances listed above.

Danielle Wadsworth		
Printed name of Principal Investigator	**Principal Investigator's Signature**	**Date**

B. FACULTY ADVISOR/SPONSOR'S ASSURANCES

1. I have read the protocol submitted for this project for content, clarity, and methodology.
2. By my signature as faculty advisor/sponsor on this research application, I certify that the student or guest investigator is knowledgeable about the regulations and policies governing research with human subjects and has sufficient training and experience to conduct this particular study in accord with the approved protocol.
3. I agree to meet with the investigator on a regular basis to monitor study progress. Should problems arise during the course of the study, I agree to be available, personally, to supervise the investigator in solving them.
4. I assure that the investigator will promptly report significant incidents and/or adverse events and/or effects to the ORC in writing within 5 working days of the occurrence.
5. If I will be unavailable, I will arrange for an alternate faculty sponsor to assume responsibility during my absence, and I will advise the ORC by letter of such arrangements. If the investigator is unable to fulfill requirements for submission of renewals, modifications or the final report, I will assume that responsibility.

Printed name of Faculty Advisor / Sponsor	**Faculty Advisor's Signature**	**Date**

C. DEPARTMENT HEAD'S ASSSURANCE

By my signature as department head, I certify that I will cooperate with the administration in the application and enforcement of all Auburn University policies and procedures, as well as all applicable federal, state, and local laws regarding the protection and ethical treatment of human participants by researchers in my department.

Mary Rudisill		
Printed name of Department Head	**Department Head's Signature**	**Date**

8. PROJECT OVERVIEW: Prepare an abstract that includes:
(350 word maximum, in language understandable to someone who is not familiar with your area of study**):**

a) A summary of relevant research findings leading to this research proposal:
(*Cite sources; include a "Reference List" as* ***Appendix A.)***
b) A brief description of the methodology, including design, population, and variables of interest

a) Approximately 31.9% of college students in the United States are overweight or obese (1). On average, studies show that freshman gain more weight throughout their freshman year compared to the general population (2). This appears to stem from most college students failing to adhere to exercise guidelines (3) as well as poor dietary habits (4). Clearly interventions are necessary to target healthy weight behaviors in college freshman, unfortunately, according to a meta-analysis, only 4 of 12 interventions targeting college freshman demonstrated significant changes in weight related outcomes (5). A possible technique that has been effective in adult populations for weight management is motivational interviewing. Motivational interviewing is a patient centered communication method that is used to elicit motivations for change rather than try and force better behaviors (6). The key communication principles of motivational interviewing are expressing empathy, supporting self-efficacy, rolling with resistance, and developing discrepancy (6). Motivational interviewing has shown to be effective in many areas, including weight management (7), however, more research is needed to demonstrate effectiveness among college freshman.
b) This intervention will be employing two interventions: motivational interviewing sessions and e-education modules for weight management among inactive overweight and obese college freshman. All freshman attending Auburn University in the Spring of 2020 who meet the following criteria are eligible for the study:

1. Classified as a college freshman and 18 years of age.
2. Low risk for medical complications from exercise (as determined by physical activity readiness questionnaire (PARQ+).
3. Neither currently engaging in exercise nor consistently exercising over the last three months (2 days or more per week).
4. Be considered overweight based on BMI (BMI at or above 25)
5. Not pregnant.

Eligible participants will be randomized to either a motivational interviewing or e-education group. College freshman will be contacted through campus email, flyers, social media blasts, word of mouth, and campus newspaper advertisement.
Motivational interviewing sessions will take place once per month and changes compared to an electronic education group will be evaluated. The entire study takes place over 29 weeks. Baseline at week 0, the core intervention will take place every three weeks from week 1 to week 9, post data collection at week 10 and 11, and a final follow-up will occur at week 28 and 29. The motivational interviewing intervention will consist of three meetings, approximately 30 minutes each during week 1, week 4 and week 7, while the e-education group receives three educational modules lasting approximately 10 minutes each matching the time of the motivational interviewing group. Topics for both groups covered include: physical activity, eating habits, stress and mental wellbeing, sleep, and alcohol consumption.
Outcome variables include: Body composition measured by a full body iDXA scan, hydration measured by bioelectrical impendence, physical activity measured by an accelerometer, food consumption measured by a dietary recall questionnaire, and questionnaires to measure: motivation, regulation, relatedness and health care climate. iDXA will be used three times over 29 weeks for a total radiation of .09 mrads.
This study meets the clinical trial definition and will be registered with ClinicalTrials.gov. Once registration is confirmed and a number is assigned we will submit a modification with the clinical trial number.

9. PURPOSE.
a. Clearly state the purpose of this project and all research questions, or aims.

The purpose of this project is to determine the anthropometric and psychological outcomes following a motivational interviewing Intervention for college freshman.

Does motivational interviewing impact body composition when compared to standard education material among college freshman?

Does motivational interviewing impact self-determination theory based psychological measures compared to standard education material?

What is the relationship between self-determination theory constructs and the effect of motivational interviewing among college freshman?

b. How will the results of this project be used? (e.g., Presentation? Publication? Thesis? Dissertation?)

Dissertation, Presentation, Publication

10. KEY PERSONNEL. Describe responsibilities. Include information on research training or certifications related to this project. CITI is required. Be as specific as possible. (Include additional personnel in an attachment.) *All key personnel must attach CITI certificates of completion.*

Principle Investigator Danielle Wadsworth Title: Assoc E-mail address wadswdd@auburn.edu

Dept / Affiliation: Kine

Roles / Responsibilities:

Recruitment, Conduct participate consent, Conduct interviews, data collection, preparation for publication and preparation for presentation.

Individual: Kameron Suire Title: Graduate Student E-mail address kbs0041@auburn.edu

Dept / Affiliation: Kine

Roles / Responsibilities:

Recruitment, Conduct participate consent, Conduct interviews, data collection, preparation for publication and preparation for presentation.

Individual: Jan Kavookjan Title: Assoc E-mail address kavooja@auburn.edu

Dept / Affiliation: Health Outcomes and Policy Research

Roles / Responsibilities:

Conduct MI training and fidelity.

Individual: Darby Winkler Title: Graduate Student E-mail address djw0042@auburn.edu

Dept / Affiliation: Kine

Roles / Responsibilities:

Conduct Interviews

Individual: _____ Title: _____ E-mail address _____

Dept / Affiliation: _____

Roles / Responsibilities:

Individual: _____ Title: _____ E-mail address _____

Dept / Affiliation: _____

Roles / Responsibilities:

11. LOCATION OF RESEARCH. List all locations where data collection will take place. (School systems, organizations, businesses, buildings and room numbers, servers for web surveys, etc.) Be as specific as possible. Attach permission letters in Appendix E.
(See sample letters at http://www.auburn.edu/research/vpr/ohs/sample.htm)

Kinesiology building 301 Wire Road: Exercise Adherence and Obesity Prevention Lab (149), TigerFit Lab (room 126), DEXA (Room 125).

12. PARTICIPANTS.

a. Describe the participant population you have chosen for this project including inclusion or exclusion criteria for participant selection.

☐ Check here if using existing data, describe the population from whom data was collected, & include the # of data files.

To be eligible, you must be:
1. Classified as a college freshman and 18 years of age.
2. Low risk for medical complications from exercise (as determined by physical activity readiness questionnaire (PARQ+).
3. Neither currently engaging in exercise nor consistently exercising over the last three months (2 days per week or less).
4. Be considered overweight based on BMI (BMI at or above 25)
5. Not pregnant.

b. Describe, step-by-step, in layman's terms, all procedures you will use to recruit participants. *Include in Appendix B a copy of all e-mails, flyers, advertisements, recruiting scripts, invitations, etc., that will be used to invite people to participate. (See sample documents at http://www.auburn.edu/research/vpr/ohs/sample.htm.)*

College freshman will be contacted through campus email, flyers, social media blasts, word of mouth, and campus newspaper advertisement.

c. What is the minimum number of participants you need to validate the study? 60

How many participants do you expect to recruit? 150

Is there a limit on the number of participants you will include in the study? ☐ No ✔ Yes – the # is 200

d. Describe the type, amount and method of compensation and/or incentives for participants.

(If no compensation will be given, check here: ☐)

Select the type of compensation: ☑ Monetary ☐ Incentives

☑ Raffle or Drawing incentive (Include the chances of winning.)
☐ Extra Credit (State the value)
☐ Other

Description:

Four, $25 dollar gift cards will be raffled at pre-testing (week 0), week 1 intervention, week 4 intervention, week 7 intervention, week 10 post-testing, week 11 accelerometer drop off and qualitative interview, week 28 follow-up, week 29 accelerometer drop off and qualitative interview. In total, $800 dollars' worth of gift cards will be rewarded at these 8 unique time points. Each participant can receive a maximum of 2 gift cards valued at $50. Using the expected number of participants, the odds of winning will be about 3% each drawing. This number will change depending on the number of entry participants and attrition. Drawings will occur after complete enrollment, meaning all participants will complete each checkpoint prior to the drawing for that checkpoint.

13. PROJECT DESIGN & METHODS.

a. Describe, step-by-step, all procedures and methods that will be used to consent participants. If a waiver is being requested, check each waiver you are requesting, describe how the project meets the criteria for the waiver.

☐ Waiver of Consent (including using existing data)

☐ Waiver of Documentation of Consent (use of Information Letter)

☑ Waiver of Parental Permission (for college students)

Before any testing, familiarization, or data collection, potential participants will be provided with the approved informed consent document and have any of their questions answered by Kameron Suire or Dr. Danielle Wadsworth. If the potential participant decides to volunteer for the study, she/he will be asked to sign the informed consent and then complete the PAR-Q as a screening tool. We are conducting the PAR-Q in person, versus a prescreening tool to answer any questions about the form. Recruits who do not meet the study inclusion criteria will have their PAR-Q and informed consent returned to them and will be not allowed to participate in the study. Participants with PAR-Q answers indicating an increased risk associated with physical activity or indicating that they are pregnant will be dismissed. Potential participants will also not be allowed to participate in the study if they are currently engaging in consistent exercise in the past three months (2 days per week). If the participant does not meet the inclusion criteria, the PAR-Q will be returned upon dismissal. If after explaining the requirements to the study, the participant does not agree to commit, the participant's forms will be returned.

b. Describe the research design and methods you will use to address your purpose. Include a clear description of when, where and how you will collect all data for this project. Include specific information about the participants' time and effort commitment. (*NOTE: Use language that would be understandable to someone who is not familiar with your area of study. Without a complete description of all procedures, the Auburn University IRB will not be able to review this protocol. If additional space is needed for this section, save the information as a .PDF file and insert after page 7 of this form.*)

Day 1 Baseline Testing – 60 minutes

Participants will arrive to the KINE department and perform the consenting procedures described in 13a. Due to typical questions regarding BMI and PAR-Q, study eligibility will be decided at the KINE department so that consultation can occur. Those that meet study criteria will receive an iDXA scan, complete questionnaires (behavioral regulation, competence, relatedness, and autonomy) and provide demographic information including: birthdate, race, sex, handedness, cell phone number and email address. These participants will also receive food logs to fill out and accelerometers to wear to monitor behavior. These baseline measures will take place in Tigerfit (room 126) and the DEXA (room 125). Baseline data collection is approximately 45-60 minutes.

Body Composition

iDexa measures body composition and bone density by dual energy X-ray absorptiometry. Participants will be asked to lie flat face-up on the iDexa table within the scanning area. The arm of the scanner will pass over the individual to assess body composition and bone density. The scan will take approximately 7-13 minutes depending on the size of the individual. All iDXA measurements will be carried out by certified and trained personnel. Participants will be asked to arrive fasting during all iDexa measures.

Bio-Electrical Impedance Analysis (BIA) – BIA will also be used to measure hydration levels and body composition. BIA is a non-invasive measure that determines the flow of an electrical current in the body. The device measures how this signal is impeded through different types of tissue. Tissues that contain large amounts of fluid and electrolytes, such as blood, have high conductivity, but fat and bone slow the signal down. As BIA determines the resistance to flow of the current as it passes through the body, it provides estimates of body water from which body fat is calculated using selected equations. The in-body BIA provides 4 contact points (2 upper body with the hands and 2 lower body with the feet) to measure body composition. Participants will remove shoes, socks and outer clothing prior to the measurement. The participant stands on the scale while holding the handles and with the feet on the sensor for approximately 30 seconds. All measurements will be carried out by certified and trained personnel. We are adding this additional measure to determine hydration for iDXA measures.

Questionnaires

All questionnaires can be found in Appendix C. All questionnaires, except the Health Care Climate Questionnaire, will be given to all participants at pre-testing, post-testing, and follow-up. The Health Care Climate Questionnaire is only given to the motivational interview group at post-testing.

Behavioral Regulation Exercise Questionnaire- The Behavioral Regulation Exercise Questionnaire version 3 (BREQ-3) will be used to detail where participants fall on the continuum of behavioral regulation, a key component of the self-determination theory. There are 24 questions, with 4 questions being a part of each subscale (amotivation, external, introjected, identified, integrated, and intrinsic).

Basic Psychological Needs Exercise Scale- The Basic Psychological Needs Exercise Scale (BPNES) will be utilized to measure autonomy, competence, and relatedness, which is an integral aspect of the self-determination theory. This scale has 12 items with 4 items being assigned to each need.

Relatedness to Others Physical Activity Scale- The relatedness to others in physical activity scale (ROPAS) will be utilized to measure the psychological need of relatedness specifically focusing on physical activity. The ROPAS scale used in this intervention contains 6-items, all gauging relatedness in regards to physical activity.

Health Care Climate Questionnaire- The health care climate questionnaire will be utilized post study among the motivational intervention group. This questionnaire will assess to the extent to which the interviewer provides an autonomy supportive climate. This scale has 15 items, all rating the perceived autonomy support of the motivational interview sessions and interviewer.

All scales have previously established acceptable validity and reliability.

Accelerometer

An accelerometer is a small device (1" by 1.5") validated to record activity counts and step counts. The number of counts accumulated over a minute are used to determine sedentary, light, moderate, or vigorous activity based on previously validated cut-off values. For this study an accelerometer will be worn on the hip or wrist over 7 days at baseline, week 10 and week 20. The accelerometer will be given to the participants and verbal instructions will be given and are listed in Appendix C7. An accelerometer log will be given to the participants to record wear times.

Dietary Recall

A 3-day dietary recall will be given to the participants to determine nutrition intake over two weekdays and one weekend day. Participants will be asked to record all food and beverages consumed and approximate the amount consumed. The dietary recall can be found in Appendix C.8.

Participants will be randomly assigned to groups by a coin flip after baseline data is collected.

Intervention Group Weeks 1, 4 and 7 - 30 minutes each X 3 = 90 minutes.

A motivational interviewing session will take place at the Kinesiology department. Motivational interviewing is a type of communication method that is subject centered, non-judgmental, evocative, empathetic, and collaborative. During these sessions, patients will discuss their own ideas for solutions with the guide and expertise of the professional. Typical motivational interviewing skills include: asking permission to share information, avoid confrontation, asking open-ended questions, developing discrepancy, assessing readiness to change, and focusing on incremental change. These sessions will last 30 minutes. Topics will center on weight management and will typically include: physical activity, nutrition, stress management, time management, sleep, alcohol consumption, etc. Due to the interviewing sessions being subject centered, an interview outline or script isn't utilized. This interview will be audio recorded, transcribed and analyzed for themes. In addition, in order to determine intervention fidelity, all transcribed interviews will be reviewed and scored by a motivational interviewing expert (Dr. Kavookjian). Finally, all interviewers have undergone training (over 6 hours) for motivational interviewing.

Electronic Education Group Weeks 1, 4 and 7 - 10 minutes reading times three emails for a total of 30 minutes.

An educational module will be sent via email on the corresponding weeks. The module will last about 10 minutes and touch upon various health topics that apply to college students and weight management such as: physical activity, nutrition, stress management, time management, sleep, alcohol consumption, etc. An example of such content is available in **Appendix C.11**.

Weeks 10 and 28 – 60 minutes each session for a total of 120 minutes.

Post-testing will occur at weeks 10 and 28. Subjects will complete the iDXA scan, questionnaires, dietary recall, and physical activity recall during both follow-up appointments. These post-test measures will take place at the KINE department in Tigerfit (room 126) and the DEXA (room 125). In addition at week 10 participants in the Motivational interviewing intervention group will complete a health care climate questionnaire to determine their perception of the intervention.

Week 11 and 29- 20 minutes

Participants will return accelerometer 1 week after they complete post-testing. Participants will also participate in a qualitative interview lasting 15-20 minutes touching upon experiences throughout the study and receive their results. The qualitative questions can be located in Appendix C.10. This will take place at the KINE department, in Exercise Adherence and Obesity Prevention Lab (room 149).

13. PROJECT DESIGN & METHODS. *Continued*

c. List all data collection instruments used in this project, in the order they appear in Appendix C.
(e.g., surveys and questionnaires in the format that will be presented to participants, educational tests, data collection sheets, interview questions, audio/video taping methods etc.)

Informed Consent, PAR-Q, Behavioral Regulation, Exercise Questionnaire, Basic Psychological Need Exercise Scale, Relatedness to Others Physical Activity Scale, Health Care Climate Questionnaire, Data Collection Sheet, Accelerometer, Dietary Recall, Qualitative Questions, Recruitment Flyer, Social Media Script

d. Data analysis: Explain how the data will be analyzed.

Paired sample t-tests will be utilized to compare the differences between the baseline and post-intervention results within the group. Independent sample t-tests will be implemented to detect the differences between the motivational interviewing intervention and the electronic education groups. Hierarchical regression analyses will be conducted to test for moderation and mediation.

14. RISKS & DISCOMFORTS: List and describe all of the risks that participants might encounter in this research. *If you are using deception in this study, please justify the use of deception and be sure to attach a copy of the debriefing form you plan to use in Appendix D. (Examples of possible risks are in section #6D on page 2)*

1. Risks of exercise include nausea, fainting, dehydration, dizziness, muscle strain/pull, heart arrhythmia, and abnormal blood pressure response. It is important to note that exercise won't be completed during the intervention, instead participants will choose their own form of physical activity with guidance and support from the interviewer or educational material.
2. Psychological discomfort including anxiety.
3. A small amount of radiation from the IDXA scan.
4. Since we will be using human subjects coercion is a risk.
5. Since we will be using human subjects and will not be collecting data anonymously, breach of confidentiality is always a risk.

15. PRECAUTIONS. Identify and describe all precautions you have taken to eliminate or reduce risks as listed in #14. If the participants can be classified as a "vulnerable" population, please describe additional safeguards that you will use to assure the ethical treatment of these individuals. ***Provide a copy of any emergency plans/procedures and medical referral lists in Appendix D. (Samples can be found online at http://www.auburn.edu/research/vpr/ohs/sample.htm#precautions)***

1. The PAR-Q is used as a screening tool to determine if participants should start an exercise program.

2. The likelihood of psychological or emotional distress from completing the study is low. As a precaution, a Referral List of local mental health provided has been compiled to be offered to participants.

3. Radiation from the iDXA is equivalent to walking outside for approximately 10 minutes. All procedures used for the iDXA are standardized and follow radiation safety.
4. All research personnel have completed CITI training and will follow consenting procedures. These include: describing all aspects of the study, informing the participant about their rights and providing a copy of the consent form to the participants.
5. Even though data will not be collected anonymously, it will be recorded anonymously, with the code list linking the participants kept confidential in a locked filing cabinet until the end of the study when it will be destroyed. Audio files will be transcribed from a non-internet connected device and deleted as soon as transcription occurs within 6 months of collection.

If using the Internet or other electronic means to collect data, what confidentiality or security precautions are in place to protect (or not collect) identifiable data? Include protections used during both the collection and transfer of data.

Audio data and electronically stored will be recorded anonymously, using a code name instead of identifiable information. Audio data will be collected using a small device, not connected to the internet that contains a hard drive for storage. Interviews will be transferred from the device to an encrypted password protected computer maintained by Auburn University and then transcribed. Once transcription occurs, the audio files will be deleted.

All electronic data will be stored on a password protected, encrypted Desktop in Kameron Suire's office 142a @ 301 Wire Road or Dr. Wadsworth office 165. The office remains locked when not in use. In the event of Kameron Suire absence, Dr. Wadsworth's will maintain electronic data in her office, room 165.

iDXA data will be shared with the participant in the form of body composition (fat mass, lean mass and body fat percentage) and overall bone density. No medical referrals are included.

16. BENEFITS.

a. List all realistic direct benefits participants can expect by participating in this specific study.
(Do not include "compensation" listed in #12d.) Check here if there are no direct benefits to participants. ☐

Participants from this study will receive a DEXA scan which provides important information such as bone density, fat mass, and lean mass. Results do not include medical referrals. In addition, all participants will participate in a weight loss intervention that if successful could have direct benefits on health.

b. List all realistic benefits for the general population that may be generated from this study.

Should motivational interviewing demonstrate success when compared to an electronic education, there could be large implications due to target population as well as the nature of motivational interviewing. Motivational interviewing is a relatively inexpensive and low-intensive commitment for health professionals and may be more realistic for widespread implementation should the potential be demonstrated when compared to other methods. With college weight gain being prevalent, finding feasible methods to address this issue could positively impact the situation and make significant health improvements.

17. PROTECTION OF DATA.

a. Data are collected:

☐ Anonymously with no direct or indirect coding, link, or awareness of who participated in the study (Skip to e)

☐ Confidentially, but without a link of participant's data to any identifying information (collected as "confidential" but recorded and analyzed as "anonymous") (Skip to e)

☐ ✔Confidentially with collection and protection of linkages to identifiable information

b. If data are collected with identifiers or as coded or linked to identifying information, describe the identifiers collected and how they are linked to the participant's data.

We will know the identity of the participants as we collect the data, but the data will be recorded by participant identifier only. After data collection and collation, the master list linking participant to numbered data will be destroyed.

c. Justify your need to code participants' data or link the data with identifying information.

Identity of participants is necessary to link baseline and follow-up data.

d. Describe how and where identifying data and/or code lists will be stored. (Building, room number?) Describe how the location where data is stored will be secured in your absence. For electronic data, describe security. If applicable, state specifically where any IRB-approved and participant-signed consent documents will be kept on campus for 3 years after the study ends.

An electronic copy of the code list will be stored on a password protected, encrypted Desktop in Kameron Suire's office 142a @ 301 Wire Road. The consent forms will also be stored in this office. The office remains locked when not in use. In the event of Kameron Suire absence, Dr. Wadsworth's will maintain the code list and consent forms in her office, room 165.

e. Describe how and where the data will be stored (e.g., hard copy, audio cassette, electronic data, etc.), and how the location where data is stored is separated from identifying data and will be secured in your absence. For electronic data, describe security

Hard copies of data will be stored in a locked filing cabinet in Room 142a. The room remains locked when not in use. Electronic data formats will be stored on a password protected encrypted computer in room 142a. This computer is maintained by the College of Education IT.

f. Who will have access to participants' data?
(*The faculty advisor should have full access and be able to produce the data in the case of a federal or institutional audit.*)

Kameron Suire and Dr. Wadsworth will have full access to the data. Only the research personnel identified in this Human Subjects section will have any access to the data.

g. When is the latest date that identifying information or links will be retained and how will that information or links be destroyed? ☐
(Check here if only anonymous data will be retained)

Dr. Wadsworth will keep the informed consent for three years (as required) in room 165. The master list will be deleted from the computer once all data have been collected and collated, which is typically 6 months after the final data week.

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD
REQUEST for MODIFICATION

For Information or help completing this form, contact: **THE OFFICE OF RESEARCH COMPLIANCE (ORC)**
Phone: 334-844-5966 **E-Mail:** IRBAdmin@auburn.edu **Web Address:** http://www.auburn.edu/research /vpr/ohs

In MS Word, click in the white boxes and type your text; double-click checkboxes to check/uncheck.

- **Federal regulations require IRB approval before implementing proposed changes.**
- **Change means any change, in content or form, to the protocol, consent form, or any supportive materials (such as the Investigator's Brochure, questionnaires, surveys, advertisements, etc.). See Item 4 for more examples.**
- **Form must be populated using Adobe Acrobat / Pro 9 or greater standalone program (do not fill out in browser). Hand written forms will not be accepted.**

1. Today's Date	03/30/2020

2. Principal Investigator (PI)

Principal Inves. (title):	Dr. Danielle Wadsworth	**Faculty PI (if PI is a student):**	
Department:	Kine	**Department:**	
Phone:	1836	**Phone:**	
AU E-mail:	wadswdd	**AU E-mail:**	
Contact person who should receive copies of IRB correspondence (Optional)			
Name:	Danielle Wadsworth	**Department Head:**	Mary Rudisill
Phone:	334-844-1836		
AU E-mail:	wadswdd@auburn.edu		

3. AU IRB Protocol Identification

3.a. Protocol Number	19-388 AR 1910
3.b. Protocol Title	Motivational interviewing to address freshman weight gain

3.c. Current Status of Protocol—For active studies, check ONE box at left; provide numbers and dates where applicable

☐ **Study has not yet begun; no data has been entered collected**

X **In progress If YES, number entered**
Adverse events since last review
0
Data analysis only

Approval Dates: From
To

☐

☐ **Funding Agency and Grant Number:** **AU Funding Information:**

☐ **List any other institutions and/or IRBs associated with this project:**

4. Types of Change

Mark all that apply, and describe the changes in item 5

☐ **Change Key Personnel**
Attach CITI forms for new personnel.

☐ **Additional Sites or Change in Sites, including AU classrooms, etc.**
Attach permission forms for new sites.

☐ **Change in methods for data storage/protection or location of data/consent documents**

☐ **Change in project purpose or project questions**

☐ **Change in population or recruitment**
Attach new or revised recruitment materials as needed; both highlighted version & clean copy for IRB approval stamp

The Auburn University Institutional Review Board has approved this Document for use from 04/15/2020 to 9/17/2020 Protocol # 19-388 AR 1810

X	**Change in study procedures** Attach new or revised consent documents as needed; both highlighted version & clean copy for IRB approval stamp
☐	**Change in data collection instruments/forms (surveys, data collection forms)** Attach new forms as needed; both highlighted version & clean copy for IRB approval stamp
☐	**Other** (BUAs, DUAs, etc.) Indicate the type of change in the space below, and provide details in Item 5.c. or 5.d. as applicable. Include a copy of all affected documents, with revisions highlighted as applicable.

▶ Provided clinical trial number.

5. Description and Rationale

5.a. For each item marked in Question #4 describe the requested changes to your research protocol, with an explanation and/or rationale for each.
Additional pages may be attached if needed to provide a complete response.

- ▶ Due to the COVID-19 pandemic it is necessary to change some procedures. We currently have 39 participants enrolled that have completed baseline testing and the intervention (weeks 0-7). We are unable to complete week 10 and 11 testing due to social distancing regulations. Therefore, we are extending our intervention through the summer and will conduct testing in August, which was previously approved. The following changes are being made to the protocol:
- ▶ Week 10 post-testing and week 11 post-testing will not occur
- ▶ Week 28 and week 29 post-testing will remain the same as detailed in the previously approved protocol.
- ▶ Both the motivational interviewing and e-education group will receive three additional intervention sessions on weeks 11, 16, 21. Motivational interviewing sessions will occur via zoom.
- ▶ The incentive structure has been altered so that now all 39 participants will receive a $25 gift card at week 28 post-testing appointment instead of being entered into a raffle. We changed this due to the extended nature of the intervention and to encourage post-testing attendance.
- ▶ We will send the enrolled participants an e-mail directing them to a qualtrics. The new consent will be on qualtrics and the participant will type their name to document consent.

5.b. Briefly list (numbered or bulleted) **the activities that have occurred up to this point, particularly those that involved participants.**

- ▶ 39 participants were consented and enrolled in the study.
- ▶ 39 participants completed baseline testing
- ▶ 39 participants received either the motivational interviewing or e-education intervention.

5.c. Does the change affect participants, such as procedures, risks, costs, benefits, etc.

▶ There is no change in risk. Benefits may increase due to the extended nature of the intervention and the potential to increase healthy eating and physical activity during times of high stress.

5.d. Identify any changes in the safeguards or precautions that will be used to minimize described risks.

▶ None

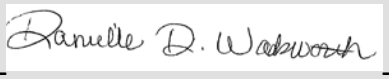
5.e. Attach a copy of <u>all</u> "stamped" IRB-approved documents currently used. (information letters, consents, flyers, etc.

▶ Forms are attached.

5.f. Attach a copy of all revised documents (high-lighted revised version and clean revised version for the IRB approval stamp).

▶ Forms are attached.

6. Signatures

Principal Investigator  _____

Faculty Advisor PI, if applicable _____

AUBURN UNIVERSITY
COLLEGE OF EDUCATION

Informed Consent for a Research Study entitled: Motivational Interviewing to address weight gain.

Due to COVID-19 and CDC guidelines for social distancing, the current project has been restructured. Previously you agreed to participate in this study; however, we had to make some changes to the procedures and want to be sure you agree and wish to continue as a participant. You have already completed baseline testing as well as week 1, 4, and 7 of the intervention. The following aspects of the study has changed:

- Week 10 post-testing and week 11 qualitative interview has been canceled.
- Week 28 follow-up testing and week 29 follow-up qualitative interview will remain and serve as post-testing.
- You will receive 3 additional interviews/educational materials depending on your group at week 11, 16, 21. Interviews will take place via zoom.
- The incentive structure has been altered. You will now receive a $25 amazon gift card at the week 28 post-testing appointment instead of being entered in a raffle.

General Information	You are invited to participate in a study that will investigate the effects of two different approaches to addressing weight gain. The procedures, risks, and benefits are fully described further in the consent form. To be eligible for the study you must be a college student, who is at low risk for medical complications from exercise, currently not exercising, over 25 BMI and not pregnant.
Purpose	The purpose of the study is to determine the effect of Motivational Interviewing and e-health education on body composition and psychological outcomes.
Duration & Visits	Motivational interviewing Group: 60 Minutes for Baseline, Post-Testing, and follow-up testing. 30 minutes for Week 1, 4, 7, 11, 16, 21 interviews 20 minutes for week 29 qualitative interview. E-Health Education-60 Minutes for Baseline, Post-Testing, and follow-up testing. 10 minutes for electronic education at Week 1, 4, 7, 11, 16, 21, 20 minutes for week 29 qualitative interview.
Overview of Procedures	You will come to a screening that will include questionnaires, DEXA scan, height and weight, and in-body scan. If you are eligible and enroll in the study you will be randomized to either the motivational interviewing group or electronic education group. After completing the protocol for your group (listed below), you will complete post-testing at week 28. Qualitative interviewing will occur at 29, detailing your experience.
Risks	Risk of self-directed exercise is small but present. There is a small amount of radiation involved with the DEXA scan (approximately equal to 10 minutes of walking outside). Risk of confidentiality breach.
Benefits	Kameron Suire and Dr. Wadsworth will provide you with all of your results including: DEXA scans, weight, BMI, Physical activity level, and eating habits after completion of intervention.
Alternatives	The alternative is to not participate in this study

What will be involved if you participate? Total estimated time for this study is 5-7 hours.

To be eligible for the study you must be: a college student, who is at low risk for medical complications for exercise, currently not regularly exercising, over 25 BMI and not pregnant. We will assess these eligibility during baseline testing which is described below.

Initials _____

Week 0, Day 1 Baseline Testing – 60 minutes: On the first day you will arrive to the lab in a fasting state (i.e. no food for eight hours prior to your lab visit) and complete the consent form and PAR-Q. The PARQ is a screening tool that helps us determine if you are ready for physical activity. Kameron Suire or Dr. Wadsworth will be present for all informed consent briefings. We will then measure your height and weight to determine study eligibility.

Those that meet study criteria will receive a total body iDXA scan, BIA body composition scan, complete questionnaires (behavioral regulation, psychological needs scale and relatedness to others scale) and provide basic information including birthdate, race, sex, handedness, cell phone number and email address.
Following your consenting process you will complete an iDXA total body composition scan. The scan is an x-ray that measures the amount of muscle and fat in your body. The radiation you are exposed to during this scan is equal to walking outside on a sunny day for 10 minutes. Over the course of the study you will have three iDXA scans which equal .09 mrads. You will also complete a BIA scan that measures how much water you have in your body. This scans requires you to stand on a scale for approximately 30 seconds. Finally, you will receive food logs to record your food intake and accelerometers to wear on the waist or wrist to measure daily physical activity. After a week you will return your food logs and accelerometers to the KINE building.

Weeks 1, 4, 7, 11, 16, 21 (30 minutes per interview/ 180 minutes total) OR (10 minutes per email/ 60 minutes total) After baseline testing you will be assigned to an intervention group: motivational interviewing or e-health education based on a coin flip. The motivational interviewing group will consist of six, thirty minute interviews over the course of 28 weeks (approximately 1 every 3 weeks.) for a total time commitment of 180 minutes. The e-health education intervention will consist of six e-mails that contain educational material aimed at improving health outcomes. These educational materials take about 10 minutes to read, for a total time commitment of 60 minutes over 28 weeks. For both interventions, the following topics may be addressed: physical activity, nutrition, stress management, time management, sleep and alcohol consumption.

Week 28 (60 minutes): Will be a retest of all variables examined in week 1 including: iDexa, BIA, questionnaires, dietary log and accelerometers.

Week 29 (30 minutes): After you have completed all of your post-testing you will be asked to return to the lab for a brief interview and return the accelerometer and dietary log. This interview will last 15-20 minutes and ask you about your experiences with the program. This interview will be audio recorded with your individual subject identifier. The audio tapes will be destroyed after the transcription is complete, which is typically 6-months after your interview. At this time, you will be given all of your results thus far.

Potential Risks

1. Risks of exercise include nausea, fainting, dehydration, dizziness, muscle strain/pull, heart arrhythmia, and abnormal blood pressure response. It is important to note that exercise won't be completed during the intervention, instead participants will choose their own form of physical activity with guidance and support from the interviewer or educational material.
2. A small amount of radiation from the IDXA scan.
3. Since we will be using human subjects and will not be collecting data anonymously, breach of confidentiality is always a risk.

"Note" Although injuries are not anticipated in this protocol, it is important for you to acknowledge that the investigators have no plans for compensation in the event of an injury you experience.

Precautions

1. The PAR-Q is used to screen for your ability to start exercise. In addition, you may ask questions about exercise in your interviews or reply to the emails.
2. Radiation from the iDXA is equivalent to walking outside for approximately 10 minutes. All procedures used for the iDXA are standardized and follow radiation safety.
3. Even though data will not be collected anonymously, it will be recorded anonymously, with the code list linking the participants kept confidential in a locked filing cabinet until the end of the study when it will be destroyed. Audio files will be transcribed from a non-internet connected device and deleted as soon as transcription occurs within 6 months of collection.

Benefits and Compensation:
Kameron Suire and Dr. Wadsworth will provide you with all of your results including: iDexa scans, weight, BMI, Physical activity level, and eating habits after completion of intervention. You will be given a handout and suggestions for maintaining your physical activity. We will not give any medical referrals based on your results.

You will receive $25 amazon gift card at the week 28 post-testing appt. for participation in the study.

Your participation is completely voluntary. If you change your mind about participating, you can withdraw at any time during the study. If you choose to withdraw, you can request to have your data withdrawn. Your decision about whether or not to participate or stop participating will not jeopardize your future relations with Auburn University, the School of Kinesiology, or the Epidemiology Lab.
Your privacy will be protected. Any information obtained in connection with this study will be maintained confidentially. Information obtained through your participation may be published or presented at a professional meeting. If so, no information which could identify you will be presented. A description of this clinical trial will be available on www.ClinicalTrials.gov, as required by US Law. This website will not include information that can identify you. At most, the website will include a summary of results. You can search the website at any time.

If you have questions about this study, please ask them now or contact Kameron Suire at kbs0041@auburn.edu or Danielle Wadsworth at wadswdd@auburn.edu. A copy of this document will be given to you to keep.
If you have questions about your rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334)- 844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. TYPING YOUR NAME IN THE BOX BELOW INDICATES YOUR WILLINGNESS TO PARTICIPATE.

Participant's signature	Printed Name	Date
Investigator obtaining consent	Printed Name	Date
Co-Investigator	Printed Name	Date

AUBURN UNIVERSITY
COLLEGE OF EDUCATION

Informed Consent for a Research Study entitled: Motivational Interviewing to address weight gain.

Due to the COVID-19 and CDC guidelines for social distancing, the current project has been restructured. Previously you agreed to participate in this study; however, we had to make some changes to the procedures and want to be sure you agree and wish to continue as a participant. You have already completed baseline testing as well as week 1, 4, and 7 of the intervention. The following aspects of the study has changed:

- Week 10 post-testing and week 11 qualitative interview has been canceled.
- Week 28 follow-up testing and week 29 follow-up qualitative interview will remain and serve as post-testing.
- You will receive 3 additional interview/educational materials depending on your group at week 11, 16, and 21. Interviews will take place via zoom.
- The incentive structure has been altered. You will now receive a $25 dollar amazon gift card at the week 28 post-testing appointment instead of being entered into a raffle.

General Information	You are invited to participate in a study that will investigate the effects of two different approaches to addressing weight gain. The procedures, risks, and benefits are fully described further in the consent form. To be eligible for the study you must be a college student, who is at low risk for medical complications from exercise, currently not exercising, over 25 BMI and not pregnant.
Purpose	The purpose of the study is to determine the effect of Motivational Interviewing and e-health education on body composition and psychological outcomes.
Duration & Visits	Motivational interviewing Group: 60 Minutes for Baseline, Post-Testing, and follow-up testing. 30 minutes for Week 1, 4, 7, 11, 16, 21, 20 minutes for week 29 qualitative interview. E-Health Education-60 Minutes for Baseline, Post-Testing, and follow-up testing. 10 minutes for electronic education at Week 1, 4, 7, 11, 16, 21, 20 minutes for week 29 qualitative interview.
Overview of Procedures	You will come to a screening that will include questionnaires, DEXA scan, height and weight, and in-body scan. If you are eligible and enroll in the study you will be randomized to either the motivational interviewing group or electronic education group. After completing the protocol for your group (listed below), you will complete post-testing at week 28. Qualitative interviewing will occur at 29, detailing your experience.
Risks	Risk of self-directed exercise is small but present. There is a small amount of radiation involved with the DEXA scan (approximately equal to 10 minutes of walking outside). Risk of confidentiality breach.
Benefits	Kameron Suire and Dr. Wadsworth will provide you with all of your results including: DEXA scans, weight, BMI, Physical activity level, and eating habits after completion of intervention.
Alternatives	The alternative is to not participate in this study

What will be involved if you participate? Total estimated time for this study is 5-7 hours.

To be eligible for the study you must be: a college student, who is at low risk for medical complications for exercise, currently not regularly exercising, over 25 BMI and not pregnant. We will assess these eligibility during baseline testing which is described below.

Initials _____

Week 0, Day 1 Baseline Testing – 60 minutes: On the first day you will arrive to the lab in a fasting state (i.e. no food for eight hours prior to your lab visit) and complete the consent form and PAR-Q. The PARQ is a screening tool that helps us determine if you are ready for physical activity. Kameron Suire or Dr. Wadsworth will be present for all informed consent briefings. We will then measure your height and weight to determine study eligibility.

Those that meet study criteria will receive a total body iDXA scan, BIA body composition scan, complete questionnaires (behavioral regulation, psychological needs scale and relatedness to others scale) and provide basic information including birthdate, race, sex, handedness, cell phone number and email address.
Following your consenting process you will complete an iDXA total body composition scan. The scan is an x-ray that measures the amount of muscle and fat in your body. The radiation you are exposed to during this scan is equal to walking outside on a sunny day for 10 minutes. Over the course of the study you will have three iDXA scans which equal .09 mrads. You will also complete a BIA scan that measures how much water you have in your body. This scans requires you to stand on a scale for approximately 30 seconds. Finally, you will receive food logs to record your food intake and accelerometers to wear on the waist or wrist to measure daily physical activity. After a week you will return your food logs and accelerometers to the KINE building.

Weeks 1, 4, 7, 11, 16, 21 (30 minutes per interview/ 180 minutes total) OR (10 minutes per email/ 60 minutes total. After baseline testing you will be assigned to an intervention group: motivational interviewing or e-health education based on a coin flip. The motivational interviewing group will consist of six, thirty minute interviews over the course of 28 weeks (approximately 1 every 3 weeks.) for a total time commitment of 180 minutes. The e-health education intervention will consist of six e-mails that contain educational material aimed at improving health outcomes. These educational materials take about 10 minutes to read, for a total time commitment of 60 minutes over 28 weeks For both interventions, the following topics may be addressed: physical activity, nutrition, stress management, time management, sleep and alcohol consumption.

Week 28 (60 minutes): Will be a retest of all variables examined in week 1 including: iDexa, BIA, questionnaires, dietary log and accelerometers.

Week 29 (30 minutes): After you have completed all of your post-testing you will be asked to return to the lab for a brief interview and return the accelerometer and dietary log. This interview will last 15-20 minutes and ask you about your experiences with the program. This interview will be audio recorded with your individual subject identifier. The audio tapes will be destroyed after the transcription is complete, which is typically 6-months after your interview. At this time, you will be given all of your results thus far.

Potential Risks

1. Risks of exercise include nausea, fainting, dehydration, dizziness, muscle strain/pull, heart arrhythmia, and abnormal blood pressure response. It is important to note that exercise won't be completed during the intervention, instead participants will choose their own form of physical activity with guidance and support from the interviewer or educational material.
2. A small amount of radiation from the IDXA scan.
3. Since we will be using human subjects and will not be collecting data anonymously, breach of confidentiality is always a risk.

"Note" Although injuries are not anticipated in this protocol, it is important for you to acknowledge that the investigators have no plans for compensation in the event of an injury you experience.

Precautions

1. The PAR-Q is used to screen for your ability to start exercise. In addition, you may ask questions about exercise in your interviews or reply to the emails.
2. Radiation from the iDXA is equivalent to walking outside for approximately 10 minutes. All procedures used for the iDXA are standardized and follow radiation safety.
3. Even though data will not be collected anonymously, it will be recorded anonymously, with the code list linking the participants kept confidential in a locked filing cabinet until the end of the study when it will be destroyed. Audio files will be transcribed from a non-internet connected device and deleted as soon as transcription occurs within 6 months of collection.

Initials _____

Benefits and Compensation:
Kameron Suire and Dr. Wadsworth will provide you with all of your results including: iDexa scans, weight, BMI, Physical activity level, and eating habits after completion of intervention. You will be given a handout and suggestions for maintaining your physical activity. We will not give any medical referrals based on your results.

You will receive $25 amazon gift card at the week 28 post-testing appt. for participation in the study.

Your participation is completely voluntary. If you change your mind about participating, you can withdraw at any time during the study. If you choose to withdraw, you can request to have your data withdrawn. Your decision about whether or not to participate or stop participating will not jeopardize your future relations with Auburn University, the School of Kinesiology, or the Epidemiology Lab.
Your privacy will be protected. Any information obtained in connection with this study will be maintained confidentially. Information obtained through your participation may be published or presented at a professional meeting. If so, no information which could identify you will be presented. A description of this clinical trial will be available on www.ClinicalTrials.gov, as required by US Law. This website will not include information that can identify you. At most, the website will include a summary of results. You can search the website at any time.

If you have questions about this study, please ask them now or contact Kameron Suire at kbs0041@auburn.edu or Danielle Wadsworth at wadswdd@auburn.edu. A copy of this document will be given to you to keep.
If you have questions about your rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334)- 844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. TYPING YOUR NAME IN THE BOX BELOW INDICATES YOUR WILLINGNESS TO PARTICIPATE.

Participant's signature	Printed Name	Date
Investigator obtaining consent	Printed Name	Date
Co-Investigator	Printed Name	Date

The Auburn University Institutional Review Board has approved this Document for use from 04/15/2020 to 9/17/2020
Protocol # 19-388 AR 1810

Appendix B.1

Research Study: Personalized Weight Loss Study at the Kinesiology Department

Motivational Interviewing to address the "Freshman Fifteen".

Participation Requirements:
You are invited to participate in research study to address freshman weight gain. The entire study takes place over 29 weeks. Baseline at week 0, the core intervention will take place every three weeks from week 1 to week 7, post data collection at week 10 and 11, and a final follow-up will occur at week 28 and 29. Participants will either receive monthly health coaching sessions (3 in total) lasting about 30 minutes each or receive 3 separate education modules lasting about 10 minutes each. We will investigate changes to body composition and psychological outcomes.

To be eligible, you must meet all of the following criteria:

1. Classified as a college freshman and 18 years or older
2. Low risk for medical complications from exercise (as determined by physical activity readiness questionnaire (PARQ).
3. Neither currently engaging in exercise nor consistently exercising over the last three months (2 days per week).
4. BMI at or above 25 (Examples: weight at or above 146 for a height of 5'4, OR weight at or above 169 for a height of 5'9).
5. Not pregnant.

Benefits: Receive personalized, health coaching from an expert in health behavior change or electronic educational modules focused on college students. Receive multiple DEXA scans that provide accurate information on body fat, bone density, and lean mass.

Compensation: Four, $25 dollar gift cards will be raffled at pre-testing (week 0), week 1 intervention, week 4 intervention, week 7 intervention, week 10 post-testing, week 11 accelerometer drop off and qualitative interview, week 28 follow-up, week 29 accelerometer drop off and qualitative interview. In total, $800 dollars' worth of gift cards will be rewarded at these 8 unique time points. Each participant can receive a maximum of 2 gift cards valued at $50. Using the expected number of participants, the odds of winning will be about 3% each drawing. This number will change depending on the number of entry participants and attrition.

YOUR PARTICIPATION IS COMPLETELY VOLUNTARY

Contact Information: Please contact Kameron Suire: kbs0041@auburn.edu or 337-396-8980.

Appendix B.2 Social Media Script

Participation Requirements:

You are invited to participate in research study to address freshman weight gain. The entire study takes place over 29 weeks. Baseline at week 0, the core intervention will take place every three weeks from week 1 to week 7, post data collection at week 10 and 11, and a final follow-up will occur at week 28 and 29. Participants will either receive monthly health coaching sessions (3 in total) lasting about 30 minutes or receive 3 separate education modules lasting about 10 minutes each. We will investigate changes to body composition and psychological outcomes.

To be eligible, you must be:

1. Classified as a college freshman and 18 years or older

2. Low risk for medical complications from exercise (as determined by physical activity readiness questionnaire

(PARQ+).

3. Neither currently engaging in exercise nor consistently exercising over the last three months (2 days per week).

4. BMI at or above 25(Examples: weight at or above 146 for a height of 5'4, OR weight at or above 169 for a height of 5'9).

5. Not pregnant.

Benefits: Receive personalized, health coaching from an expert in health behavior change or electronic educational modules focused on college students. Receive multiple DEXA scans that provide accurate information on body fat, bone density, and lean mass.

Compensation: Four, $25 dollar gift cards will be raffled at pre-testing (week 0), week 1 intervention, week 4 intervention, week 7 intervention, week 10 post-testing, week 11 accelerometer drop off and qualitative interview, week 28 follow-up, week 29 accelerometer drop off and qualitative interview. In total, $800 dollars' worth of gift cards will be rewarded at these 8 unique time points. Each participant can receive a maximum of 2 gift cards valued at $50. Using the expected number of participants, the odds of winning will be about 3% each drawing. This number will change depending on the number of entry participants and attrition.

YOUR PARTICIPATION IS COMPLETELY VOLUNTARY

CONTACT INFORMATION: Please contact Kameron Suire at: kbs0041@auburn.edu or via text or phone call at 337-396-8980.

Appendix C.1

Adapted PAR-Q

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people.

However, some people should check with their doctor before they start becoming much more physically active. If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly with response of Yes or No.

1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?

2. Do you feel pain in your chest when you do physical activity?

3. In the past month, have you had chest pain when you were not doing physical activity?

4. Do you lose your balance because of dizziness or do you ever lose consciousness?

5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?

6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?

7. Do you know of any other reason why you should not do physical activity?

8. Are you pregnant?

Informed use of the PAR-Q: Reprinted from ACSM's Health/Fitness Facility Standards and Guidelines, 1997 by American College of Sports Medicine. *Added Pregnancy Question for Research Eligibility.

Appendix C.2

EXERCISE REGULATIONS QUESTIONNAIRE (BREQ-3)

Age: _____years **Sex: male female (please circle)**

WHY DO YOU ENGAGE IN EXERCISE?

We are interested in the reasons underlying peoples' decisions to engage or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

		Not true for me		Sometimes true for me		Very true for me
1	It's important to me to exercise regularly	0	1	2	3	4
2	I don't see why I should have to exercise	0	1	2	3	4
3	I exercise because it's fun	0	1	2	3	4
4	I feel guilty when I don't exercise	0	1	2	3	4
5	I exercise because it is consistent with my life goals	0	1	2	3	4
6	I exercise because other people say I should	0	1	2	3	4
7	I value the benefits of exercise	0	1	2	3	4
8	I can't see why I should bother exercising	0	1	2	3	4
9	I enjoy my exercise sessions	0	1	2	3	4
10	I feel ashamed when I miss an exercise session	0	1	2	3	4
11	I consider exercise part of my identity	0	1	2	3	4
12	I take part in exercise because my friends/family/partner say I should	0	1	2	3	4
13	I think it is important to make the effort to exercise regularly	0	1	2	3	4
14	I don't see the point in exercising	0	1	2	3	4
15	I find exercise a pleasurable activity	0	1	2	3	4
16	I feel like a failure when I haven't exercised in a while	0	1	2	3	4
17	I consider exercise a fundamental part of who I am	0	1	2	3	4
18	I exercise because others will not be pleased with me if I don't	0	1	2	3	4
19	I get restless if I don't exercise regularly	0	1	2	3	4
20	I think exercising is a waste of time	0	1	2	3	4

		Not true for me		Sometimes true for me		Very true for me
21	I get pleasure and satisfaction from participating in exercise	0	1	2	3	4
22	I would feel bad about myself if I was not making time to exercise	0	1	2	3	4
23	I consider exercise consistent with my values	0	1	2	3	4
24	I feel under pressure from my friends/family to exercise	0	1	2	3	4

Wilson, P.M., Rodgers, W.M., Loitz, C.C., & Scime, G. (2006). “It’s who I am…really!” The importance of integrated regulation in exercise contexts. *Journal of Biobehavioral Research, 11*, 79-104.

Markland, D. & Tobin, V. (2004). A modification of the Behavioral Regulation in Exercise Questionnaire to include an assessment of amotivation. *Journal of Sport and Exercise Psychology, 26,* 191-196.

Appendix C.3

The Basic Psychological Needs in Exercise Scale (BPNES)

Instructions:
The following sentences refer to your overall experiences in exercise as op- posed to any particular situation. Using the 1-5 scale below, please indicate the extent to which you agree with these statements by circling one number for each statement.

	I don't agree at all	I agree a little bit	I somewhat agree	I agree a lot	I completely agree
1. I feel I have made a lot of progress in relation to the goal I want to achieve.	1	2	3	4	5
2. The way I exercise is in agreement with my choices and interests.	1	2	3	4	5
3. I feel I perform successfully the activities of my exercise program.	1	2	3	4	5
4. My relationships with the people I exercise with are very friendly.	1	2	3	4	5
5. I feel that the way I exercise is the way I want to.	1	2	3	4	5
6. I feel exercise is an activity which I do very well.	1	2	3	4	5
7. I feel I have excellent communication with the people I exercise with.	1	2	3	4	5
8. I feel that the way I exercise is a true expression of who I am.	1	2	3	4	5
9. I am able to meet the requirements of my exercise program.	1	2	3	4	5
10. My relationships with the people I exercise with are close.	1	2	3	4	5
11. I feel that I have the opportunity to make choices with regard to the way I exercise	1	2	3	4	5

Vlachopoulos, S. P., Ntoumanis, N., & Smith, A. L. (2010). The basic psychological needs in exercise scale: Translation and evidence for cross-cultural validity. international Journal oF sport and exercise psychology, 8(4), 394-412.

Appendix C.4

Relatedness to Others in Physical Activity (6-item)

Circle the best option that best represents your feelings in regards to your physical activity habits and behavior.

I am included by others	False	Mostly False	More False than True	More false than True	Mostly True	True
I am part of a group who share my goals	False	Mostly False	More False than True	More false than True	Mostly True	True
I am supported by others in this activity	False	Mostly False	More False than True	More false than True	Mostly True	True
Others want me to be involved with them	False	Mostly False	More False than True	More false than True	Mostly True	True
I have developed a close bond with others	False	Mostly False	More False than True	More false than True	Mostly True	True
I fit in well with others	False	Mostly False	More False than True	More false than True	Mostly True	True

Wilson, P. M., & Bengoechea, E. G. (2010). The relatedness to others in physical activity scale: evidence for structural and criterion validity. *Journal of Applied Biobehavioral Research*, *15*(2), 61-87.

Appendix C.5

Health Care Climate Questionnaire

Perceived Autonomy Support

Please answer the questions below **regarding your relationship with your interviewer about various health behaviors.** Interviewers have different styles in dealing with patients. Your responses will be kept confidential, so none of the practitioners will know your responses. Please be honest and candid. Choose your answers using the scale below for each question by filling in the blank after each question with a number from 1 to 7.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

1. I feel that my interviewer has provided me choices and options about my health. _____
2. I feel my interviewer understands how I see things with respect to my health. _____
3. I am able to be open with my interviewer about my health. _____
4. My interviewer conveys confidence in my ability to make changes regarding my health. _____
5. I feel that my interviewer accepts me whether I follow their recommendations or not. _____
6. My interviewer has made sure I really understand my health risk behaviors and the benefits of changing these behaviors without pressuring me to do so. _____
7. My interviewer encourages me to ask questions. _____
8. I feel a lot of trust in my interviewer. _____
9. My interviewer answers my questions related to my health fully and carefully. _____
10. My interviewer listens to how I would like to do things regarding my health. _____
11. My interviewer handles my emotions very well. _____
12. I feel that my interviewer cares about me as a person. _____
13. I don't feel very good about the way my interviewer talks to me about my health. _____
14. My interviewer tries to understand how I see my health before suggesting any changes. _____
15. I feel able to share my feelings with my interviewer. _____

Adapted from: G.C. Williams, V.M. Grow, Z.R.Freedman, R.M. Ryan, E.L. Deci. Motivational predictors of weight loss and weight-loss maintenance. J Pers Soc Psychol, 70 (1) (1996), pp. 115-126.

Appendix C.6

Data Collection Worksheet

Subject #		Race:	
Date:		Accelerometer #	
DOB:	Height:		
Hand: R or L			
E-mail			
Phone			
Variable	Baseline	Post-Test	Follow-up
Weight			
Waist			
BMI			
Fat Mass lbs			
Lean Mass lbs			
BMD			
Hydration			

Appendix C.7

Activity and Accelerometer Log

Device and Activity Log

Wear the devices for seven (7) consecutive days. If you are unable to wear the device for seven (7) consecutive days, add additional days at the end of the week. Please fill out the log daily. An example entry is provided. If you take the accelerometer off for more than 5 minutes, such as showering, record when you take it off and put it back on, and any activity you performed while not wearing.

Questions? Just call or text: 337-396-8980 or email: kbs0041@aubum.edu

Example	Time On:	Time Off:	Activity while not wearing:	Location:	
	6:00 am	7:00 am	Showered and changed after walking in a.m.	Home	
	7:30	9:30 pm			
	Exercise performed: walked				

Day 1	Time On:	Time Off:	Activity while not wearing:	Location:
	Exercise performed:			
Day 2	Time On:	Time Off:	Activity while not wearing:	Location:

	Exercise performed:			
Day 3	Time On:	Time Off:	Activity while not wearing:	Location:
	Exercise performed:			
Day 4	Time On:	Time Off:	Activity while not wearing:	Location:
	Exercise performed:			
Day 5	Time On:	Time Off:	Activity while not wearing:	Location:
	Exercise performed:			

Day 6	Time On:	Time Off:	Activity while not wearing:	Location:
	Exercise performed:			

Day 7	Time On:	Time Off:	Activity while not wearing:	Location:
	Exercise performed:			

Appendix C.8

Three Day Food Log

1. Please write down everything you eat and drink for 3 typical days. Try to include at least one weekend day - Saturday or Sunday.

2. Record this in the column marked FOOD and BEVERAGES.

3. Record only amounts EATEN, not amount served.

4. Record the brand name and method of cooking in the "METHOD OF PREPARATION / BRAND NAME" column.

5. Under 'AMOUNT', record in 'teaspoons', 'cups', or fractions of these. You may use 'slices' or 'pieces' when necessary. If something eaten has a specific measurement on the label, record that amount. For example: Coke - 12 ounce can, Hershey bar 1.45 ounces.
6. It is important to remember the following while recording different types of food:

   Milk: State if whole, skim, fortified, powdered, liquid, evaporated, or chocolate

   Liquids: Record amount of milk and all beverages in 'cups' or 'ounces'.

   Bread: Specify white, rye, whole wheat, raisin, etc.

   Meats: Give the length, width and thickness of the portion, or its weight in 'ounces' after cooking.

   Cereals, rice, and pasta: Record amount of cereals, rice, and pasta in 'cups' or fractions of cup. Do not record in 'BOWLS'. List anything added e.g. fruit, sugar

   Fruits and Vegetables: Specify, fresh, frozen, canned, dried, or freeze dried.

   Condiments: Record any jelly, butter, ketchup, mayonnaise or seasonings added.

   Canned foods: Record what food is packed in – oil, water, syrup, etc.

Again, If you have any questions, please send me an email at wadswdd@auburn.edu or call 334-844-1836. I will be more than happy to answer your questions.

Danielle

Appendix C.9

24 Hour Diet Recall

Subject #: _____ Date:_____
Day of the week: Monday Tuesday Wednesday Thursday Friday Saturday Sunday
Does this day represent your typical eating habits? Yes No
Please be as specific and honest as possible for review with the Registered Dietitian. Thank you.

Day 1

Time	FOOD/BEVERAGES	Method of Preparation - (baked, fried, boiled, canned etc.) Brand Name	Amount/Serving Size

Day 2 24 Hour Diet Recall

Day of the week: Monday Tuesday Wednesday Thursday Friday Saturday Sunday
Does this day represent your typical eating habits? Yes No

Time	FOOD/BEVERAGES	Method of Preparation - (baked, fried, boiled, canned etc.) Brand Name	Amount/Serving Size

Day 3 24 Hour Diet Recall

Day of the week: Monday Tuesday Wednesday Thursday Friday Saturday Sunday

Does this day represent your typical eating habits? Yes No

Time	FOOD/BEVERAGES	Method of Preparation - (baked, fried, boiled, canned etc.) Brand Name	Amount/Serving Size

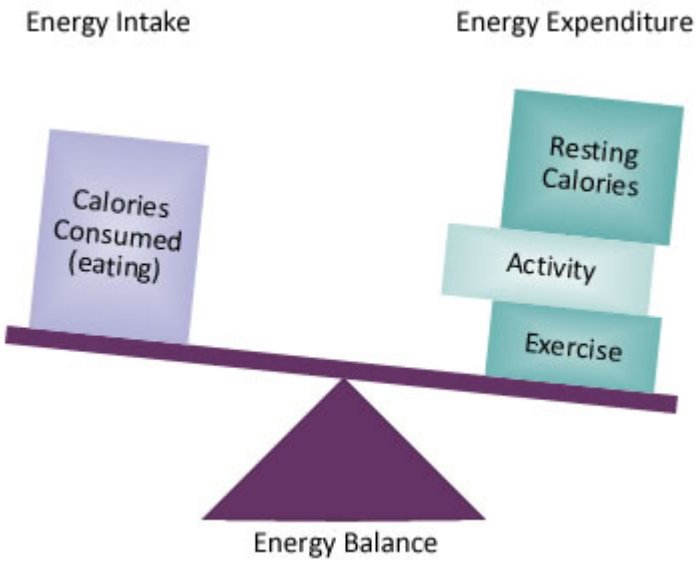
Appendix C.10
Qualitative Interview Questions

1. How would you describe your experience over the past three months?
2. What would you say was the most challenging aspects of changing your behavior?
3. Describe how the campus here at Auburn helps or hinders your behavior.
4. How successful do you feel with your health behavior after these last three months?
5. How would you describe your enjoyment and feelings of the interviews?
6. What are your thoughts on how the interviews contributed to your behavior?
7. What feedback or additional thoughts would you like to share today?

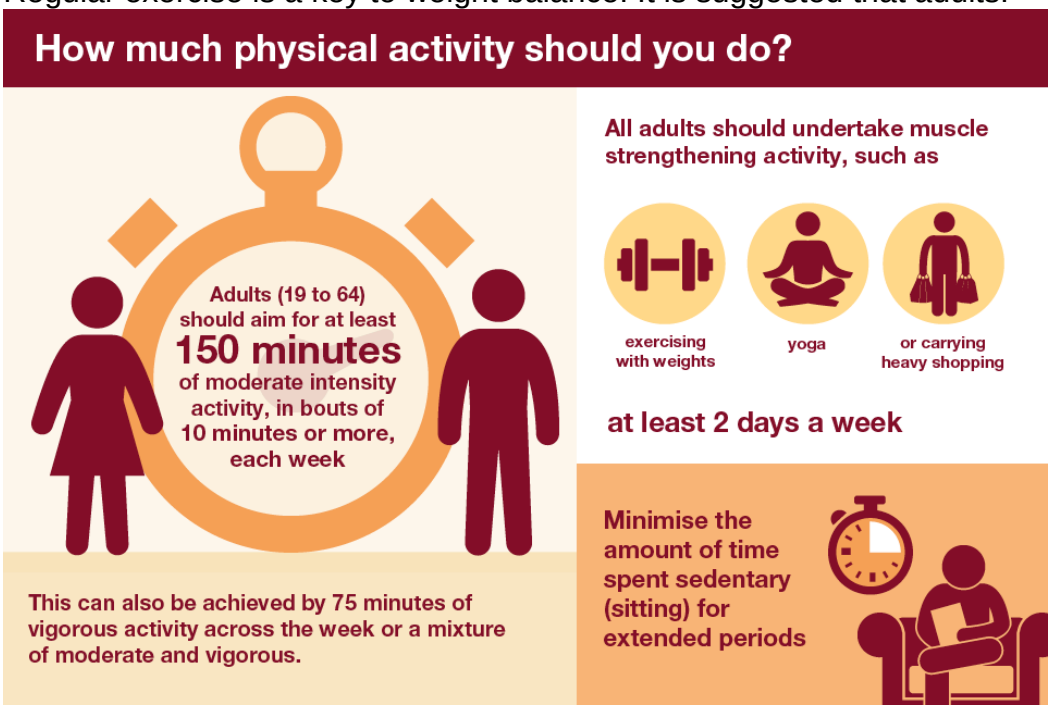
Appendix C.11

Electronic Content Example

Losing weight is really about the scale…but not the scale you are thinking about. It is really about the balance of energy intake and energy expenditure.



Regular exercise is a key to weight balance. It is suggested that adults:



Meeting these guidelines will help you balance your weight as well as improve overall health. You can see below how exercise can burn calories.

EXERCISE

TO LOSE AND CONTROL WEIGHT

Consistent exercise can help you increase your chances of living longer, decrease your chances of becoming depressed, sleep well at night, move around more easily, have stronger muscles and bones, and stay at or get to a healthy weight. Plus, physical activity can help you reduce your risk of heart disease, stroke, high blood pressure, high cholesterol, and even type 2 diabetes.

Most people should exercise for 30-60 minutes on most days in order to reap the substantial health benefits of regular physical activity.

According to the Physical Activity Guidelines for Americans, "Being physically active is one of the most important steps that Americans of all ages can take to improve their health."

Moving burns more calories than sitting:

Sedentary:	1 hour
computer, TV	76

Medium Activity:	1 hour
laundry	153
cooking	157
washing dishes	163
vacuuming, sweeping	180
grocery shopping	259
walking the dog	316
washing the car	326
dancing	326
gardening	345

Exercise:	1 hour
gym workout	403
walking, quickly	422
aerobics	431
biking, easy	470
racquetball	470
weight lifting	499
rollerblading	508
tennis singles	585
swimming	643
jogging	720