

**An evaluation of the feasibility and acceptability of a technology-based pilot
program to reduce overweight and obesity among college students**

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Abstract

Background: One-third of US undergraduate students are overweight or obese, and weight gain may occur during the college years. Thus, there is a need for weight loss interventions for college students. Innovative technology-based programs may be a promising strategy to promote weight loss. Weight management interventions incorporating technology have been implemented in US university settings, with varying degrees of success.

Objective: The purpose of this study was to investigate the feasibility and acceptability of a pilot technology-based weight loss program to reduce overweight and obesity among college students.

Methods: The pilot study investigated the effectiveness of a technology-based weight loss intervention on reducing body mass index (BMI) among college students. Participants were randomly assigned to one of two conditions: (1) an 8-week technology-based weight loss program or (2) an 8-week email education program. A mixed methods approach, including online surveys and focus groups, was employed to evaluate the feasibility and acceptability of the pilot study. Feasibility was measured through recruitment and retention data and participant engagement.

Results: Twenty undergraduate students (90% female, age 20.4 ± 1.4 years, BMI 32.1 ± 4.6 kg/m²) participated in the study. The retention rate for the study was 95%, with 90% of the intervention group and 100% of the control group completing the 8-week assessments. The technology-based program was acceptable to the students. In addition, over half the respondents in the intervention group indicated that text messaging was most helpful as well as the website, exercise videos, nutrition facts, and smartphone applications. There were mixed responses about the forum, which was underutilized. Participants in the intervention group expressed a desire for

additional accountability, support, and motivation and suggested using Skype group chats and mobile accessibility to further facilitate interaction among group members.

Conclusion: Technology-based weight loss interventions, which include a central peer support component and mobile accessibility, are a promising strategy for recruiting, retaining, and engaging overweight and obese college students. Further research is needed to enhance the development of effective technology-based programs for students.

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CHAPTER I
LITERATURE REVIEW

BACKGROUND AND SIGNIFICANCE

A. Introduction

The prevalence of overweight and obesity among undergraduate students in the United States is 33.7%, according to the 2013 American College Health Association survey [1]. This is a major concern, as cohort and cross-sectional studies suggest that higher weight status during young adulthood is associated with increased risk for metabolic syndrome [2], hypertension [3], cardiovascular events, and type 2 diabetes [4] in later life. Furthermore, longitudinal research indicates that young adults who are overweight may experience greater weight gain and obesity risk over a period of 10 to 15 years, compared to young adults who are a healthy weight [5, 6]. In addition, overweight and obesity has been linked with long-term risk for morbidity [7] and mortality [7, 8]. Thus, it is important to target young adults and college students in obesity prevention and treatment efforts [9-11].

Over 20 million students are enrolled in postsecondary institutions in the United States [12]. Consequently, implementing effective weight loss programs in the university setting may assist in reducing the prevalence of overweight and obesity among young adults. In a recent national survey of undergraduate students at 153 schools, 33.7% of respondents indicated an overweight or obese status [1]. Moreover, research shows that weight gain is common during the college years and may be mediated by a variety of unhealthful behaviors [11, 13]. Survey data reflect that only 6% of college students eat five or more daily servings of fruits and vegetables, and 50% meet the recommended levels of physical activity [1]. In addition, a prospective study revealed that young adults consume fast food an average of 2.5 times each week, an increase from an average of twice each week in adolescence [14]. Students suggest that environmental factors, such as the university cafeteria and the availability of fast food, impact weight gain and

encourage unhealthful behaviors [15, 16]. Social situations, stress, substance abuse, and a lack of time are perceived as other facilitators to less healthful behaviors [11, 15]. Thus, there is a need to develop and implement effective weight loss programs for college students, which reduce the prevalence of overweight and obesity and promote healthy choices in the university setting.

B. College Students and Technology

Weight loss programs incorporating technology and the Internet are promising for college students, who are comfortable with using technology. Students regularly access the Internet and use technology in their academic and personal lives. Findings from a 2013 survey revealed that almost 90% of US undergraduate students own a laptop and over 75% own a smartphone [17]. The recent trends suggest that ownership of technology devices is on the rise in the university setting. Particularly, both smartphone and tablet ownership among undergraduate students in 2013 increased nearly 15% since 2012 [17].

Many college students and young adults also regularly incorporate technology into their social lives [18, 19]. Students often initiate and maintain connections with others through social media. Young adults reportedly access social networking sites, such as Facebook, Twitter, Instagram, and Pinterest, more than any other age group [18]. Facebook continues to be the social media platform most often utilized by young adults, but Twitter and Pinterest are steadily growing in popularity [18]. In addition, mobile technology devices enable college students and young adults to remain connected throughout the day. The majority of young adults frequently use their smartphones for text messaging, social media, and emails [19].

College students' high ownership rates and frequent use of technology devices offers the advantage of easy access to a plethora of online health-related information. Students and young adults are among millions of Americans, who search the Internet for a variety of health-related

resources, including nutrition and physical activity information and online social support [20, 21]. According to a 2013 report, young adults were more likely to have used the Internet to access health-related information, compared to older adults [20]. Nearly three-fourths of young adults indicated that they had searched online for health materials [20]. Notably, 32% of the young adult Internet users reported that they had searched online for weight management information [20]. In addition to supporting access to health information, the Internet provides people with opportunities for online social support, offering users the ability to connect with others around similar health issues or shared experiences [22].

The widespread availability, high ownership rates, and frequent use of technology make it an attractive platform for weight management interventions for college students. Technology has the potential to successfully reach students by providing online social support, anonymity, and confidentiality and addressing concerns for stigmatization. Furthermore, technology can afford convenience [23], which could increase recruitment, retention, and participation among busy college students with different schedules.

C. Technology-Based Weight-Related Interventions

The results of several randomized controlled trials have demonstrated that Internet-based platforms can be utilized in weight management programs in the university setting [23-29]. Five studies explored the use of technology in programs seeking to prevent weight gain and promote healthful behaviors among students [23-26, 29]. These studies enrolled a broad range of students, ranging from underweight to obese students. In addition, two recent studies investigated the incorporation of technology into weight loss interventions, which exclusively target overweight and obese college students [27, 28]. Summaries of the technology-based weight-related studies are presented in Tables 1 and 2 in Appendix A.

C.1. Technology-Based Weight Gain Prevention Studies

Five studies evaluated the impact of technology-based interventions on anthropometric measures or weight-related health behaviors, such as diet and physical activity, among college students [23-26, 29]. Two studies supported the effectiveness of the programs on impacting weight outcomes; significantly less weight gain was found among students in the intervention groups compared to the control groups [24, 26]. One study showed positive improvements in dietary behaviors and motivation for change, but did not report on weight outcomes [29]. In contrast, the results of the other two studies reflected no significant differences in body mass index (BMI) and weight change between the groups; however, the studies reported improvements in health behaviors [23, 25].

Levitsky et al. conducted two small studies utilizing daily weighing and feedback emails to prevent weight gain among female freshmen students [26]. The first trial in 2002 included 32 students, and the 2003 trial was comprised of 41 students. Both 10-week programs compared the changes in body weight in an experimental feedback group and a nutrition education group. The students in the experimental groups reported their daily weight to researchers and received daily emails, which reflected the changes in their body tissue mass over a 7-day period. The slope of a line was used to depict the weight changes in the first trial. In the second trial, students were told the daily caloric intake necessary to maintain their average weekly weight [26].

The results of both trials showed significant differences in weight change between the feedback and control groups [26]. While both control groups gained an average of 2-3 kg, the two feedback groups experienced insignificant weight gain. The researchers did not indicate whether the outcomes differed by weight status or note the proportion of participants who were normal weight, overweight, and obese. Both studies included small samples, and the attrition was

not equal across groups. In the first study, 31% of the experimental group and 6% of the control group dropped out. In contrast, 6% of the experimental group and 33% of the control group did not complete the second study. The students in the experimental group cited time constraints as their reason for leaving the study. The results provided preliminary evidence of the feasibility and effectiveness of utilizing technology and daily weight monitoring to prevent weight gain. The researchers concluded that the use of a tissue monitoring system, or technology that tracks weight, could be beneficial in preventing weight gain [26].

Two studies investigated the effectiveness of MyStudentBody.com-Nutrition (MSB-N), a web-based nutrition and physical activity education program tailored for college students [23, 29]. Franko and colleagues utilized formative assessments and piloting to develop the interactive online intervention, which included learning modules, self-assessments, and informational links [29]. Their research team recruited 476 students from six universities. The study targeted full-time undergraduate students in all weight status groups, but the sample included 23% overweight and 12% obese participants. The students were randomly assigned to one of three conditions: the MSB-N group with two web sessions, the MSB-N group with three web sessions, or the control group with two anatomy education web sessions. The pre- and post-intervention assessments were conducted two weeks apart in a campus computer lab, with the exception of the third web session, which was accessed remotely [29].

The study did not collect data on weight or BMI change but assessed health behaviors and psychosocial outcomes, such as attitudes and motivation for behavior change, support, and encouragement [29]. In comparison to the control group, the two MSB-N intervention groups had greater increases in fruit and vegetable consumption, support for dietary changes, and motivation for behavior change. However, the web-based program did not have a significant

effect on physical activity. One of the strengths of the study was its large sample size and high retention rates, with 93% completing posttest measures and 88% completing 3-month and 6-month follow-up assessments. However, the researchers noted the short duration and low intensity of the intervention, with the dose being two to three 45-minute educational sessions [29].

Similarly, LaChausse conducted a study exploring the use of the MSB-N program to prevent weight gain in college students [23]. The 12-week study included 328 participants, who were recruited through emails, flyers, and school billboards at a single university. The students were randomly assigned to one of three conditions: MSB-N program, on-campus program, or control group. The MSB-N group was instructed to spend two hours each week on the MSB-N website and to complete the self-assessments. The on-campus group attended two-hour weekly sessions, which consisted of lecture and reflection papers. Both programs were offered for course credit [23].

The results of this study substantiate the findings of the previous study by Franko et al. [23, 29]. LaChausse reported that study findings revealed no significant changes in self-reported BMI or aerobic exercise within and between the groups, but suggested that the Internet program may have improved fruit and vegetable intake [23]. Although the study had 95% retention, the extent to which participants used the website could not be determined. Participants logged into the website an average of 29.84 ± 12.44 times over the 12 weeks [23].

In 2010, Gow and colleagues reported the results of a 6-week trial that investigated the effects of technology-delivered interventions on weight gain prevention and the promotion of healthful behaviors among students [24]. The study recruited first year students of all weight status groups, including 35% overweight and obese students. Participants (n=170) were recruited

from introductory psychology courses and randomly assigned to one of four groups: 1) Internet program, 2) weight and caloric feedback emails, 3) combination of the Internet program and feedback emails, and 4) control group. The Internet program utilized a Blackboard platform to deliver six weekly 45-minute interactive lessons, which included self-assessments, activities, a group discussion board, and homework. The feedback component included weekly weighing and emailed feedback with a graph of weight and caloric changes [24].

The findings support the effectiveness of the combined web-based and feedback program, which resulted in significantly lower BMIs, compared to the other three groups [24]. No other significant differences in BMI or dietary and physical activity behaviors were detected. Despite some positive results, the researchers suggested the challenge of retention and long-term follow-up in this population. Of the participants randomized, 93% began and 64% completed the 6-week intervention. Retention varied by group, ranging from 56% in the Internet group to 80% in both the combined and control groups. Fewer participants (11%) completed the 3-month follow-up assessments. It was hypothesized that students could have been attracted to participate because of the incentive of research credit, rather than a desire to maintain a healthy lifestyle. The researchers highlighted the value of further exploring Internet-based weight management interventions, which offer convenience and anonymity for students [24].

In 2012, Greene and colleagues published the results of Project WebHealth, a nondieting Web-based program targeting freshmen, sophomores, and juniors at eight US universities [25]. The 10-week study included 1,689 students, with 30% of students being overweight and obese. The participants were randomly assigned to the web-based intervention group or a no treatment control group. The web-based program emphasized weight-related behaviors, such as healthful eating and physical activity. The students engaged in 15-minute interactive lessons, which

included mini assessments, graphs and charts, research findings, and goal setting. Weekly emails notifications were sent to inform students of new materials [25].

The study found no significant changes in weight or BMI between the two groups but reported positive effects of the web-based program on healthful behaviors [25]. In comparison with the control condition, the intervention group had a significantly greater increase in fruit and vegetable intake and smaller declines in physical activity levels. The researchers also reported that 80% of participants completed the 10-week assessments, and 68% completed the 15-month assessments [25]. One of the strengths of the study was the collection of process evaluation data from 43% of participants [30]. The researchers measured satisfaction and the motivational effects of the study components. They found the weekly lessons to be “somewhat motivating” to students, with the physical activity and healthy weight lessons receiving the highest ratings (3.2 on a 5-point scale). In contrast, the forum questions received the lowest ratings (1.9 on a 5-point scale). Both the process and outcome data provide evidence of the benefits of a web-based health promotion program but highlight the need for further research in this population [25, 30].

C.2. Technology-Based Weight Loss Studies

Two studies incorporated the Internet and technology into programs targeting a reduction in weight or BMI among college students enrolled in US universities [27, 28]. To be eligible to participate, students needed to be either overweight or obese. The findings of one pilot study [27] revealed positive changes in body weight following the technology-based program, while the other study [28] is currently in progress.

Napolitano et al. reported on the feasibility and effectiveness of a recent pilot trial, using Facebook to deliver an 8-week weight loss program for college students [27]. Participation in the study was limited to students between 18-29 years, who were overweight or obese (BMI 25-50

kg/m²). The participants (n=52) were randomly assigned to one of three conditions: Facebook, Facebook Plus, and a waiting list control. Private Facebook groups were used to deliver nutrition and physical activity materials, including podcasts and handouts, to the Facebook and Facebook Plus conditions. Polls and event notifications were also posted to the Facebook group pages. In addition, the Facebook Plus condition included a behavioral component with daily text messages, weight loss goals, weekly feedback, self-monitoring, and support from a self-selected “buddy” [27]. The text messages included reminders, feedback, and motivational messages. Students sent their weight and caloric and physical activity records to research staff and received weekly feedback reports through Facebook. In addition, research staff sent text messages for the support “buddy” to send to the participant.

The Facebook Plus program was most effective in facilitating weight loss [27]. No significant difference in weight loss was observed between the Facebook and control groups. These results suggest the limitation of utilizing a technology-based platform for the purpose of delivering educational content. Despite being able to detect significant program effects, the researchers noted the limitations of a small sample size, which was recruited over one semester. The 96% retention was higher than that reported in an earlier weight loss study for overweight and obese students [31]. The previous study, which was not a technology-based study, had 58% attrition, with most students citing a lack of time as their reason for leaving the study [31].

Patrick and colleagues [28] are currently conducting the 2-year SMART (Social Mobile Approaches to Reduce Weight) trial, which is grounded in health behavior theories and social network theory. The study includes two conditions: the SMART intervention and informational control group. The SMART intervention includes a variety of technology tools, such as a website with a blog, Facebook page, mobile smartphone applications, text messaging, telephone health

coaching, and emails. The blog was used to deliver the informational content, such as nutrition, physical activity, and weight-related tips. The research staff posted prompts on the Facebook page, which were designed to encourage interaction. The prompts included campaigns, in which students were asked to pledge and plan to change a specific behavior. The smartphone applications were utilized for goal setting, self-monitoring, and feedback; and the text messages served to reinforce behaviors and remind participants to self-monitor. Finally, email was the primary form of communication between research staff and participants. The students were encouraged to select the technology tools that best met their needs and to seek support from their existing social networks. The researchers indicated that the inclusion of a variety of modalities could potentially assist with adherence [28].

The study is currently in its second year. The researchers reported that over a two-year recruitment period, 404 overweight and obese students (18-35 years, BMI 25-34.9 kg/m²) from three universities were enrolled in the study. The study will assess the effects of the intervention on weight loss, diet and physical activity, sedentary behavior, quality of life, and depression. The researchers will also ask participants to rate their satisfaction with the program. The in-person assessments will be conducted at baseline, 6, 12, 18, and 24 months [28].

C.3. Limitations of Previous Research

Despite the growing body of research regarding technology-based weight management interventions for college students, several limitations exist. Of the five weight-related programs that targeted students of varying weight status categories, 80% were predominantly comprised of a web-based educational curriculum [23-25, 29]. The studies included limited behavioral elements, such as goal setting [25] or a discussion board or forum [24, 25]; and the studies did not include a designated social support component. The results of the process evaluation of

Project WebHealth suggest that students may be interested in receiving greater interaction, potentially through a forum [30].

Research suggests that social influences are important for weight loss and the promotion of healthful behaviors among young adults [32, 33]. LaRose and colleagues indicated that social factors, such as a desire to improve appearance or feel better about oneself, are strong motivators for young adults to lose weight [32]. Additionally, they reported that social influences provide greater motivation than health concerns. It has also been documented that peer support and social contacts may be important for both weight loss and maintenance in young adults [33].

Both the technology-based weight loss interventions for overweight and obese students incorporated a peer support component, in varying capacities [27, 28]. Napolitano et al. had participants select a “buddy” for support during the program, but they were not able to measure the amount of support received from the “buddy.” In addition, the study included a survey, which measured the social support received from family and friends [27]. Similarly, in the ongoing SMART trial, Patrick and colleagues are utilizing participants’ existing online social networks to encourage and support weight loss [28]. The incorporation of social support into technology-based weight management trials is a relatively new area of research. Thus, researchers highlight the need to further explore the use of friends and peers as resources and motivators for weight loss among young adults and college students [30, 32, 33].

Another limitation of the existing research is the challenge of recruitment and the appropriate use of incentives for college students. With the exception of the study by Levitsky et al., the weight management studies included samples ranging from 170-1,689 students [23-25, 29]. The studies included students of varying weight status categories. The three studies, which reported on weight status, indicated that nearly one-third of their sample was overweight or

obese students [24, 25, 29]. In contrast, the weight loss trials exclusively targeted overweight and obese college students. The sample sizes varied. Napolitano et al. recruited 52 students [27], while Patrick et al. recruited 404 students [28]. The existing literature provides evidence of the difficulty of recruiting and retaining overweight and obese young adults in weight loss trials [34-36]. In a recent systematic review of weight loss interventions for young adults, researchers concluded that recruitment and retention was a challenge, as evidenced by the small sample sizes, reported recruitment difficulties, and high attrition rates [36]. Furthermore, the results of a secondary data analysis substantiate the low participation of young adults in weight loss trials. In three in-person behavioral weight loss programs for adults, only 7% of participants were young adults [35]. Thus, researchers have suggested the need to identify and develop effective age-appropriate strategies for reaching overweight and obese students and young adults [34-36].

Despite their ability to recruit and retain relatively large samples, four of the seven technology-based weight management studies used significant incentives [23, 24, 28, 29]. Two studies offered academic incentives [23, 24]. LaChausse recruited 328 students for a 12-week web-based program, which could be taken for course credit [23]. Similarly, the study by Gow et al. offered participants (n=170) research credit, in addition to weekly gift card drawings [24]. The researchers stated that only 18 students completed the 3-month follow-up assessments and posited that the lower participation could be related to the lack of research credit [24]. Several studies offered monetary incentives. Franko et al. gave students \$25 at the baseline assessment, \$40 at the 2-week posttest measures, \$40 at the 3-month measures, and \$55 at the 6-month measures [29]. They were able to recruit 476 students, with retention ranging from 84% to 92% at the 6-month follow-up assessments [29]. In addition, Patrick et al. recruited 404 overweight and obese students for a 2-year weight loss trial, noting that students had received \$40 at baseline

and \$50 at the 6-month assessments [28]. In contrast, the study by Napolitano and colleagues offered participants (n=52) a \$5 incentive at 4-weeks and \$10 at 8-weeks [27].

In one of the studies, students indicated that the monetary incentive was one of the stronger motivators for making health-related changes [30]. The use of academic or monetary incentives may have implications for sustaining long-term changes in weight and health behaviors among college students. From a program implementation perspective, limited funds may have a negative impact on the long-term sustainability of a program. In addition, it may affect the ability to recruit and retain students in weight management programs. To enhance recruitment efforts and the feasibility of implementing sustainable interventions for this age group, further research should be conducted to explore the factors motivating students to participate in weight control interventions.

A third limitation of the existing research is the lack of data on both feasibility and acceptability. Technology-based weight management interventions among college students are a relatively young area of research; yet, only two studies have reported data on both feasibility and acceptability measures [27, 30]. In the Project WebHealth study, researchers used quantitative surveys to measure satisfaction and the motivational effects of the web-based nutrition and physical activity program [30]. However, the study did not collect data on access and usage of the program [25, 30]. In addition, Napolitano et al. utilized several strategies to measure the feasibility and acceptability of an 8-week Facebook and text messaging intervention [27]. The studies tracked engagement through Facebook “likes” and responses to text messages. In addition, acceptability was measured using quantitative and qualitative responses in a survey on consumer satisfaction. The study highlighted the importance of further exploring participant engagement and use of program tools in technology-based programs for college students [27].

Most of the studies reported the recruitment strategies, sample sizes, and retention across each condition, but collected limited data on engagement and acceptability. The interventions incorporated a variety of technology tools, including web-based programs [23-25, 29], emailed feedback [26], a discussion board or forum [24, 25], social media [27, 28], and mobile devices [27, 28]. Some studies included multiple components or technology tools. Thus, it could have been valuable to measure engagement, to assist in identifying which components – incentives, inclusion of a social support component, certain technology tools, frequency of contact with research staff or other students, or specific program components – are important in an effective technology-based weight management intervention. In addition, qualitatively measuring acceptability and satisfaction could have aided in identifying the factors crucial for recruiting, retaining, and engaging college students in technology-based weight management programs.

D. Feasibility and Acceptability in a Pilot Technology-Based Intervention

Technology-based weight loss interventions for the treatment of overweight and obesity in college students are a relatively new area of research [27, 28]. Consequently, collecting data on feasibility and acceptability is an important step in developing effective programs for college students. Feasibility has been defined as “the extent to which a new treatment, or an innovation, can be successfully used or carried out within a given agency or setting” [37]. To evaluate the feasibility of implementing a weight loss intervention, researchers may consider various factors, such as recruitment, retention, and participant engagement [37-41]. Feasibility data may offer perspective in interpreting the weight-related outcomes. In a recent review of technology-based weight loss programs for adults, the authors suggested that attrition rates and lack of adherence may have impacted the ability to detect statistically significant results in some of the studies [42].

Participant acceptability is important to the successful implementation of an intervention. Researchers have defined acceptability as “the perception among implementation stakeholders that a given treatment, service, practice, or innovation is agreeable, palatable, or satisfactory” [37]. Acceptability data may offer insight into participants’ perspectives and experiences in the intervention, including comfort level and perceptions of program content, components, duration, and intensity [37, 43-45]. Feasibility and acceptability data from a pilot trial may be valuable for informing the development and implementation of a larger trial. Specific components of the program or the study design may be adapted to improve the larger intervention [43, 46].

D.1. Feasibility of Recruitment

A pilot study provides an opportunity to evaluate the feasibility of recruitment [44, 45]. To assess feasibility, researchers may explore several factors: whether a sufficient number of participants can be recruited to detect a program effect, how much time is necessary to recruit an adequate sample, if certain subgroups are more or less likely to be recruited, and which recruitment strategies are most effective [39, 44, 45]. Evaluating and reporting the feasibility of recruiting college students is valuable, as previous research reflects the challenges of recruiting students and young adults into weight loss trials [27, 31, 34-36]. In addition, collecting feasibility data could contribute to the growing body of evidence around effective age-appropriate strategies for recruiting overweight and obese students and young adults [34, 35].

Kolodziejczyk and colleagues collected feasibility and acceptability data for an 8-week pilot study evaluating a tailored text messaging weight loss intervention for both English- and Spanish-speaking adult participants [47]. Feasibility was primarily assessed by recruitment success and adherence. The researchers defined recruitment success as achieving the goal of recruiting 20 participants, 40% male and 50% self-reported Spanish-speaking, in two months.

They reported that recruitment was feasible in the target population, as a number of individuals were interested in the program. In total, the research team received 123 inquiries and easily met the recruitment goal. The feasibility and acceptability data were utilized to inform the development of a larger trial. It was noted that the ongoing 1-year trial successfully recruited and enrolled 298 participants [47].

D.2. Feasibility of Retention

Another important component of assessing feasibility is retention. Researchers often determine the percentage of participants who complete or drop out of the study. The number of participants who complete the study has a critical affect on statistical power and the ability to detect a program effect [39]. In addition, it may be important to consider whether there are differences, such as gender, socioeconomic status, and race, between completers and non-completers [38]. Qualitative measures, such as interviews or focus groups, may also be utilized to identify the factors and resources that kept participants in the program [39]. Retention data may inform the development of a larger trial or assist in interpreting the outcome data.

Allen and colleagues assessed the feasibility and acceptability of a pilot weight loss trial comprised of diet and exercise counseling and smartphone applications for self-monitoring [38]. It included measures to assess the recruitment strategies, retention, and frequency of using the smartphone application. In total, 68 overweight and obese adults participated in the 6-month study. The study had an overall retention rate of 63%, with a range of 59% to 69% across the four conditions. The researchers noted that one of the limitations of the pilot study was the 37% attrition rate, with attrition as high as 41% in two of the groups. Through the feasibility data from the pilot trial, they identified the need to include retention strategies to minimize dropout in a larger trial [38].

D.3. Feasibility of Engagement

An evaluation of participant engagement with the program materials is also important, as it assists researchers in interpreting the outcome data and guides the improvement of a larger intervention [45]. The extent to which participants utilize or access program materials or services may moderate the effect of the intervention [39, 48]. In a systematic review of web-based weight loss interventions targeting adults, Neve and colleagues [49] reported that greater use of certain components, such as self-monitoring tools and discussion boards, was associated with positive weight-related outcomes. Yet, research suggests that actual participant engagement in online weight loss interventions tends to be lower than intended by those who developed the program [48]. Thus, it is important to collect data on engagement in online programs.

Assessing engagement also aids in identifying the “active ingredients,” which are most integral for program success [44, 45]. This is beneficial for online weight loss trials, which may include multiple components. It has been noted that program effectiveness may be contingent upon a variety of factors, such as the types of technology used and participants’ familiarity with technology [49, 50]. To assess engagement, researchers may consider which components were used and the extent to which they were used [39]. Evaluating participant engagement in a web-based intervention may require different measures than in-person studies, which assess session attendance [38], use of services [45], or adherence to dietary or exercise regimens. Instead, engagement may be measured by the number of webpage log-ins, views, or visits [48].

Hebden et al. published the results of a recent 12-week mobile health weight loss trial for overweight young adults [40]. Limited research has been conducted around mobile programs for young adults, thus the researchers sought to assess participant engagement with the mobile materials. The intervention condition included multiple technology features: text messages,

emails, smartphone applications, and access to online forums. Engagement was measured as the number of replies to text messages, application log-ins, and forum views or posts. In addition, a survey included questions on self-reported use of the program content. The researchers found that engagement was lower than intended in the program design. Participants responded to nearly half the text messages, used the applications an average of 7.7 times, and rarely posted on the forums. The feasibility and acceptability data enabled the researchers to identify potential barriers to engagement. They plan to use the findings to implement a larger trial in the community [40].

D.4. Acceptability

The acceptability of the intervention is another important consideration in a pilot study [44, 48]. Acceptability is valuable to measure, as it captures the perspectives and experiences of the participants who receive the intervention [45]. In addition, it may impact retention, engagement, and the effectiveness of the intervention. Acceptability data are also beneficial for determining the key components of an intervention [45]. Participants may be asked about what program materials or features they liked or found to be most or least helpful, and they may comment on the duration and intensity of the intervention [43]. Finally, researchers may also consider whether the control condition is acceptable in a randomized controlled trial, as low acceptability levels could impact attrition [43]. Measures of program relevance, participant satisfaction, or program usability may be used to determine whether participants found the intervention to be acceptable [48].

Interviews or surveys with closed- and open-ended questions may assist in assessing acceptability and exploring participants' experiences in the program [27, 41, 46]. Allen and colleagues conducted in-depth interviews to assess satisfaction and the acceptability of the SLIM

program and the smartphone applications [38]. The researchers reported that participants liked several program features: the accountability and structure, the smartphone applications, and the counseling sessions. In addition, they found that the participants wanted more feedback and a stronger physical activity component [38]. Napolitano et al. utilized different methodology to collect acceptability data [27]. They used questionnaires to assess college students' satisfaction with a technology-based weight loss intervention. The students in the intervention conditions rated the helpfulness of the overall program and the intervention components and indicated whether they would recommend the program to a friend. In the survey, participants also provided qualitative feedback on what they liked [27]. Overall, the researchers reported that the students were satisfied with the program. Both studies demonstrate the value of gaining insight into the participants' experiences in the program and soliciting suggestions for improvement.

D.5. Mixed Methods Approach

A mixed methods approach, utilizing both quantitative and qualitative data collection strategies, has been recommended for evaluating the feasibility and acceptability of a pilot study [41, 45]. Multiple methods could strengthen the findings, as the results from one method support or complement the results of the other method [51]. Quantitative strategies may be used to collect data on certain components, such as recruitment, retention, compliance, and fidelity. In contrast, qualitative strategies may be beneficial for assessing different facets of the pilot intervention, such as acceptability and satisfaction. Overall, a mixed methods approach may provide a more comprehensive assessment, compared to a single method [51].

Several weight loss studies have incorporated a mixed methods approach to collect feasibility and acceptability data [41, 46]. Morgan et al. published the results of a process evaluation of SHED-IT, an online weight loss program targeting 65 male university students and

faculty [41]. A combination of qualitative and quantitative data collection tools were used, including questionnaires, interviews, and website usage statistics. Acceptability was measured through the interview questions on experiences in the program as well as quantitative survey questions on satisfaction. To assess feasibility, data were collected on recruitment, self-reported compliance with the study protocol, and actual usage based on website statistics. Through the mixed methods approach, the researchers found the intervention to be feasible, based on their ability to recruit their sample within 10 days and implement the intervention. In addition, the quantitative data indicated that engagement was lower than intended, but the interview responses provided insight into strategies to improve compliance and the overall program. The authors reiterated the value of collecting feasibility and acceptability data in an area where limited research exists [41].

A mixed methods approach has also been used to assess the feasibility and acceptability of in-person weight loss programs. Dombrowski et al. used feasibility and acceptability data to improve an open-pilot obesity treatment intervention for adults [46]. Adopting a mixed methods approach, the researchers collected both qualitative and quantitative data to assess acceptability. Participants and the facilitator completed surveys, which included quantitative questions to rate satisfaction with each session and open-ended questions to provide written feedback on the sessions, the overall program, and intervention content. To evaluate feasibility, the researchers recorded the number of responses to mailed invitations, retention rates, and session attendance. The mixed methods approach enabled researchers to gain insight into participants' experiences and perspectives of the program. The findings were used to make changes during the program and may also be beneficial for the development of future behavioral interventions [46].

CONCLUSION

In summary, the prevalence of overweight and obesity among undergraduate students in the United States is 33.7%, according to data collected in 2013 [1]. This is a major concern, as higher weight status during young adulthood is associated with increased risk for metabolic syndrome [2], hypertension [3], type 2 diabetes, and cardiovascular events [4] in later life. There is an urgent need to address weight issues among college students, who may be particularly susceptible to weight gain [11, 13]. Research suggests that the university environment facilitates weight gain and unhealthful behaviors [11, 15, 16]. Thus, it is important to develop and implement weight loss interventions in the university setting to reduce the prevalence of overweight and obesity among college students.

Technology-based platforms can be utilized in weight management interventions for college students [23-29], many of whom regularly use the Internet, smartphones, personal computers, and social media [17, 18]. Five studies have evaluated the use of technology in programs seeking to prevent weight gain and promote healthful behaviors among college students [23-26, 29]. Two studies reported positive outcomes in preventing weight gain [24, 26]. In addition, two recent studies have explored the use of technology-based weight loss interventions for overweight and obese students [27, 28]. One study showed the feasibility and effectiveness of a Facebook and text messaging program [27].

The existing research has several limitations [23-29]. The majority of the studies were primarily educational and included limited social support, an important factor in weight loss for young adults. A second limitation was the challenges of recruitment and incentives for college students. Finally, the majority of studies did not collect and report data on both feasibility and acceptability. Overall, the findings of the previous studies provide preliminary evidence of the

benefits of technology-based weight management efforts and highlight the need for further research exploring novel strategies to recruit and engage students in weight loss programs. Additionally, evaluating the feasibility and acceptability of technology-based programs in university settings is a crucial step towards developing much-needed interventions to reduce the prevalence of overweight and obesity in this population.

Specific Aims

Therefore, the primary objective of this research project was to evaluate the feasibility and acceptability of implementing a pilot technology-based weight loss intervention for overweight and obese college students. The overall pilot study used a randomized controlled trial design to assess the effectiveness of a technology-based weight loss intervention on reducing BMI. The pilot study included 20 overweight or obese ($\text{BMI} \geq 25 \text{ kg/m}^2$) undergraduate students from the University of Tennessee Knoxville. Students were randomized to one of two conditions, an 8-week technology-based weight loss group or an 8-week email education group. The technology-based weight loss condition had access to a website with nutrition materials, exercise videos, a private forum, and social media links. The email education condition received weekly emails with the nutrition materials and links for exercise videos. This research project focused specifically on the feasibility and acceptability of the pilot trial. The primary aims of this project were:

1. To test the feasibility of implementing the pilot technology-based weight loss intervention for overweight and obese college students.
 - Report recruitment and retention data
 - Evaluate participant engagement throughout the study

2. To test the acceptability of implementing a technology-based weight loss intervention for overweight and obese college students.
 - Analyze quantitative and qualitative data from post-intervention online surveys and focus groups to assess acceptability and satisfaction

CHAPTER II
MANUSCRIPT

INTRODUCTION

In a recent national survey, one-third of undergraduate students in the United States reported an overweight or obese status [1]. In addition, research suggests that weight gain commonly occurs during the college years and may be mediated by a variety of unhealthful behaviors [11, 13]. This is a major concern, as higher weight status during young adulthood has been correlated with an increased risk for metabolic syndrome [2], hypertension [3], type 2 diabetes, and cardiovascular events [4] in later life. Furthermore, research has shown that young adults who are overweight may have a greater risk for weight gain and obesity over a period of 10 to 15 years, compared to young adults who are a healthy weight [5, 6]. Thus, it is important to develop and implement effective programs that support weight loss and promote healthy choices among college students.

Weight management interventions incorporating technology, the Internet, or social media hold promise in the university setting. Many students own and frequently use the Internet and a variety of technology tools in their academic and social lives [17, 18]. Several randomized trials have been conducted to investigate the effectiveness of using technology in weight management programs for students [23-29]. The results of three of the studies support the effectiveness of technology-based programs in preventing weight gain or supporting weight loss [24, 26, 27]; however, two studies showed no significant effects on weight or body mass index (BMI) [23, 25]. In addition, three studies reported improvements in healthy behaviors, such as fruit and vegetable intake or physical activity [23, 25, 29].

Despite the growing body of research regarding technology-based weight management interventions for college students, several limitations exist. One of the limitations is the lack of data on both feasibility and acceptability, which may be important for enhancing the field and

informing the development of effective interventions. Few studies have collected and reported data on both feasibility and acceptability [27, 30]. Most of the studies described recruitment strategies, sample sizes, and retention but collected limited data on engagement and acceptability. Feasibility data on recruitment, retention, and engagement may offer perspective in interpreting the weight-related outcomes of a study. In a recent review of technology-based weight loss programs for adults, the authors suggested that retention and adherence may have impacted the ability to detect statistically significant results [42]. In addition, acceptability data may provide insight into participants' perspectives and experiences in the intervention [43-45]. Evaluating the feasibility and acceptability of technology-based programs in university settings is an important step in designing and implementing effective interventions to reduce overweight and obesity in this age group.

Therefore, the purpose of this study was to evaluate the feasibility and acceptability of implementing a pilot technology-based weight loss intervention for overweight and obese college students.

METHODOLOGY

A. Overall Pilot Study Design

The objective of this research project was to evaluate the feasibility and acceptability of implementing a pilot technology-based weight loss program for overweight and obese college students. The overall pilot study utilized a randomized controlled trial design to investigate the effectiveness of a technology-based weight loss intervention on reducing BMI among college students. A total of 20 overweight and obese undergraduate students from the University of Tennessee Knoxville were recruited to participate in the pilot study. The students were randomly

assigned to one of two conditions: 1) an 8-week technology-based weight loss program (intervention), and 2) an 8-week email education program (attention control).

The pilot study was comprised of three phases: recruitment and screening, the 8-week intervention, and online surveys and focus groups. All phases of the study were technology-based, which offered the advantage of no required in-person meetings. Skype, a popular Internet communication software [52], was used for the screenings, informed consent, height and weight measures, and focus groups.

A.1. Primary Measures

Primary and secondary measures were collected at baseline and 8 weeks. The primary measure was change in BMI. Since the study was a technology-based intervention, research staff collected height and weight measures for BMI through a novel approach, utilizing the Skype video call feature [52]. Each participant was mailed a digital bathroom scale and tape measure, and study staff scheduled a virtual meeting with each student. During the Skype assessment, a trained research assistant instructed the participant to place the scale on a flat surface, step on the scale, and show the scale reading to the camera. For the height measurement, the student stood against a wall in view of the camera, marked his/her height on the wall, and used the tape measure to assess height. The height and weight measures were used to calculate BMI. Any student who preferred an in-person assessment was accommodated. Students also completed an online baseline questionnaire, which collected demographic characteristics. The questionnaire is shown in Appendix B.

This novel Skype method was used for collecting height and weight measures because it offered students the advantage of not having to report for an in-person meeting. In addition, this

method enabled the research team to collect actual height and weight measurements, which may be more accurate than self-reported measures [53].

A.2. Secondary Measures

The secondary measures were feasibility and acceptability, perceptions of social support, dietary intake, and physical activity levels. A mixed methods approach, including online surveys and focus groups, was employed to collect data on feasibility, acceptability, and perceptions of social support. Dietary intake and physical activity levels were measured through 24-hour dietary recalls and physical activity recalls. Trained research assistants followed pre-determined protocol in collecting the primary and secondary measures.

B. Study Participants

The Institutional Review Board (IRB) at the University of Tennessee Knoxville approved the protocol for this pilot study. Additionally, the study protocol has been submitted to ClinicalTrials.gov and is awaiting approval. Consent was obtained from all students who participated in the study. Undergraduate students (n=20), who were overweight or obese ($\text{BMI} \geq 25 \text{ kg/m}^2$), were recruited from the University of Tennessee Knoxville. To be eligible for participation in the pilot study, students needed to be between 18-22 years of age and have a personal computer or tablet, smartphone, and access to the Internet. Students were excluded from participation in the study if they reported: having a medical condition with dietary restrictions, taking prescribed medications that might impact their weight, planning to participate in any other weight loss program in the subsequent six months, having a diagnosis of an eating disorder or a major psychiatric illness (e.g., depression, bipolar disorder, schizophrenia) in the 12 months preceding the study, being pregnant or planning to become pregnant in the subsequent six months, or giving birth in the six months preceding the study.

C. Recruitment

Participants were recruited from the University of Tennessee Knoxville, a public land-grant university that enrolled over 21,000 undergraduate students in the Fall 2013 semester [54]. Facebook was initially selected as the primary recruitment tool, since college students regularly use social media sites, such as Facebook. Research staff created a public Facebook page, which included an electronic program flyer, an overview of the study, eligibility criteria, and contact information (See Appendix C for recruitment materials). Upon receiving IRB approval, research staff “published” the Facebook page to make it publicly available. An undergraduate student, who had over 2,000 Facebook friends, shared the electronic flyer on her personal Facebook timeline, using the “friends of friends” setting to promote dissemination of the recruitment information. In addition, research staff asked several undergraduate and graduate students from the nutrition department to “like” the Facebook page or “share” the electronic flyer on their Facebook timeline.

Facebook was the sole strategy used during the first four days of the recruitment period. After receiving no inquiries about the study, the research team employed two non-technological strategies. Research staff posted flyers around the university and distributed handouts to students on campus. The flyers and handouts included the study contact information and a QR (quick response) code, which students could scan with their smartphones to be directed to the study Facebook page. Students were encouraged to “like” the Facebook page and “share” the electronic flyer on their personal Facebook timelines. In addition, the university’s S.E.E. (Safety, Environment, and Education) Center placed handouts in the student health center and sent emails with the electronic flyer to their mailing lists.

On several evenings, research staff went to the off-campus university intramural fields to distribute handouts, but they found few bystanders in attendance. In addition, the research team pursued the option of distributing handouts at a large college student event; but the church did not grant permission. The research team also considered a variety of other recruitment venues. Potential Internet-based recruitment strategies included an advertisement in the online campus newspaper, *The Daily Beacon*, emails, and paid promotions to boost the reach of the Facebook page and electronic flyer. In addition, non-technological strategies included: advertisements in print version of *The Daily Beacon*, a booth on Pedestrian Walkway, and recruiting through student clubs, campus organizations, and introductory courses. However, due to time and personnel limitations, the research team was not able to implement these recruitment strategies.

Interested students contacted the research team by Facebook message, telephone call, text message, or email. A research assistant responded to the inquiries with a standardized message and collected contact information, including two email addresses, a cellular phone number, and Facebook name.

D. Screening

A research assistant contacted interested students to schedule a Skype screening. If the student did not have an existing account, he/she created a Skype account and downloaded the software to his/her smartphone or laptop. Using the Skype video call feature, a research assistant “met” with interested students to provide an overview of the study, answer questions, and assess eligibility with a standard screening form. The screening form is shown in Appendix D.

Students, who were eligible and willing to participate, completed the informed consent process during a subsequent Skype meeting. A research assistant emailed the consent forms to the student, then went over the forms and answered questions during a virtual meeting. Students

signed and returned the consent forms to research staff. The informed consent form is provided in Appendix E.

E. Study Conditions

In this pilot study, 20 students were recruited and randomized, with 10 students in each condition: 1) an 8-week technology-based weight loss group (intervention), and 2) an 8-week email education group (attention control).

E.1. Description of the Intervention Condition

The 8-week technology-based weight loss condition consisted of a variety of tools to promote weight loss. The students had access to the private study website, nutrition materials, YouTube exercise videos, a social support forum, social media pages, and suggested smartphone applications for self-monitoring. The study website was the central platform for the delivery of program curriculum and social support for this condition. The structured website included the nutrition lessons, YouTube exercise videos, and the support forum. Appendix F includes screenshots of a sample of the technology tools utilized in the intervention condition.

Students in the intervention group were emailed instructions and a link to the website, which was only accessible to members of this condition. During the study, research staff updated the website three times per week with the nutrition lessons and exercise videos. Participants received regular updates three times per week. The updates notified students of new materials on the website and encouraged them to visit the website to access program materials and post on the support forum. Intervention components included:

E.1.a. Nutrition Education

The weekly nutrition lessons focused on one of three topics that are relevant to college students: (1) portion control, (2) reduced fast food consumption, and (3) decreased sugar

sweetened beverage (SSB) intake. The importance of addressing these topics has been noted [15, 16, 55]. Researchers suggest that the university environment, including the school cafeteria and the availability of fast food on campus, may encourage overconsumption and poor dietary habits among students [15, 16]. In addition, research indicates that SSB consumption may result in unnecessary caloric intake for students [55].

E.1.b. Physical Activity

The physical activity component of the intervention included selected YouTube exercise videos and brief summaries on the health benefits of different types of exercises. Three workout videos and one summary were posted twice a week. The featured exercise videos varied in intensity and duration and included a selection of flexibility or balance, aerobic or endurance, and strength or resistance workouts. A recent study revealed the benefits of variation in exercise activities, as college students reported that a lack of variety was a barrier to sustaining regular physical activity [56].

E.1.c. Social Support

Students in the intervention group were provided several channels for social support, an important factor in weight loss for young adults [32, 33]. The private study forum served as the primary avenue for peer support. Students were encouraged to post and interact regularly on the forum, which was monitored daily by a research assistant. In addition, the social media pages linked to the study website, served as sources of support and motivation. Pinterest, a popular online pin board website, offered encouragement through motivational sayings and images reinforcing healthful behaviors. The study website was also linked to a private Facebook group. Students had the option of joining the group to receive regular updates; participants who preferred not to join the group were sent text message updates instead.

E.1.d. Self-Monitoring

Suggested free smartphone applications were posted on the website at the beginning of the intervention. Students were encouraged to select and use an application to self-monitor their dietary intake and physical activity.

E.2. Description of the Attention Control Condition

The 8-week email education program was comprised of three educational emails per week to promote weight loss. Each week, students in this group received one email with the nutrition lesson and two emails with a summary and links for the three YouTube exercise videos. Participants were able to access the emailed materials throughout the week, at their own convenience. The control group received the same nutrition curriculum and exercise summaries and videos each week as the intervention condition. The group was not given access to the study website or social media pages.

F. Participant Confidentiality

Pre-determined protocol for maintaining confidentiality and privacy were followed. To protect confidentiality, personal identifying information was stored in locked file cabinets and in a password-protected database on a secure server. Additional strategies included:

F.1. Website and Forum

Website access was limited to students in the intervention condition. Participants logged on to the website with a personal password and email address and used a non-identifying username to post on the forum. A statement was posted at the top of the forum, asking students to respect the privacy of others and refrain from sharing information outside the study.

F.2. Facebook

The Facebook group settings were “secret,” which restricted viewing and posting to members and prevented non-members from finding the group in searches. Within the group, a student’s profile was available to other members only to the extent allowed in his/her privacy settings. The participants were informed of the privacy settings and given the option of joining the Facebook group to receive regular updates. Joining the Facebook group was not compulsory.

F.3. SurveyMonkey

Research staff used enhanced security features, such as secure sockets layers encryption, and disabled the option to collect respondents’ IP and email addresses. Students were advised not to complete the survey on public or shared devices. The survey responses were stored in a file on a secure site with restricted access.

F.4. Skype Video Calling

To minimize the disclosure of their identities, the students covered their video cameras and did not use the video or microphone features during the focus groups. Prior to participating in the focus groups, students changed their display picture and their username to their first and last initial. At the start of each focus group, the facilitators posted a statement asking the students to respect the privacy of others and refrain from sharing information outside the study

G. Incentives

Students who participated in the study were mailed a \$15 gift card after completing baseline assessments and another \$15 gift card after completing the 8-week assessments.

H. Feasibility and Acceptability

This research project was an evaluation of the appropriateness of the pilot technology-based weight loss program for engaging and retaining overweight and obese undergraduate

students. These measures are valuable in a pilot randomized controlled trial, as the data may assist in establishing viability and inform the development of a larger trial [41, 46]. The results of feasibility and acceptability evaluations are important in the design of future studies.

A mixed methods approach, including online surveys and focus groups, was employed to assess the feasibility and acceptability of the pilot study. Feasibility was assessed at each stage of the intervention, and acceptability was evaluated after completion of the intervention through online surveys and focus groups. The approach utilized to collect feasibility and acceptability data offered several advantages. Both quantitative and qualitative data were collected through web-based technology, specifically online surveys and text-based focus groups. From a program implementation standpoint, the web-based tools were cost-effective, as they eliminated the need for transcription of audiotapes. In addition, the online modalities offered convenience for students. Another benefit was that the online tools allowed students to maintain anonymity, which could have encouraged participation and sharing.

H.1. Development

Since the intervention development did not include a formative research phase, existing literature was referenced to assist in designing the feasibility and acceptability component. Morgan and colleagues reported on process evaluation data from the SHED-IT trial, an Internet-based weight loss program targeting men, a population underrepresented in weight loss studies [41]. The study used a mixed methods approach. Quantitative data were collected through surveys and website usage tracking, and interviews were conducted to gather qualitative data. Similarly, a study by Dombrowski et al. used qualitative and quantitative measures to collect data on feasibility and acceptability [46]. The information presented in these studies informed the design of the pilot study's mixed methods strategy and the selection of feasibility and

acceptability measures. In addition, some of the topics and questions in the online surveys used in this study were modified from the acceptability measures included in the two studies [41, 46].

H.2. Data Collection Tools

H.2.a. Online Surveys

Participants in both groups completed an online post-intervention survey. Data were collected and compiled through SurveyMonkey, a popular survey tool that has security measures to protect respondents' privacy. The surveys were comprised of a combination of closed-ended and open-ended questions. Quantitative questions included several formats: yes or no, multiple choice, and a 5-point rating scale with 1 indicating "strongly disagree" and 5 "strongly agree." The post-intervention survey questions are provided in Appendix G.

H.2.b Online Focus Groups

Students in the intervention condition were invited to participate in a text-based focus group using Skype group messaging. Two focus groups were conducted, with six students in the first group and two in the second. Two trained research assistants facilitated the online focus groups. Text-based focus groups have been conducted in populations in which recruitment and stigmatization are concerns [57]. An advantage of online text-based focus groups is that it encourages equal participation, in comparison to in-person groups where a few individuals can dominate the discussion [58]. However, shorter responses may be a potential limitation [58]. To address this, the focus group script included prompts to elicit responses. The focus group questions are presented in Appendix H.

H.3. Measures of Feasibility

In implementation research, feasibility has been defined as "the extent to which a new treatment, or an innovation, can be successfully used or carried out within a given agency or

setting” [37]. For this pilot study, feasibility of implementation was measured to aid in establishing whether students would participate in the program and which specific features they would use. Feasibility was assessed through recruitment and retention data and self-reported records of participant engagement.

H.3.a Recruitment

Previous studies evaluating the feasibility of weight loss interventions were referenced to assist in assessing recruitment [39, 44, 45]. An electronic log was used to track the number of interested students, the number of students who were recruited and excluded, and the reasons for exclusion. In addition, the number of potential participants and the study participation rate were determined [39]. Since the university health center does not collect campus data on weight status, the number of potential participants was estimated using the national rates for overweight and obesity in undergraduate students [1]. The participation rate was determined by calculating the percent of the potential participants enrolled in the study [39]. Finally, this project sought to identify which recruitment strategies were most effective [39, 44, 45]. The post-intervention surveys included four open-ended questions to gain insight into recruitment: 1) How did you hear about the program, 2) What attracted you to participate in the program, 3) Why did you sign up for the program, and 4) How do you feel about the use of social media for informing students about this type of program.

H.3.b. Retention

Published studies often report the percentages of participants who complete and drop out of the study [39]. To assess retention in the pilot study, a research assistant tracked and reported the percentages of participants who completed the 8-week assessments. In addition, qualitative

questions were included in the post-intervention surveys to better understand what factors kept students participating in the study [39].

H.3.c. Engagement

Engagement was measured based on participants' self-reported usage or access of the program materials or technology tools [39, 40]. The post-intervention surveys included questions asking participants how often they accessed the study website and nutrition information, used the physical activity videos and smartphone applications, and went on the forum. Additionally, a research assistant documented the number of times each participant posted on the forum.

H.4. Measures of Acceptability

In implementation research, acceptability has been defined as “the perception among implementation stakeholders that a given treatment, service, practice, or innovation is agreeable, palatable, or satisfactory” [37]. For this pilot study, participant acceptability was assessed predominantly through data collected in online surveys. The acceptability topics are presented in Table 3. Participants were asked to provide feedback on each technology tool in the program, the website, methods of delivery, the duration of the program, and the overall program (See Appendix G for the post-intervention surveys). The Skype focus groups were used primarily to understand students' perceptions of online social support, but it included a question to collect data on participant satisfaction and experiences in the program (See Appendix H, question 1).

I. Data Analysis for Feasibility and Acceptability

Feasibility and acceptability measures were collected through quantitative and qualitative methods. Research staff utilized descriptive statistics to analyze and report quantitative data for both feasibility and acceptability. Specifically, frequencies were used to determine percentages for recruitment and retention. The quantitative survey data were analyzed through descriptive

statistics. The responses to the questions with the 5-point rating scale were analyzed through computation of means and standard deviations. Frequencies were used to analyze and report the responses to questions with a multiple choice and yes/no format. A research assistant entered the data into SPSS 21 [59], the software used in the analyses of all quantitative data.

Due to the methods of data collection, qualitative responses were automatically compiled in text form. Data were transferred to a coding spreadsheet for analysis. Qualitative responses to the open-ended questions in the online surveys and focus groups were analyzed through identifying themes and determining the number of times each theme was mentioned.

Table 3. Post-Intervention Survey Topics

Closed-ended questions (Rating scale)	▪ Helpfulness of the individual components of the program (i.e., website, forum, nutrition materials, etc.) ▪ Satisfaction with the overall program ▪ Program duration and frequency of contact ▪ Level of comfort with technology use (overall and for weight loss) ▪ Appropriateness of the choice of technology tools for students
Open-ended questions	▪ Likes and dislikes about the overall program ▪ Suggested changes to the overall program

RESULTS

A. Feasibility

A.1. Recruitment

A.1.a. Recruitment Strategies

The study Facebook page was the sole strategy used during the first four days of the recruitment period. After not receiving any responses to the Facebook page, the research team employed two non-technological recruitment strategies. Research staff posted flyers around the university campus and distributed handouts to students. In total, 32 students inquired about the study during the three-week recruitment period. See Figure 1 for the participant flow chart. Of the 32 students, 47% contacted research staff through text message, 25% email, 19% Facebook message, and 9% telephone call. In addition, 11 students contacted the research team after the recruitment period. Of those, four students had seen the original flyers. The other seven students inquired about the study in the last week of the semester, in response to new recruitment flyers posted around campus for the spring trial.

Post-intervention survey questions were utilized to assist in evaluating the recruitment strategies. The majority of participants reported hearing about the program through the flyers. Several students indicated that they had received a handout, and one participant reported hearing of the program through Facebook. The majority of the survey respondents felt that social media could be a helpful strategy for informing students of the program. One student stated, *“Since so many people use social media, it would be a great way to inform students”* (#20). However, a few disagreed with social media as a strategy or reported that they do not personally use social media. Comments included, *“I don't think it's the best idea, it's somewhat distracting from the goal and keeps you on the computer, not to mention everyone doesn't like social medias”* (#15).

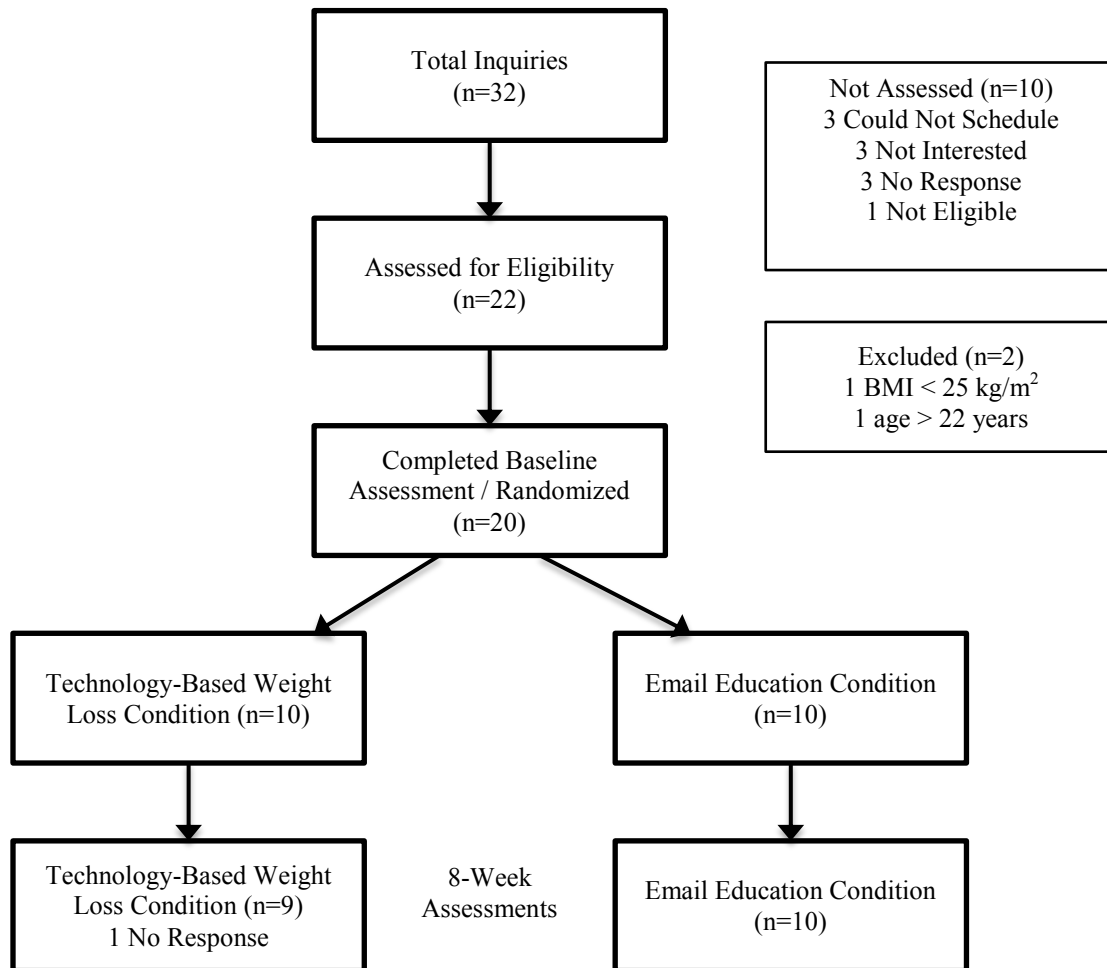


Figure 1. Participant Flow Chart

Almost two-thirds of the survey respondents (63%) reported that they were attracted to participate in the program because they wanted or needed to lose weight. Six students (32%), including five students in the control condition, commented that they were attracted to the program by the \$30 monetary incentive. In addition, the participants indicated that they were drawn to the program by the focus on college students, tips for healthier living, technology, convenience, and the prospect of a buddy for motivation.

A.1.b. Baseline Characteristics

Twenty overweight and obese undergraduate students (mean BMI $32.1 \pm 4.6 \text{ kg/m}^2$) participated in the pilot study. The participants were between 18-22 years, with a mean age of 20.4 ± 1.4 years at baseline. The sample was comprised primarily of female students (90%), with both male students randomized to the intervention group. The racial demographics of the sample were: 45% White, 45% Black, and 10% other. In addition, 30% of the students were freshmen, 15% sophomores, 15% juniors, and 40% seniors. Over half (65%) of the participants reported living on the university campus. See Table 4 for the baseline characteristics of the participants.

A.1.c. Potential Participants and Participation Rate

The university does not collect campus data on overweight or obesity, thus the number of potential participants was approximated based on Fall 2013 enrollment statistics and the national overweight and obesity rates for undergraduate students. In the 2013 American Association of College Health survey, 33.7% of students indicated an overweight or obese status. Therefore, it can be estimated that about 7,088 of the 21,033 undergraduate students enrolled at the University of Tennessee Knoxville are overweight or obese [54]. It should be noted that the number of potential participants could be lower, since students needed to own a laptop or tablet and a

Table 4. Baseline Demographics

	Intervention (n=10)	Control (n=10)	Total (n=20)
Age (years)	20.5 ± 1.4	20.2 ± 1.5	20.4 ± 1.4
BMI (kg/m²)	32.9 ± 4.4	31.3 ± 5.0	32.1 ± 4.6
Weight (kg)	91.6 ± 16.7	85.7 ± 16.2	88.6 ± 16.3
Gender (%)			
Female	8 (80)	10 (100)	18 (90)
Male	2 (20)	0 (0)	2 (10)
Race (%)			
White	4 (40)	5 (50)	9 (45)
Black	4 (40)	5 (50)	9 (45)
Other	2 (10)	0 (0)	2 (10)
Ethnicity (%)			
Non-Hispanic	9 (90)	9 (90)	18 (90)
Hispanic/Latino	1 (10)	1 (10)	2 (10)
Classification (%)			
Freshman	3 (30)	3 (30)	6 (30)
Sophomore	1 (10)	2 (20)	3 (15)
Junior	2 (20)	1 (10)	3 (15)
Senior	4 (40)	4 (40)	8 (40)
Current Residence			
On-campus	6 (60)	7 (70)	13 (65)
Off-campus	4 (40)	3 (10)	7 (35)

smartphone to be eligible for participation in the study. Based on the number of potential participants, the study participation rate was estimated to be less than 1%.

A.2. Retention

The retention rate for the overall pilot study was 95%, with 90% of the participants in the intervention condition and 100% in the attention control condition completing the 8-week assessments. One participant (female, freshman student) in the intervention condition could not be reached for the 8-week measures. In the post-intervention surveys, the participants reported several factors for continued participation in the program: their goals of weight loss, the regular text message reminders or emails, their sense of personal commitment or obligation, and the monetary incentive.

A.3. Engagement

A.3.a. Intervention Condition

Levels of participant engagement were assessed based on self-reported access or use of the program materials and technology tools. In the intervention group, four survey respondents reported accessing the website one to two days a week, two students accessed it three to five days a week, and one student accessed it daily. See Table 5 for participant use/access of program components. In the focus groups, the students mentioned several reasons for the infrequent visits to the website, including forgetting to log onto the website or not being able to incorporate regular website access into their online routine. The participants suggested that greater interaction on the forum could have provided more of an incentive to access or use the website, as they were interested in gaining support, accountability, and motivation through the program.

The students did not regularly use the study forum. In the post-intervention survey, only two (22%) respondents indicated that they had visited the forum at least once a week. Over the

duration of the program, seven participants posted at least one time, with a range of one to three posts per participant. In the focus groups, the students reported several barriers to posting on the forum: the lack of responses, the feeling that others would not read their posts, the challenge of the forum layout, not knowing anything about the other group members, and personal time constraints. The participants suggested icebreakers, scheduled Skype chat sessions, and mobile accessibility to facilitate further interaction and increase the forum usage.

Three students used a smartphone self-monitoring application on a daily basis. The nutrition lessons were posted weekly on the study website. Three students reported accessing the materials three to five days a week, and two students accessed it one to two days a week. In addition, the new YouTube exercise videos were posted semiweekly to the study website, but the videos were not frequently used. One-third of the survey respondents indicated using the videos at least once a week, while two-thirds of the students reported using the videos less frequently.

A.3.b. Attention Control Condition

In the attention control condition, five students reported accessing the website one to two days a week, two students accessed it three to five days a week, and one student accessed it daily. In contrast, the YouTube exercise videos were used less frequently. Only three students maintained that they used the videos at least once a week, while seven students indicated that they used the videos every few weeks or less often. See Table 5 for participant use/access of program components.

Although a social support component was not offered in the control condition, two participants sought out social support during the program. In addition, smartphone applications were not mentioned for self-monitoring of diet and exercise. However, one student reported utilizing a smartphone application, FitnessPal, a few times a week.

Table 5. Use/Access of Program Components

How often did you use/access the following:		
	Intervention (n=9)	Control (n=10)
Nutrition Information (n)		
Daily	0	1
3-5 days a week	3	2
1-2 days a week	2	5
Every few weeks	2	1
Less often	2	1
Exercise Videos (n)		
Daily	0	0
3-5 days a week	0	1
1-2 days a week	3	2
Every few week	3	4
Less often	3	3
Website (n)		
Daily	1	
3-5 days a week	2	
1-2 days a week	4	
Every few weeks	2	
Less often	0	
Forum (n)		
Daily	0	
3-5 days a week	1	
1-2 days a week	1	
Every few weeks	6	
Less often	1	
Smartphone Applications (n)		
Daily	3	
3-5 days a week	2	
1-2 days a week	1	
Every few weeks	0	
Less often	3	

B. Acceptability

B.1. Technology

The post-intervention survey responses support the potential for utilizing technology to reach college students for weight loss interventions. The results of the technology questions are reported in Table 6. In total, 90% of the respondents indicated they were comfortable with using technology and 79% reported they were comfortable with using technology for a weight loss program (rated a 4 or 5 on a 5-point scale). Over half the students maintained that they liked using technology in a weight loss program; 78% of the intervention group and 60% of the control group rated a 4 or higher on a 5-point scale. Moreover, at least two-thirds of the survey respondents in both groups affirmed that the technology tools utilized in their condition were appropriate for college students.

B.2. Program Components

The students provided feedback on the helpfulness of the overall program and technology features. The post-intervention survey results from each condition are presented in Table 7. The respondents in the intervention condition provided slightly higher ratings than the control condition for the overall program, nutrition information, YouTube exercise videos, and exercise information. In the intervention group, the nutrition lessons received the highest mean rating for helpfulness, while the forum received the lowest mean rating. In addition, the smartphone applications and website were rated more favorably than the forum and Pinterest page, both of which were used less frequently throughout the 8-week intervention. The majority of students in both conditions viewed the 8-week duration favorably.

Table 6. Technology Ratings

	Intervention (n=9) Mean ± SD	Control (n=10) Mean ± SD	<i>p</i>
Comfortable using technology	4.89 ± 0.33	4.10 ± 0.99	0.037
Comfortable using technology in a weight loss program	4.33 ± 1.22	4.00 ± 1.16	0.532
Liked using technology in a weight loss program	4.22 ± 0.83	3.60 ± 1.35	0.250
Technology tools were appropriate for students	4.11 ± 1.17	3.90 ± 0.74	0.640

Rated on a 5-point scale, 1 = strongly disagree and 5 = strongly agree

Table 7. Program Helpfulness

How helpful was/were the following:		
	Intervention (n=8) Mean ± SD	Control (n=10) Mean ± SD
Overall Program	3.25 ± 1.04	3.10 ± 1.20
Nutrition Information	3.88 ± 0.99	3.20 ± 1.14
Exercise Videos	3.63 ± 1.06	3.00 ± 1.16
Exercise Information	3.75 ± 0.89	3.33 ± 1.12
Website	3.25 ± 0.89	
Forum	2.00 ± 0.93	
Smartphone Apps	3.38 ± 1.51	
Pinterest Posts	3.00 ± 1.41	

Rated on a 5-point scale, 1 = not helpful and 5 = very helpful

*n=9 for exercise information responses in the control group

B.2.a. Intervention Condition

Over half the survey respondents in the intervention condition indicated that the program feature they liked and found to be most helpful was the regular text message updates from research staff. One student stated: *“The constant reminder text messages made me think about healthy eating”* (Female, Sophomore). Several participants also commented that they liked the smartphone applications, nutrition information, and YouTube exercise videos.

A few students specifically commented that they liked or found the website to be helpful. However, several other participants did not prefer the website or offered a few suggestions for improvement. While the students enjoyed the online delivery of the program materials, a few students indicated that it could be more convenient if the website or forum were more accessible on mobile devices. At the beginning of the study, the students were informed of the availability of a free WordPress smartphone application for iPhone and Android devices. The research staff tested the applications but noted the difficulty of using the iPhone version to access the website and post on the forum. In addition, several students suggested that it would be better to utilize social media rather than the WordPress website. In one of the focus groups, the students discussed the idea of using Facebook as a platform for the study. The participants provided mixed responses, with several commenting that they did not use Facebook or social media on a regular basis. The following quotes are participants’ responses regarding the website:

“I like the website with the easy access to videos and facts. Wish there was more facts”

(Female, Freshman)

“The website wasn't accessible on my phone.” (Female, Sophomore)

“it would be easier and I would have posted more if it was a private Facebook group, a twitter feed, etc, that I could do on the fly as a college student.” (Male, Senior)

“Do it primarily over something such as facebook to make it easier to use.” (Senior, Female)

There were mixed responses about the forum, which was underutilized during the 8-week program. Several survey respondents listed the forum or “writing in the forum” as one of the most helpful features of the program, while other students stated that the forum was the least helpful feature. Although the participants did not regularly interact on the forum, their survey responses revealed an interest in receiving social support in a weight loss intervention. The students commented that more interaction and support from the other group members would have been helpful for the program. The following survey responses represent students’ comments regarding interaction and support:

“No one used the forum so there was no community and accountability.” (Female, Senior)

“I would prefer more contact with other participants.” (Female, Junior)

“...I also wish there was some face-to-face interaction. I would have liked it better if I got to meet other participants every week or so and we discussed things. I feel like meeting each other would create greater accountability and encourage us to motivate each other.” (Female, Junior)

“Possibly having organized meetings or workouts.” (Male, Senior)

Similar ideas were discussed in the focus groups, with participants expressing a desire for greater accountability and support from peers and research staff. Students suggested facilitating more interaction between group members, either in-person or through Skype chat meetings, or reporting to research staff to increase accountability and motivation. The majority of the survey respondents in the technology-based weight loss condition indicated that the frequency of contact from the research staff was good.

B.2.b. Attention Control Condition

The YouTube exercise videos were most frequently mentioned as the program feature students in the control group liked or found most helpful. One survey respondent stated, “*the exercise videos made it less boring to work out*” (Female, Junior). While some students reported that they found the nutrition lessons to be helpful, others indicated they already knew most of the facts and wanted to receive additional information. One student commented, “*Most of the health and nutrition information I was already aware of*” (Female, Freshman). Several participants mentioned that they liked the email delivery, while other students did not prefer it. One survey respondent stated, “*I liked the email delivery. I think it was easy and convenient and I didn't have to search for the tips. They were just there*” (Female, Senior). In contrast, another student commented, “*It was easy to ignore the emails. And, I knew a lot of the information or could find looking on health websites.*” (Female, Sophomore)

The students’ responses highlighted several of the advantages and disadvantages of using technology for a weight loss intervention. The email delivery was considered by some to be easy and simple. However, several participants commented that the program lacked interaction or felt impersonal. A common suggestion for program improvement was greater interaction or contact, potentially through group fitness classes, frequent check-ins, or weigh-ins. In addition, students mentioned they would have liked more information, greater motivation, and accountability. The majority of survey respondents in the email education group thought that more contact from the research staff would have been better. The following survey responses represent students’ comments regarding interaction, accountability, and support:

“I would maybe check up on the participants once in the middle of the program.”

(Female, Senior)

“Make the check ins more frequent.” (Female, Senior)

“hold us more accountable” (Female, Sophomore)

“Make it more personable so that a person remains motivated” (Female, Freshman)

DISCUSSION

This research project sought to evaluate the feasibility and acceptability of implementing a pilot technology-based weight loss intervention for overweight and obese college students. The results suggest that technology may be a viable and appropriate platform to reach and engage students in a weight loss program.

In this pilot study, 20 participants were recruited from a single university over a three-week period. In comparison to the two previous technology-based weight loss interventions for college students, this pilot study had a smaller sample size and shorter recruitment period. Napolitano et al. recruited 52 students (18-29 years) from a single university over one semester [27], and Patrick et al. recruited 404 students (18-35 years) from three universities over a two-year period [28].

The number of overweight and obese students, who were enrolled in the technology-based weight gain prevention studies, varied. These studies targeted normal weight, overweight, and obese students; but about one-third of the students in their studies were overweight or obese [24, 25, 29]. Specifically, Franko et al. enrolled 166 overweight and obese students (about 28 students per school) from six universities [29], while Green et al. enrolled approximately 485 overweight and obese students from eight universities (about 61 students per school) [25]. In addition, Gow et al. conducted a study at a single university, enrolling 55 overweight and obese first-year students [24]. These studies did not specify the length of their recruitment periods.

In this pilot study, the initial recruitment goal was 100 undergraduate students (18-22 years). However, this was a lofty goal. Once the research team experienced the challenges of recruitment in a college setting, it was realized that this goal might have been unrealistic, given the short recruitment period. While only 20 students enrolled in the study, a total of 32 students inquired about the study during the three-week recruitment period. Several students could not be scheduled for a Skype screening before the start of the study, and several others contacted the research team after the recruitment period. In addition, a second study was conducted in the spring semester, in which 24 students were enrolled. Thus, it is likely that a larger sample could have been recruited, if the recruitment period had been extended to one semester.

The study incorporated an innovative social media recruitment strategy, utilizing a public Facebook page with an electronic flyer and encouraging students to “like” or “share” the page or flyer. The intent of the strategy was to promote the spread of the study information through existing online social networks. Despite the large potential for social media to diffuse information, only 5% of the participants reported hearing about the program through Facebook, and 19% of the interested students contacted the study through Facebook message. In a recent study, Corsino et al. reported similar findings from their experience of recruiting young adults [60]. The researchers tested various recruitment strategies, including Facebook advertisements and traditional mass mailings. Despite collecting formative data from young adults and using a marketing firm to develop the ads, the researchers reported that Facebook was not an effective strategy. Less than 1% of the 365 young adults enrolled were recruited through Facebook [60].

Recent research on the diffusion of news on Facebook suggests several factors influence the spread: exposure to the news in one’s newsfeed, the number of friends who are exposed, and the strength of ties between people [61]. The researchers found that one out of every 12.5 URLs

that surfaced in an individual's Facebook newsfeed was shared, and weak social ties were more important than stronger ties for the rapid diffusion of information. The study results indicate that Facebook may be a potential strategy for spreading recruitment information. Previous research highlights the need for effective recruitment strategies for young adults and college students [27, 34-36]. Further studies should be conducted to identify and evaluate social media strategies to recruit this population [60, 61].

The results of the study also suggest that technology may be beneficial for retaining and engaging students. In this pilot study, 95% of the sample completed the program and the 8-week assessments. Previous research has shown that high attrition may be one of the limitations of traditional, in-person weight loss interventions for young adults and college students [34-36]. However, the 95% retention in this study is consistent with the high retention rates reported in the 8-week technology-based study conducted by Napolitano and colleagues [27].

The technology-based intervention was found to be acceptable to most students. In the post-intervention surveys, 78% of students in the intervention condition and 60% in the control condition indicated that they liked using technology in a weight loss program. In terms of technology tools, over half the participants in the intervention condition reported that they liked receiving the regular text message updates. Several students also liked the study website and smartphone applications. In contrast, the forum received less favorable reviews, with four students citing it as the least helpful feature of the program. This may be attributed to the low utilization of the forum and website.

Overall, participant engagement in the intervention group was lower than intended. The results of the online survey revealed that the study website and forum were not regularly used by the majority of participants in the intervention group. Despite receiving text message updates and

notifications throughout the week, only one-third of respondents reported accessing the website three or more times each week. In addition, two students indicated that they went on the forum on a weekly basis, with the rest of the group members reporting less frequent visits to the forum. The lower levels of engagement are consistent with a recent mobile health weight loss study among young adults [40]. The researchers indicated that participants viewed the forum an average of 2.1 times over the 12 weeks, while only two of the 26 participants in the intervention condition posted on the forum. It was hypothesized that usability of the technology tools and lack of time were barriers to engagement in this population [40].

In spite of the low forum and website utilization in this pilot study, the qualitative data highlight the value of exploring strategies to promote use of the forum. Students indicated that they were interested in finding support and accountability through the program. They maintained that greater use of the forum by other group members would have encouraged them to access the forum and website more frequently. Barriers to posting included the low forum use, the lack of responses, and the feeling that their posts would not be read. To increase forum views and posts, the participants suggested mobile accessibility to post on-the-go or facilitating regular Skype sessions to “meet” other participants. These findings reflect the importance of social factors in weight loss, which is supported by the existing literature around weight loss in college students and young adults [32, 33].

LaRose and colleagues suggest that social factors are strong motivators for young adults to lose weight. Young adults may be driven to lose weight because of their desire for improved appearance or to feel better about themselves [32]. It has also been documented that peer support and social contacts may be important for both weight loss and maintenance in young adults [33]. Thus, researchers underscore the potential for exploring the use of friends and peers as resources

and motivators for weight loss among young adults [32, 33]. The two studies on technology-based weight loss interventions for overweight and obese college students incorporated a peer support component [27, 28]. Napolitano et al. had participants select a “buddy” for support during the program [27]. However, the researchers noted that they were unable to measure the amount of support the participants received. Similarly, in the ongoing SMART intervention, Patrick and colleagues are utilizing students’ existing online social networks to encourage and support weight loss [28].

In addition, the results of this feasibility and acceptability study suggest that mobile health interventions may be beneficial in this population [40]. In the post-intervention surveys, over half the students reported using a smartphone self-monitoring application at least three times a week, and one third used an application on a daily basis. In addition, students reported that they liked the regular text messages and found them to be helpful. Although the intent of the text messages was to notify participants that new program materials were posted on the website and remind them to post on the forum, participants may have viewed the text messages as reminders for healthful behaviors. Finally, the students commented that mobile accessibility of the website might have encouraged them to visit the website or post on the forum more frequently.

Overall, the students seemed to value the use of technology for the purpose of receiving program content and information. For example, participants indicated that the website and emails promoted easy and convenient access to program materials. Technology may afford a convenient platform for students to receive health-related information and allow them to connect on the go with others in the program. This may be beneficial for students who have limited time or busy

schedules. Other studies have documented that lack of time and a demanding intervention may negatively affect engagement or attrition among college students and young adults [31, 40].

While participants acknowledged the advantages of technology, they also noted the impersonal aspect of technology. The students in the control condition indicated a desire for greater contact or interaction with other participants or research staff. Likewise, the participants in the intervention condition commented that while the use of technology was helpful, they wanted more interaction with other group members or some sort of non-technological aspect. The students were looking for support, accountability, and motivation through the program. These preferences were consistent with the participant feedback reported in two recent technology-based weight management studies [30, 41].

Strengths & Limitations

One of the strengths of this research study was the mixed methods approach used to collect both quantitative and qualitative data on feasibility and acceptability. Limited evidence exists on the feasibility and acceptability of technology-based weight management interventions in the university setting [27, 30]. Dour and colleagues measured satisfaction and motivational effects of their program [30], and Napolitano et al. evaluated recruitment, retention, engagement, and satisfaction in their study [27]. The data collected through the mixed methods approach add to the existing literature on the feasibility and acceptability of technology-based weight loss programs for college students. Specifically, the qualitative data were valuable for assessing the specific program features and tools students liked and found to be most helpful. In addition, participants shared constructive criticisms, barriers to greater engagement, and strategies to improve the study. The study enabled the research team to gain insight into students'

perspectives and experiences in the program and better understand the components that were important to students in a technology-based weight loss intervention.

Another strength of the pilot study was that all aspects of the program were technology-based, which could have had positively impacted retention. Previous research suggests that it is challenging to recruit and retain college students and young adults in weight loss interventions [26, 31, 35, 36]. In past studies, students cited a lack of time as their reason for dropping out [26, 31]. This pilot study sought to use technology in all phases of the study, including the assessments. Students were not required to attend in-person assessments, meetings, or focus groups. This strategy could have provided convenience for college students, who are balancing busy school, work, and social schedules. For example, the height and weight measures were collected in a 5-10 minute Skype meeting. This offered students the advantages of saving travel time, minimizing the need for transportation, and providing flexible meeting times, including lunch breaks, evenings, and weekends. From a research standpoint, the video feature enabled the research team to collect actual height and weight measures, rather than rely on self-reported data. It has been suggested the self-reported data may be less accurate than actual weight measurements, as young adults may under-report their weight and over-report their height [53].

Furthermore, the focus groups were conducted through Skype group messaging, with the video feature turned off and the microphone and audio muted to offer anonymity. The online focus groups afforded flexibility and convenience, as they could be held during the evening hours (i.e., 7:00 p.m. and 10:00 p.m.), after students finished classes or work obligations. Scheduling students to participate in the online focus groups was relatively quick and easy; the majority of students responded promptly to the email or text message invitations.

An additional strength of this pilot study was the inclusion of a social support component, through the forum. This addressed one of the limitations of the existing research. In most studies, online social support was not included or used in a limited capacity [24, 25, 27]. Four of the seven technology-based weight management interventions utilized a web-based educational curriculum as the central component [23-25, 29]. Social support may be tied to acceptability in an online weight loss intervention.

Despite the forum usage being lower than intended, the pilot study enabled the research team to explore students' perceptions of online social support. The surveys and focus group responses revealed students' interest in gaining support and accountability for weight loss and provided insight into barriers to regularly visiting the website and posting on the forum. The data were used to improve another trial, through integrating strategies to facilitate additional online interaction among participants.

Despite its strengths, this feasibility and acceptability study had several limitations. One of the limitations was the small size and composition of the study sample. With only 20 students enrolled in the study, each condition included 10 students. Thus, these preliminary study findings about feasibility and acceptability should be interpreted with caution, as they are based on the responses of the 9-10 students in each group. In addition, the sample was 90% female, and all students were 18-22 years old. The age criterion was selected with the intent of including traditional college students, who finish their degree in four or five years. These factors may limit the generalizability of the findings to males and older college students. It is possible that older students may be different in terms of their work experiences, family life, and technology use. It is also important to note that the students were recruited from a four-year public postsecondary institution. As a result, the sample was most likely comprised of college students of higher

socioeconomic status. These students may have greater access to healthy resources and technology devices, which can support their weight loss efforts. In contrast, young adults, who do not attend college or who attend technical schools or two-year postsecondary institutions, may have a lower socioeconomic status and be limited in their access to healthy resources.

The target goal was initially set at 100 undergraduate students. However, the three-week recruitment period limited the ability to recruit additional students. One of the major challenges in this pilot study was the university schedule, including the exam period near the conclusion of the study and the one-month winter break. The research team decided to shorten the recruitment period and commence the study, rather than delay the start date and continue the intervention during the winter break. Unlike studies conducted among working young adults, research among college students must consider the additional challenge of the school schedule, including exam periods and the fall, winter, spring, and summer breaks. Furthermore, students' class and work schedules may change by the semester. The two previous technology-based weight loss studies recruited 52 students from a single university over one semester [27] and 404 students from three universities over a two-year period [28]. In this research study, a longer recruitment period may have helped with the recruitment of a larger sample.

Another limitation is the recruitment and engagement measures. The results of the study revealed that Facebook was not the most effective recruitment strategy. However, it should be noted that the reach of the Facebook page in the university community could not be measured. It could not be determined whether the lack of responses to the Facebook page was due to the limited reach or to the ineffectiveness of the strategy in attracting students to participate in the program. In addition, participant engagement measures were based on self-reported usage of

program materials, rather than actual usage statistics. The inclusion of additional engagement measures may be valuable for identifying the “active ingredients” in an effective intervention.

Lessons Learned

Recruiting a large sample of college students in three weeks was challenging. Yet, extending the recruitment period by several weeks would have delayed the start date, and part of the eight-week intervention would have overlapped with the university winter break. This posed several challenges. In addition to the potential for weight gain over the holidays, students’ use of technology devices may be different during a break from academics. Moreover, collecting the post-intervention measures during the break could have been difficult.

To meet the recruitment numbers, it could have been helpful to extend the recruitment period to one semester. In this pilot study, seven of the 11 students, who responded to the flyers after the recruitment period in the fall semester, enrolled in the spring trial. It is possible that actively recruiting throughout the semester could have resulted in a larger sample. In addition, a longer recruitment period would have made it possible to employ other recruitment strategies. In this pilot study, the short time frame made it difficult to have the necessary time to receive IRB approval and implement alternative strategies. Furthermore, it might have been beneficial to recruit earlier in the semester, at campus events, orientation activities, and introductory courses.

In this pilot study, it took time to promote the Facebook page and disseminate the study information. Having more undergraduate students “like” the page or “share” the electronic flyer on their Facebook timelines could have helped spread the study information. In addition, gaining the support of the university administration may potentially enhance technology-based recruitment strategies. The university listservs and social media pages, such as Twitter and Facebook, have the potential to reach a large number of students at the university.

Implications for Future Research

Future research should investigate the feasibility and acceptability of implementing technology-based weight loss interventions in different college student populations. Similar to this pilot study, the majority of the weight loss studies have had greater success in recruiting female students. Incorporating technology may enhance the recruitment of male students in weight loss interventions. Morgan et al. conducted a technology-based weight loss study targeting male students, faculty, and staff at a university [41]. Their sample (n=65), which was comprised of 43% students, was recruited in less than 10 days. In addition, future studies should target students, who attend two-year postsecondary institutions. These students may be different in terms of socioeconomic status, family and work obligations, and access to technology devices.

In addition, future research should be conducted to explore effective recruitment strategies for college students and young adults. Researchers have suggested the need for innovative strategies to recruit the young adult population for weight loss studies [34, 35]. In their weight loss study for young adults, Corsino et al. reported that Facebook advertisement strategies were the least effective strategy for recruiting participants, despite the fact that young adults had suggested the use of social media for recruitment [60]. They found the traditional strategy of mass mailings to be most effective. Future research should continue to explore whether online social networking sites, such as Twitter, Facebook, and Instagram, can be used to disseminate study information to students. In addition, research suggests that social factors are strong motivators for young adults to lose weight and engage in healthful behaviors [32, 33]. Recruitment messages may be tailored to include social motivators to attract college students.

Finally, additional research should further investigate the feasibility and acceptability of incorporating an online social support component in technology-based weight loss interventions

for college students. Social support from peers or an online social network has the potential to assist in weight loss in young adults and college students. Similar to previous studies, students in this pilot study indicated a desire for greater interaction, support, and accountability in an online weight loss program [30, 41]. A sense of support may be associated with the acceptability of the intervention. Finally, researchers should continue to investigate the feasibility and acceptability of mobile health weight loss interventions for college students. In this pilot study, participants indicated an interest in mobile accessibility to post on the forum or better access the website. Mobile accessibility could assist with the integration of an intervention into students' busy schedules, which could enhance retention and participant engagement.

In conclusion, the results of this research study suggest the potential benefits of a technology-based weight loss intervention and highlight the need for further research among college students. Participant feedback was valuable for identifying barriers to using the website and forum and potential strategies to promote greater engagement, support, and accountability. While students valued the use of technology in a weight loss program, they noted an interest in receiving greater support, interaction, and accountability from other group members. Finally, participants reported that the text message updates and notifications were helpful and commented on the advantages of mobile accessibility of program materials. The data collected in this pilot study was used to inform the design and implementation of another trial.

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APPENDICES

Appendix A. Technology-Based Weight-Related Studies

Table 1. Summary of Previous Research: Design

AUTHOR	POPULATION	N	DURATON	INTERVENTION	TECHNOLOGY TOOLS
WEIGHT GAIN PREVENTION STUDIES					
Levitsky et al. 2006 [26]	Female freshmen (Age: 18-21 years, Weight: 62.5±10.2)	32	10 weeks	2 arms: 1) Daily TMS slope feedback, 2) nutrition education control	Email and Tissue Monitoring System (TMS)
Levitsky et al. 2006 [26]	Female freshmen (Age: 18+ years, Weight: 62.0±8.6)	41	10 weeks	2 arms: 1) Daily TMS caloric feedback, 2) nutrition education control	Email and Tissue Monitoring System (TMS)
Franko et al. 2008 [29]	6 universities 56.3% Female, 58.2% White, Age 20.1±1.7	476	2 weeks (3, 6-month)	3 arms: 1) MSB-N I, 2) MSB-N II, 3) attention control	MyStudentBody.com-Nutrition (MSB-N)
Gow et al. 2010 [24]	First year students 74.2% Female, BMI 24.38 ± 5.05	170	6 weeks (3-month)	4 arms: 1) Internet program, 2) weight/caloric feedback emails, 3) Internet program + feedback, 4) no treatment	Blackboard Internet intervention, discussion board, emails with feedback graphs
LaChausse 2012 [23]	76% Female BMI: 29.5 ± 8.78 (1), 29.19 ± 6.64 (2), 28.31 ± 8.30 (3)	328	12 weeks	3 arms: 1) MSB-N (online), 2) on-campus weight management, 3) control	MyStudentBody.com-Nutrition (MSB-N)
Greene et al. 2012 [25]	8 universities Age 19.1 ± 1.1 years and 23.9 ± 4.1 BMI	1689	10 weeks	2 arms: 1) 10-lesson web-based nutrition and physical activity intervention, 2) Control	Web-based lessons, forum questions, weekly email reminders
WEIGHT LOSS STUDIES					
Napolitano et al. 2012 [27]	86.5% Female Age: 20.47 ± 2.19 years; BMI: 31.36 ± 5.3 kg/m2	52	8 weeks	3 arms: 1) Facebook, 2) Facebook Plus, 3) Waiting list control	Facebook group with polls, event invitations, group posts/messages, podcasts. Plus: text messages
Patrick et al. 2013 [28]	70% Female Age 22±4years BMI 29±2.8	404	24 mo.	2 arms: 1) SMART intervention, 2) comparison condition (website access but no social networking)	SMART: Facebook, mobile apps, website with blogs, email, text messages, telephone coach

BMI=body mass index, PA=physical activity, FV=fruit and vegetable, FB=Facebook

Table 2. Summary of Previous Research: Results

AUTHOR	OUTCOMES	RESULTS
WEIGHT GAIN PREVENTION STUDIES		
Levitsky et al. 2006 [26]	Change in body weight	Sig. difference in weight gain between control and TMS groups. Sig. weight gain in control groups in both trials.
Franko et al. 2008 [29]	FV intake, stages of dietary/PA change, nutrition knowledge, frequency of PA, social support, self-efficacy, exercise benefits and barriers. No anthropometric measures.	Compared to control, the MSB-N I & II had greater increases in FV intake, support for dietary changes, attitudes towards PA, and motivation to change behaviors. No changes in PA behavior.
Gow et al. 2010 [24]	BMI, eating and weight related attitudes and behaviors questionnaire	Combined had lower post-test BMIs compared to other groups. No BMI difference between other groups. No difference in diet and PA behaviors.
LaChausse 2012 [23]	Self-reported body weight. Surveys of nutrition/PA behaviors, self-efficacy, perceived stress, attitudes towards nutrition/PA	No change in BMI in any group. Online program increased healthy eating behaviors.
Greene et al. 2012 [25]	Anthropometric measures, cardiorespiratory fitness, FV intake, PA behavior, emotional problems and stress, eating competence	No sig. changes in weight or BMI between groups. Increased FV intake with sig. greater increase in intervention group. Decrease in PA in both groups, with sig. less decline in intervention.
WEIGHT LOSS STUDIES		
Napolitano et al. 2012 [27]	Weight, leisure-time exercise questionnaire, PA and weight self-efficacy, social support measure, engagement, satisfaction questionnaire	FB Plus weight losses significantly greater than waiting list and FB at 8 weeks; no significant difference between WL and FB at 8 weeks
Patrick et al. 2013 [28]	Weight, self-reported diet and PA, sedentary behavior, quality of life, depression, levels of program satisfaction	Ongoing - study in Year 2 (as of Nov 2013)

BMI=body mass index, PA=physical activity, FV=fruit and vegetable, FB=Facebook

Appendix B. Baseline Questionnaire

Name _____

DOB ____/____/____

1. What is your classification in school?

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior

2. What is your gender?

- ☐ Male
- ☐ Female

3. Which of the following describes your race?

- ☐ American Indian
- ☐ Asian
- ☐ African American
- ☐ Pacific Islander
- ☐ Caucasian
- ☐ Other

4. Which of the following describes your ethnicity?

- ☐ Hispanic or Latino
- ☐ Non-Hispanic or Latino

5. Where are you from? _____

6. Where do you currently live?

- ☐ Home (with family)
- ☐ Dormitory
- ☐ Off-campus apartment
- ☐ Other _____

7. Where do you eat most of your meals?

- ☐ University cafeteria
- ☐ Fast food
- ☐ Restaurants/dining out
- ☐ Home/home-prepared meals
- ☐ Other _____

8. Do you have a university meal plan?
- ☐ No
 - ☐ Yes (If so, what type _____)
9. In the last 7 days, on how many days did you eat at a fast food type place (i.e., McDonalds, Kentucky Fried Chicken, Pizza Hut, Taco Bell, etc.)?
- ☐ 0 days
 - ☐ 1 day
 - ☐ 2 day
 - ☐ 3 day
 - ☐ 4 day
 - ☐ 5 day
 - ☐ 6 day
 - ☐ 7 day
10. On average, how often in the past month did you consume a non-diet, sugar-sweetened soft drink (i.e., soda, sweet tea, fruit drinks, sports drinks, etc.)
- ☐ Never or less than 1 per month
 - ☐ 1-4 per month
 - ☐ 2-6 per week
 - ☐ 1 per day
 - ☐ 2 per day
 - ☐ 3 or more per day
11. Have you received any support for weight loss efforts in the past (i.e., family, friends, or healthcare providers)?
- ☐ No
 - ☐ Yes
12. Have you participated in any weight loss programs in the past?
- ☐ No
 - ☐ Yes (If so, did you receive any social support through the program? Yes / No)
13. Have you ever been a member of any weight loss community (online or in-person)?
- ☐ No
 - ☐ Yes

Appendix C. Sample Recruitment Materials

Public UTK Health Facebook Recruitment Page



Sample UTK Health Flyer and Handout



Appendix D. Screening Form

Are you an undergraduate student at the University of Tennessee?

☐ Yes ☐ No

What is your classification in school?

☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior

DOB ____/____/____

Age ____ years ____ months (student must be between 18-22 years)

Height _____ Weight _____

Calculate BMI _____ (student BMI must be $\geq 25 \text{ kg/m}^2$)

Gender:

☐ Male ☐ Female

Do you have access to the Internet?

☐ Yes ☐ No

Do you have a personal computer?

☐ Yes ☐ No

Do you have a smartphone (cell phone with a data package)?

☐ Yes ☐ No

Do you have a medical condition that restricts the types of foods you can eat?

☐ Yes ☐ No

Are you taking any prescribed medications that might affect your weight?

☐ Yes ☐ No

Do you have plans to participate in any other weight loss program in the next 6 months?

☐ Yes ☐ No

Have you been diagnosed with a major psychiatric illness in the last 12 months (e.g., depression, bipolar disorder, schizophrenia)?

☐ Yes ☐ No

Have you been diagnosed with any type of eating disorder in the last 12 months?

☐ Yes ☐ No

[Females Only] Are you pregnant or planning to become pregnant in the next 6 months

☐ Yes ☐ No

[Females Only] Have you given birth in the last 6 months?

☐ Yes ☐ No

Appendix E. Informed Consent Form

INFORMED CONSENT

INTRODUCTION

Researchers from The University of Tennessee Department of Nutrition are working on a research study about how factors in diet choices and lifestyle may affect body weight in overweight or obese college students. You are being invited to participate in this study. Please read the information below and decide whether you would like to participate. The people in charge of this study will answer any questions you have.

PURPOSE OF THE STUDY

Young adults have the greatest increase in obesity prevalence, compared to any other age group. The college environment and the transition to young adulthood can make it difficult for students to maintain a healthy body weight and healthy behaviors. A research team from the University of Tennessee is interested in learning more about how diet choices, lifestyle, and technology can affect weight loss in college students who are overweight or obese. This study will provide valuable information about how to best help students manage their weight and a healthy lifestyle.

DESCRIPTION OF THE STUDY

PROCEDURES

You will be randomly assigned to one of two groups. The first group will receive emails three times per week with information on healthy eating and links to exercise videos for 8 weeks. The second group will have access to a private website, which will be regularly updated with nutrition materials, exercise videos, and a forum, during the 8-week program. This group will be encouraged to join a private Facebook group and use smartphone applications to track their exercise and food intake. Students in both groups will be asked to try to make changes in their eating and exercise habits that might help them manage their weight and become healthier. At the end of the study, you may be invited to participate in an online Skype focus group to share your experiences in the program.

The program will last 8 weeks, going from September through November. At the beginning and end of the study, we will ask you to measure your height and weight during a Skype meeting with research staff, and complete an online questionnaire through SurveyMonkey. In addition, we will call you two times during the study (once at the beginning and once at the end) to ask about your food intake and exercise the day before. Research staff will be available to answer any questions you may have about the study. We will provide you with detailed instructions before the study begins.

POSSIBLE RISKS

All information you provide will be kept as private and confidential as possible. The study website and Facebook group will be private. However, since we will be posting on a forum, other people in the website group may see what you write. At the beginning of the study and before the focus groups, we will post this statement: "What we share here will be confidential. Please be respectful of everyone's privacy; please don't talk about what was shared in this group. I will only be sharing the information with our research team. Also, we want to ask that no one

outside of the study be present and able to read the chat dialogue during the group meeting.” However, once the groups have disbanded, confidentiality cannot be assured. Given that the topic of these discussions will be healthy weight and healthy lifestyles, we do not anticipate highly sensitive information being discussed. Being in this study may keep you from being in other studies at the same time.

POSSIBLE BENEFITS

You may directly benefit from the nutrition information, exercise videos, and social support. Others may benefit in the future from the information we obtain while you are in this study. However, you will not receive any medical benefits from being in this study.

PAYMENT FOR PARTICIPATION

Because we’re asking you to spend time in the study, possibly change your diet and exercise, and answer some questions, you will be given a \$15 gift card for completion of baseline and 8-week assessments for a total of \$30 in gift cards.

CONFIDENTIALITY

All information you provide will be kept private and confidential to the extent legally possible. We will assign you a number and any information you give will be matched with that number. Data with identifying information, including your contact information (email addresses and phone numbers) and usernames (Facebook, Pinterest, Skype, and WordPress), and electronic files linking your name and data will be stored in locked file cabinets and a password-protected database. Only research staff will have access to your data and responses. No one else will be able to identify you from your responses. Our examination of the data will be done on the basis of the responses of the entire group of participants. Therefore, no individual information will be available about you. All hard copies and electronic files containing identifying data will be destroyed 7 years after the completion of the study and analyses. The University of Tennessee IRB Committee may assess information as needed.

Additional privacy measures: You will access the website through the username and password you create. The website will be private, which means only invited users and the research team will be able to view the site. You will be given the option to join the study’s private Facebook group. Privacy options for the Facebook group will be set to “secret,” which restricts viewing and posting to members and prevents non-members from finding the group in searches. Group information will not appear in your timeline, and your timeline will be available to non-friend members only to the extent allowed in your privacy settings. SurveyMonkey, the tool that will be used to collect survey data, has enhanced security features, such as secure sockets layers encryption, to protect data transmission from your computer to the research team. We will disable the option to collect IP and email addresses, but we will ask you to provide your ID number when completing the survey. For security purposes, we will advise you not to complete the survey on public or shared devices. Your responses will remain private to you and the research team. You will have the option to mark “no response” or withdraw from the survey. In the online Skype focus groups, you will use the instant messenger function and leave the video feature and webcam off to maintain privacy and minimize disclosure of your identity. Before starting the focus groups, we will ask all participants to respect the privacy of the other group members by ensuring that no one outside the study (i.e., friend, roommate, family member) is

present and able to read the chat dialogue during the focus group. Whenever it is necessary, we will encourage you to use and create usernames that do not reveal your identity.

VOLUNTARY PARTICIPATION/WITHDRAWAL

Your participation in this study is voluntary. You may decide not to participate in this study. If you participate, you may freely withdraw from the study at any time by telling any of the research staff. Your participation in this study may be stopped at any time by the research staff or without your consent. Enrolling in this study may exclude you from participating in other studies at the same time.

You have the right to sign or not to sign this form. If you choose not to sign, you will not be able to take part in this research study. Even if you sign this form now, you may still withdraw your permission at any time by telling the research staff in writing. If you decide to withdraw your permission, you may no longer be in the research study. Any information that has already been collected and shared about you may keep being used.

COMPENSATION FOR INJURY

If you are injured as a result of being in the study, or if you think you have not been treated fairly, contact the research staff at (865) 964-5571. However, the University of Tennessee does not have a program to pay you if you are injured or experience adverse outcomes. You and your insurance company will be responsible for payment of any treatment or hospitalization you require if you are injured as a result of being in the study. Your health insurance company may or may not pay for treatment of injuries as a result of your participation in this study.

QUESTIONS

If you have any questions concerning your participation in this study, you may contact the research staff at (865) 964-5571 or by email (utkhealth@gmail.com).

If you have questions about your rights as a research participant, or any problems that you feel you cannot discuss with the investigators, or have any research related issue contact the Compliance Officer and Institutional Review Board (IRB) Administrator at the University of Tennessee at (865) 974-7697. The IRB is a group of people who review the research study to protect your rights.

CONSENT

I am making a decision whether or not to participate in this study. I have read all of the information above. I have asked questions and received answers about things I did not understand. I willingly give consent to participate in this study.

My signature indicates that I understand that:

- I can cancel this authorization/consent. The use and/or disclosure of information will stop after researchers receive this notification. Information that is used or disclosed before this notice may still be used.
- I have the right to refuse to sign this authorization.
- If I do not sign this authorization, I will not be allowed to be in this study.

- I will receive a signed and dated copy of this authorization.

I consent and authorize the research staff to perform the research described above upon:

Name of Participant _____

Signature of Participant _____ Date _____

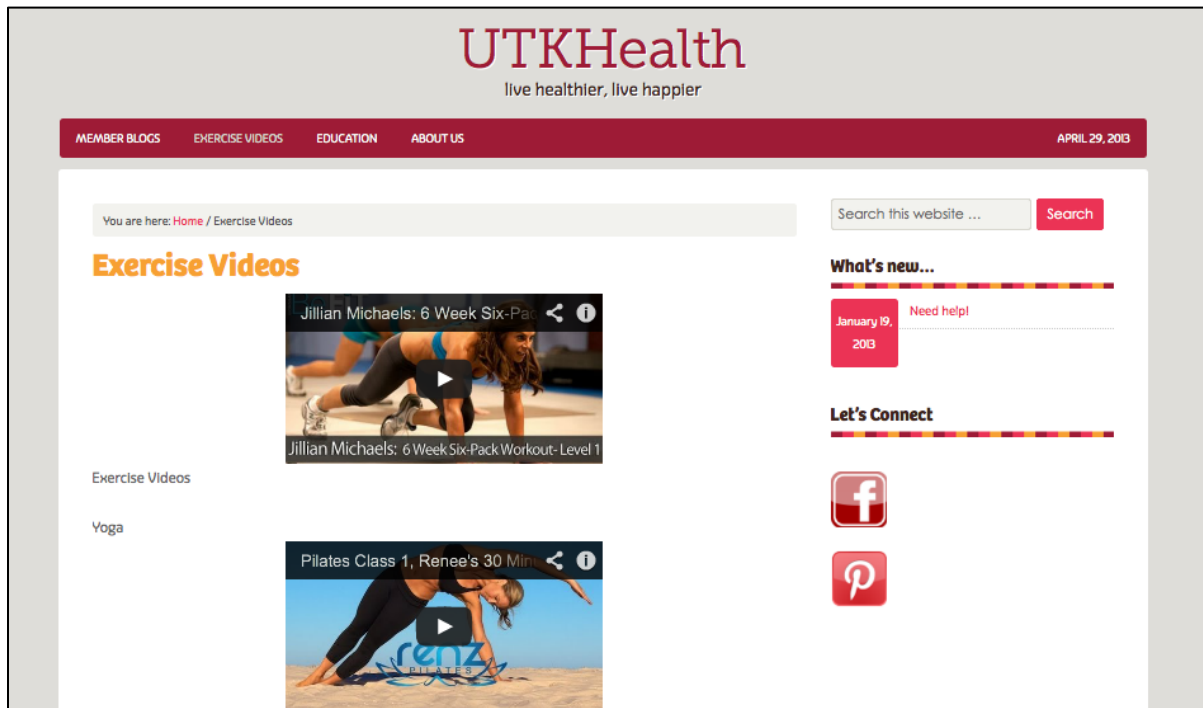
I the undersigned, certify that to the best of my knowledge the subject signing this consent had the study fully and carefully explained. He/she clearly understands the nature, risks, and benefits of participation in this project.

Name of Person Administering Consent (Investigator or Designee)

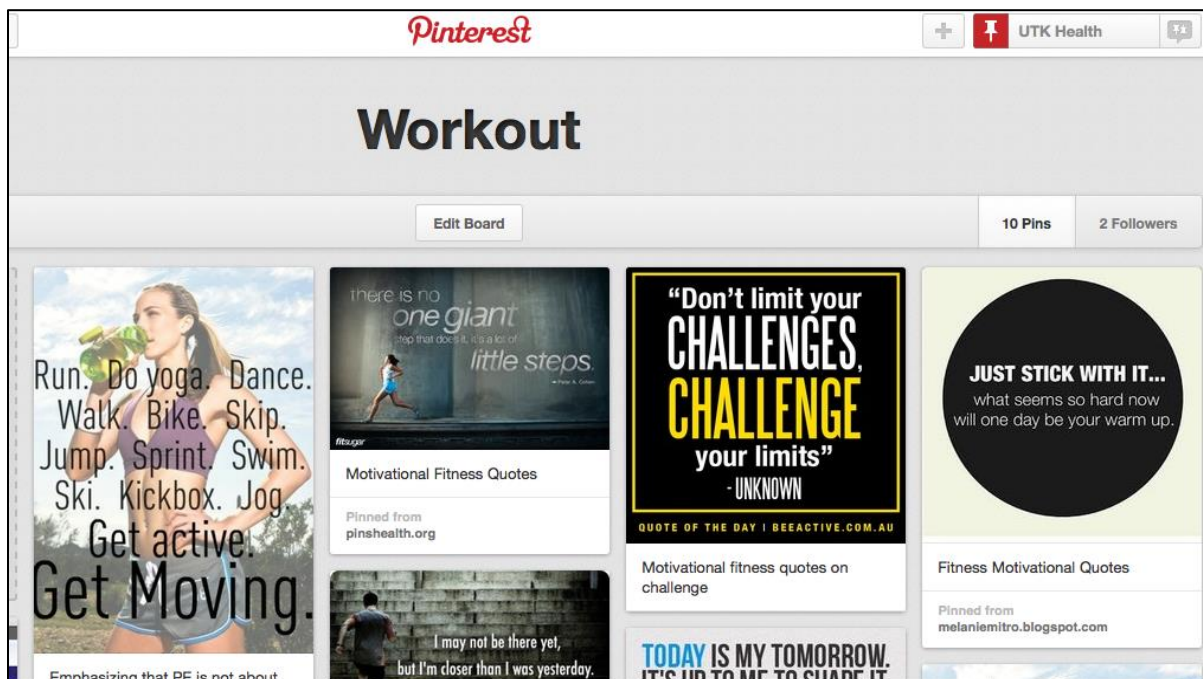
Signature of Person Administering Consent _____ Date _____

Appendix F. Sample Technology Tools

Study Website (Exercise Page)



Study Pinterest Workout Page



Appendix G. Post-Intervention Online Surveys

INTERVENTION CONDITION

Quantitative Survey Questions

Overall Program

On a scale of 1-5 with 1 = not helpful and 5 = very helpful, please rate the following:

1. How helpful was/were the following? (a)
 - a. Overall program
 - b. Website
 - c. Forum
 - d. Pinterest posts
 - e. Smartphone applications
 - f. Nutrition information
 - g. Exercise videos
 - h. Exercise information

On a scale of 1-5 with 1 = strongly disagree and 5 = strongly agree, please rate the following:

2. I am comfortable with using technology.
3. I am comfortable with using technology for a weight loss program.
4. I liked using technology in a weight loss program.
5. The technology tools used in the program (website, YouTube videos, social media, smartphone applications, etc.) were appropriate for college students.
6. I prefer interacting with people online rather than in-person to help with weight loss.
7. The program was a good/appropriate length.

Frequency of Use (Multiple choice: Several times a day; About once a day; 3 to 5 days a week; 1 to 2 days a week; Every few weeks; Less often)

8. How often did you access the website?
9. How often did you access the nutrition information?
10. How often did you use the physical activity videos?
11. How often did you use smartphone applications to record your exercise or food?
12. How often did you go on the forum?

Social Support (Yes or no questions)

13. Did you know any other group members before the start of the intervention?
14. Did you communicate with any other participants outside the forum?

Qualitative Survey Questions: Open-ended questions

15. How did you hear about the study?
16. What attracted you to participate in the program?
17. Why did you sign up for the study?
18. How do you feel about the use of social media for informing students about this type of program?
19. What did you like about the program?
20. What did you like less about the program?

21. What specific features of the program do you think were the most helpful?
22. What specific features of the program did you think were least helpful?
23. What aspects of the program would you change?
24. What kept you participating in the program?
25. What are your thoughts on how frequently we contacted you during the program?
26. How does this program compare to other weight-loss programs you have tried?

ATTENTION CONTROL CONDITION

Quantitative Survey Questions

Overall Program

On a scale of 1-5 with 1 = not helpful and 5 = very helpful, please rate the following:

1. How helpful was/were the following?
 - a. Overall program
 - b. Nutrition information
 - c. Exercise videos
 - d. Exercise information

On a scale of 1-5 with 1 = strongly disagree and 5 = strongly agree, please rate the following:

2. I am comfortable with using technology.
3. I am comfortable with using technology for a weight loss program.
4. I liked using technology in a weight loss program.
5. The technology tools used in the program (nutrition information and YouTube videos) were appropriate for college students.
6. I prefer interacting with people online rather than in-person to help with weight loss.
7. The program was a good/appropriate length.

Frequency of Use

Multiple choice options: Several times a day; About once a day; 3 to 5 days a week; 1 to 2 days a week; Every few weeks; Less often

8. How often did you access the nutrition information?
9. How often did you use the physical activity videos?

Other (Yes or no questions)

10. Did you seek out any form of social support (i.e., family, friends, etc.) during the program?
11. Did you use any self-monitoring applications (food diary, exercise journal, etc.) at any time during the intervention? If so, how often?
12. Did you have access to the materials from the other group (website and social media) at any time during the intervention?

Qualitative Survey Questions: Open-ended questions

13. How did you hear about the study?
14. What attracted you to participate in the program?
15. Why did you sign up for the study?
16. How do you feel about the use of social media for informing students about this type of program?
17. What did you like about the program?
18. What did you like less about the program?
19. What specific features of the program do you think were the most helpful?
20. What specific features of the program did you think were least helpful?
21. What aspects of the program would you change?
22. What kept you participating in the program?

23. What are your thoughts on how frequently we contacted you during the program?
24. How does this program compare to other weight-loss programs you have tried?

EXIT SURVEY

Quantitative Survey Questions:

The survey includes the same quantitative questions from the control group survey or the intervention group surveys

Qualitative Survey Questions: Open-ended questions

1. Why did you decide to discontinue the study?
2. How did you hear about the study?
3. What attracted you to participate in the program?
4. Why did you sign up for the study?
5. How do you feel about the use of social media for informing students about this type of program?
6. What did you like about the program?
7. What did you like less about the program?
8. What specific features of the program do you think were the most helpful?
9. What specific features of the program did you think were least helpful?
10. What aspects of the program would you change?
11. What are your thoughts on how frequently we contacted you during the program?
12. How does this program compare to other weight-loss programs you have tried?

Appendix H. Focus Group Questions

- 1) Tell me about your experience using the website?
- 2) How do you feel about this weight loss program being completely online?
 - a) What were the advantages?
 - b) What were the disadvantages?
 - c) Do you think anything can be done to improve the website?
- 3) What kept you from using the forum?
 - a) Why didn't you post more often on the forum?
 - b) What would cause you to post more often on the forum?
- 4) What did you see as the purpose of the forum?
 - a) What are your thoughts on interacting with other members on the forum?
 - b) Do you feel comfortable interacting with people you don't know online? Why or why not?
- 5) There is a concept of "social support," which means that you are in a supportive social network, that you are getting support and assistance while you are trying to do something. How do you all feel about knowing the people compared to not knowing the people in this type of group?
 - a) Is it extremely important to know the people in order to have a support system?
 - b) How do you feel about using social support for weight loss?
 - c) How do you think social support can affect your weight loss?
 - d) How do you feel about getting support on an online weight loss forum in comparison to meeting in person?
- 6) Did you contact other members on the forum for social support? Why?
 - a) What was the purpose of your interaction? Could you explain a little bit better?
 - b) Could you explain a little bit more why you didn't?

VITA

Christine Sugimoto was born and raised in Hawaii. She received her Bachelor of Science degree in Pre-Medicine from Clearwater Christian College near Tampa, Florida. In 2012, Christine was accepted into graduate school at the University of Tennessee, Knoxville. While working on her master's degrees, she had the opportunity to work as a Graduate Research Assistant in the Department of Nutrition. Christine will receive her Master of Science degree in Public Health Nutrition and her Master of Public Health degree from the University of Tennessee, Knoxville in August 2014. She plans to continue her education by beginning medical school in the Fall 2014 semester in California.