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The Feasibility of an E-mail–Delivered Intervention to Improve Nutrition and Physical Activity Behaviors in African-American College Students

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Abstract

Objectives—To evaluate the feasibility and acceptability of an e-mail-delivered program to promote nutrition and physical activity in African-American college students.

Participants—47 students (76% female, ages 18–20 y).

Methods—Students participated in a 24-week randomized controlled trial, receiving either general health information or the intervention focused on diet and physical activity.

Results—At baseline, 80.9% and 76.0% of participants reported interest in improving diet and physical activity, respectively. Participants evidenced poor nutrition behaviors and 46% were overweight or obese. At 24 weeks, most participants (70% control, 84% intervention) were “somewhat” or “very” satisfied with the program. The program was feasible to administer, with the exception of measurement of physical activity using accelerometers.

Conclusions—An innovative e-mail-delivered program promoting positive health behaviors appears to be feasible and acceptable in African-American college students. Further research is needed to evaluate program efficacy in this population, including prevention of excess weight gain.

Keywords

African American; electronic intervention; health education; nutrition

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Obesity is a widely recognized and growing epidemic in the United States that carries increased subsequent risk of morbidity (e.g., cancer, hypertension, diabetes, and cardiovascular disease) and associated mortality.¹ Poor nutrition behaviors and lack of

physical activity are well established as primary mechanisms underlying obesity and its associated health risks.^{2,3} These behaviors, particularly low consumption of fruits and vegetables, insufficient physical activity, and high consumption of fats and added sugars appear to be prevalent among young adults, particularly African-American young adults.^{4,5}

Emerging Adulthood and College Students

Emerging adulthood, the period following adolescence and before one identifies as having reached full adulthood is a developmental time during which many young adults leave their parent's home and take greater responsibility for themselves,⁶ including in nutrition and physical activity behaviors.⁷ The transition to young adulthood, especially during college, seems to be a critical period for risk for weight gain^{8,9} but one with potential for intervention.⁷ Some behavior choices made by college students, such as high rates of fast food and alcohol consumption and frequently skipping breakfast, may place them at risk for health problems and weight gain.¹⁰ Physical activity is often compromised such that 42% and 62% of college-age Americans fail to meet guidelines for both moderate and vigorous physical activity, respectively.¹¹ The result is a high prevalence of significant weight gain during the college years, as illustrated by findings of increased rates of overweight/obesity from freshman year (15%) to senior year (23%).¹² Moreover, the weight gain is relatively rapid, with an average of 7-8 pounds gained in only 8 months.¹² College students also report sleep loss, stress, and alcohol consumption, which may be associated with weight gain.⁷ This is a developmental period with potential for significant impact of intervention, given that young adults are engaged in identity development^{6,7} which could be influenced to include health as a critical part of identity.

African-American Students

Like their adult counterparts, African-American college students demonstrate high rates of obesity and associated health risk, such as metabolic syndrome.¹³ Beyond the college years, African-American adults display higher prevalence rates of obesity and related medical complications¹⁴ and poorer health outcomes in general¹⁵ than their peers. This increased risk by race/ethnicity remains even when the effects of socioeconomic status (SES) are considered.¹⁶ Therefore, improving their nutritional and physical activity behaviors in young adulthood may improve long-term health outcomes.

Existing Interventions

Because of the need to improve diet and exercise in the college population across ethnicities, recent studies have examined the feasibility and efficacy of such programs. Laska and colleagues¹⁷ published a review of the few interventions aimed at preventing weight gain in college students finding that existing studies have demonstrated preliminary efficacy and feasibility. They also note that weight gain *prevention* programs need to address the needs of minority young adults, who represent an understudied group at high risk for the development of obesity and comorbid health conditions.^{7,17}

Technology-based interventions show great promise for integration into college life as a means of easy and low-cost dissemination. College students have easy access to the internet

and use it daily for communication and to gain information.^{18,19} In general, technological intervention shows promise as an efficacious and efficient modality of treatment for both the general population²⁰⁻²² and specifically during emerging adulthood.^{23,24} Indeed, a recent study found that a technology-based program aimed at weight loss using Facebook and texting demonstrates indications of good feasibility and preliminary efficacy for already overweight/ obese college students from diverse backgrounds.²⁵ Gow and colleagues²⁶ demonstrated that an internet-based program for *prevention* of weight gain during the freshman year shows promising feasibility and efficacy. Neither, however, examined African-American college students specifically.

Current Study

The current study focused on determining the feasibility (e.g., ease of recruitment, delivery, and participation) and acceptability of an innovative, e-mail-based intervention to improve nutrition and physical activity behaviors and to prevent excess weight gain in African-American college students. These preliminary program characteristics are considered to be pivotal in informing the broader translation of such programs into college campuses, which in turn may have a significant impact on public health. The current study hypothesized that: 1) African-American college students demonstrate behaviors indicating a *need* for a health behavior promotion/weight gain prevention program; 2) the use of an e-mail-based program will be *feasible* with African-American college students, and 3) African-American college students will find such an e-mail-based health promotion/weight gain prevention program *appealing and useful*.

Methods

Sample

The current study was approved by the appropriate Institutional Review Board. Data were collected between August, 2011 and April, 2012. Participants were eligible if they: 1) were enrolled in college for the semester the study was conducted; 2) were between 18-20 years of age; and 3) had regular (at least once per week) access to e-mail. Given the small sample size, it was determined that evaluating this narrow age range would provide insight into a specific age group. Therefore, these particular ages were targeted in order to sample students from the early transition period to young adulthood and entry into college, an age range during which future prevention efforts might be introduced and outcomes tracked overtime. Participants were excluded if they: 1) were pregnant/lactating; 2) reported an eating disorder; 3) were currently in treatment for weight loss; 4) had bariatric surgery; or 5) were currently participating in a clinical trial or commercial program that may affect diet and physical activity.

Participants were part of a double-blind randomized controlled trial evaluating an e-mail/ internet-delivered program designed to prevent excess weight gain in college students. Participants were randomized on a 2:1 ratio (intervention to control, as the sample size was small and emphasis was on examining feasibility and acceptability of the intervention) on the basis of gender and baseline body mass index (BMI) to assure similarity across groups. For additional details on recruitment and retention, see the CONSORT table (Figure 1).²⁷

Procedure

Participants were recruited via flyers distributed and posted on campus and word of mouth for a program advertised to study how students might improve health behaviors through e-mail. Recruitment was conducted for 6 weeks at the beginning of the Fall semester. Upon expressing interest in the study, potential participants completed a short phone interview to screen for eligibility. Eligible participants were scheduled for an initial assessment.

Study visits included 2 baseline visits during which informed consent was conducted, questionnaires were administered, and body composition assessed. Participants also wore accelerometers (Phillips Respironics, Andover, MA) on the right hip at the midaxilla line for 3 days to provide an objective assessment of physical activity. Follow-up assessment was completed at 12 and 24 weeks following baseline during which questionnaires were completed and body composition was assessed. Participants were compensated for their time with \$25 gift certificates to a national retailer and were entered into a lottery to win a \$250 gift certificate.

Intervention

The intervention program utilized an online diet and physical activity program which was originally designed for use in a workplace setting (Alive! Version 2, NutritionQuest, Berkeley, CA)²⁸, that was edited for relevance for college students. For example, instead of referring to work and family, the focus was shifted to dorm or apartment living and eating in cafeteria settings. Based on Social Cognitive Theory (SCT),²⁹ the intervention utilized the following strategies: (1) goal setting and self-regulation, (2) addressing barriers, (3) providing concrete suggestions for behavior change, (4) repetition of core messages and repeated practice of skills, (5) emphasis on small, cumulative goals in order to promote self-efficacy, and (6) incorporating ecological principles and social networks. These components of SCT are particularly relevant to weight gain prevention in college students.³⁰

As part of the baseline assessment, all participants, regardless of group assignment, received immediate feedback on their nutrition and physical activity behaviors based on information provided via self-report. This included whether they were meeting goals for fruit/vegetable intake, saturated fat, and regular exercise. All participants then selected one goal choosing between increasing fruit/vegetable/fiber intake, reducing saturated fat intake, or increasing physical activity. Each control participant selected one goal for the duration of the study but intervention participants were allowed to maintain or change their goal as desired throughout the 24-week program.

Next, students randomized to the intervention condition selected small steps towards their larger goals, for example adding a fruit/vegetable to their evening meal or increasing their physical activity at one specific point during the week. Following randomization, the program began immediately with weekly e-mails for the next 24 weeks. Those randomized to the intervention program received weekly e-mails reminding them of their previously set goals, and prompting them to select new “small steps” goals. They could also log on to their account on the study website for more information and feedback on their progress at any point. The website and e-mail messages provided concrete recommendations for ways to

meet goals, tips relevant to college students, methods for overcoming common barriers, and allowed participants to access a wide-range of information about nutrition and physical activity. Emphasis was on encouraging participants to incorporate these habits into their daily lives and within their social networks.

The attention control group also received weekly e-mails with informational materials, the content of which utilized publically available information on a variety of health topics (i.e., hand washing, food safety, and sexual health) but did not include information on nutrition or physical activity. There was no interactive component or access to additional information.

Measures

Background information—Demographic information was obtained through a questionnaire developed by the research team.

Weight Status—Participants were admitted to the clinical research center having refrained from food, all drinks and strenuous exercise for two hours. Weight (Scale-Tronix®, digital weight scale, Wheaton IL, serial number 5002-21539), height (Harpenden® wooden stadiometer, Holtain Limited, Crymych UK), and waist circumference, taken at the right suprailiac crest (GulickII® fiberglass tape measure, model # 4192G, Gays Mills, WI) were measured. Participants wore gowns over undergarments for these measurements and stood barefoot or in socks; gown weight was subtracted to report net weight. Measurements were taken in triplicate at each visit and averaged for reliability of measurement. While the participant was seated, blood pressure was measured in duplicate using a zero sphygmomanometer (model 53STO serial JA096584 or JA096585, Welch Allyn Inc, Skaneateles Falls, NY). Each participant's blood pressure was categorized using the average value of the two measures.³¹

Percent body fat was computed using air displacement plethysmography according to manufacturer's instructions (BodPod® model 2000A COSMEDUSA, Inc., formerly Life Measurement, Concord, CA). The BodPod® was calibrated daily and prior to each subject, using a control cylinder for volume displacement and 20 kg weights for the weight scale. Participants were measured wearing compression shorts/sports camisole and a swim cap. Jewelry and glasses were removed. Lung volume was measured or estimated (if measures were not attainable) using the BodPod® and standardized procedures.

Nutrition—Dietary intake was assessed utilizing a food frequency questionnaire (FFQ)³² built into the online intervention program (Alive! Version 2, NutritionQuest). Foods were identified for inclusion based on analyses of the National Health and Nutrition Examination Survey, with separate analyses for African Americans, Whites, and Hispanics to ensure inclusion of foods appropriate for those ethnic groups. Nutrient content was based on the US Department of Agriculture's Food and Nutrient Database for Dietary Studies³³ as well as on published data and label values. Nutrient estimates were calculated by multiplying frequency, portion size, and nutrient content and summing over all foods. Four-month test-retest reliability of the dietary questionnaire ranged from 0.70 to 0.78, indicating good reliability.³² For the current study, fruit cup equivalents, vegetable cup equivalents, total

saturated fat (grams), and free sugar total (grams) were used as indices of daily nutritional intake.

Physical Activity—In order to obtain an objective measure of volitional physical activity, each participant wore an Actical accelerometer (Phillips Respironics, Andover, MA) clipped to their waistband above the right hip at the midaxilla line for 3 consecutive days. The Actical measures acceleration in all planes of motion and converts the motion counts into minute-by-minute energy expenditure dependent upon the participant's age, sex, and body weight. When validated against activity energy expenditure measured by direct calorimetry, the Actical demonstrates very good accuracy (i.e., showing a <2% difference in moderate and vigorous activity level when compared to room calorimetry) in predicting activity energy expenditure from light-, moderate-, and vigorous intensity activities especially when worn at the hip.³⁴ Motion counts were recorded by the Actical every 60 seconds and values were averaged over 24 hours and then across the 3 days of wear for each participant in order to obtain average energy expenditure ($\text{kcal} \cdot (\text{kg} \cdot \text{min})^{-1}$). Minutes of time spent in light-, moderate-, and vigorous-intensity activity also were determined using intensity cut points of < 0.031 for light; 0.031–<0.083 for moderate; and 0.083 $\text{kcal} \cdot (\text{kg} \cdot \text{min})^{-1}$ for vigorous respectively, according to manufacturer's instructions.

Feasibility/Engagement—Feasibility was assessed by evaluating recruitment and retention numbers, participant self-report of their level of engagement including their use of the e-mails, their application of the program into their daily lives and social networks, their perceptions of their own behavior changes, and feedback regarding perceived barriers and motivators towards using the program or making health behavior changes.

Program Satisfaction—Participants evaluated the program immediately following their final measures at the 24-week visit. Participants' level of satisfaction with the program was assessed using metrics designed by the research team. Items included satisfaction with the program, willingness to refer a friend, interest in completing the program in the future for course credit, and which parts of the program they found particularly helpful or less helpful. Items included both write-in responses as well as multiple choice formats.

Data Analytic Plan

To assess the aims of sample characterization, feasibility, and acceptability, descriptive statistics and frequencies were computed for all participants by group status. On self-report measures, percentages reported were based on the number of respondents to each individual item (valid percent). Qualitative responses were examined for the emergence of common themes.

Results

Sample

Participants in the current study included 47 college students at a historically Black university who were part of a multisite study of the Alive intervention. Participants were 76% female and ages ranged from 18–20, with a mean age of 19.02 years (SD = 0.85).

Ninety-two percent of the sample were African-American and 8% were of mixed ethnicity (see Table 1), reflective of the population of the institution. Participants were equally divided among freshman, sophomore, and junior grade levels. When asked about readiness for change, 80.9% of participants reported that they were actively trying or desire to try to eat more healthfully and 76% noted that they were actively trying or desired to try increasing their physical activity.

Overall, participants had an average BMI (in kg/m²) of 24.28 (SD = 3.57), which falls just below the cutoff for overweight. Forty percent of participants were classified as overweight and 6% as obese, according to NIH guidelines.³⁵ Forty percent of females and 25% of males had percentage body fat above recommended cutoffs.³⁶ Further, 35.3% of females had waist circumferences above recommended cutoffs specific to African-Americans (>83 cm), and 14.7% of males exceeded guidelines (>89 cm), placing them at increased risk for cardiovascular disease.³⁷ Among participants, 45.5% of males and 21.6% of females had blood pressure measurements in the 120-139 mmHg systolic (SBP) range, indicating prehypertension.³¹ No males and 5.4% of females evidenced blood pressure measurements in the 80-89 mmHg diastolic (DBP) range for prehypertension.³¹ No participants had BP measurements in the range 140-159 mmHg SBP and/or 90-99 mmHg DBP for Stage I hypertension.³¹

According to Centers for Disease Control,³⁸ females between the ages of 18-20 who engage in about 30-60 minutes of activity a day should consume 2 cups of fruit and 2.5-3 cups of vegetables daily and males should consume 2.5 cups of fruit and 3.5 cups of vegetables daily. In the current sample, the mean for fruit cup equivalents was 1.49 (SD=1.02) and the mean for vegetable cup equivalents was 1.44 (SD=1.19). Further, 51% exceeded recommendations for saturated fat intake. Sixty-nine percent of females and 83% of males exceeded recommendations for daily added sugar intake.³⁹ In fact, the US Dietary Guidelines specify that only 5-15% of daily intake should be a combination of solid fat and added sugar.³⁹ Using these guidelines, 71% of females and 91.7% of males ate too much fat and sugar as a percentage of their daily caloric intake. On average, total daily energy intake (see Table 1) was less than that estimated for energy balance for even sedentary individuals at this age, by gender, 1800-2000 kcal/d for young women and 2400-2600 kcal/d for men.³⁹ Thus, reported intakes by this sample, which includes many overweight and obese students, are even less than expected for sedentary individuals, suggesting either substantial underreporting or insufficient methods of dietary measure.

Overall, adherence to Actical wear was low. Only 14 (30%) participants had valid data (i.e., >10 h/day) for day 1; 36 (86%) for day 2; and 29 (62%) for day 3. Only 9 (19%) had valid data for all three days. Baseline data from day 2 only were analyzed, as that day had the greatest reported adherence to study protocol. Daily energy expenditure was extremely low in these participants. For example, a man of average weight for this sample (80 kg) spent approximately 0.96 kcal/minute-1 (58 kcal/hour-1), which is no different than resting levels of energy expenditure. Participants spent about 6 hours per day-1 (Mean = 338.1±93.1 minutes/day) in sedentary activity, but virtually no time in vigorous-intensity activities. Light activity (Mean = 158.4±57.3 minutes/day) and moderate activity (Mean = 128.3±67.9 minutes/day) were also low.

Feasibility/Engagement

In the 6 weeks of recruitment, (see Figure 1), 49% of those students expressing interest and 68% of those screened for eligibility were randomized. Retention rate was 79% from baseline to week 24 assessment. Only 6 participants (13%) asked to withdraw from the study, all citing the fact that they were too busy to travel to the research center. Both groups reported high levels of program engagement with 90% of the control participants and 96% of the intervention participants reporting that they read at least half of the program e-mails. Among control participants, 86.7% reported that they changed at least a few health behaviors. On the other hand, 100% of intervention participants reported changing at least a few health behaviors based on participation. When asked how much they had learned specifically about diet and exercise, 60% of the control participants reported learning a little or a lot compared with 86.2% of intervention participants. Moreover, only 10% of the control participants reported discussing diet/exercise with a friend or family member as a result of participation, whereas 68% of intervention participants reported discussing these issues with a friend or family member.

Barriers to participation and behavior change were assessed with selection from a common list of barriers and the ability to write in additional barriers. From the list, the two most frequently chosen barriers for control participants were being too busy (67%) and not taking enough time to try all program resources (e.g., links to more information online; 33%). The two most frequently chosen barriers for intervention participants were being too busy (72%) and lack of choices for healthy foods in their environments (44%). Qualitative analysis of write-in responses for barriers to participation and change indicated that control participants additionally viewed access to healthy foods and exercise equipment and motivation for change as barriers. Two intervention participants reported high stress or lack of energy as additional barriers to change.

Aspects of the program that supported change were also noted by participants in both groups including a desire to be healthy (control=67%, intervention=88%) and look/feel better (control=56%, intervention=76%). Aspects of the program both found helpful were that it was user friendly (control=33%, intervention=36%), sent weekly e-mail reminders (control=22%, intervention=56%), and gave ideas for how to make changes (control=22%, intervention=52%).

When setting initial goals for the program based on feedback about their own eating and physical activity behaviors (which both control and intervention participants were allowed to do), 48% chose increasing physical activity, 24% increasing fruits, vegetables, and fiber, and 22% reducing intake of saturated fats and carbohydrates. Setting these initial goals was perceived as helpful by 60% of control participants and 88% of intervention participants.

Participants were also asked about their interest in participating in this type of program for course credit in order to assess for potential for future translation and dissemination of the intervention. Almost all participants (with the exception of one intervention participant) indicated at least some interest in receiving course credit for participation.

Acceptability

In the satisfaction survey, 70% of control participants and 84% of intervention participants reported that they were “somewhat” or “very” satisfied with the program. The majority of control (80%) and intervention (84%) participants would recommend the program to a friend. A majority of the control (72.7%) and intervention (83.3%) participants reported that they found benefit in getting the information via e-mail.

Qualitative write-in responses to items were also evaluated for common themes. For what was considered most helpful about the program, control and intervention participants noted the accountability and reminder function of the frequent e-mails. For example, intervention participants noted “It was a constant reminder that I need to be active” and “It reminded me to eat healthy foods, mostly fruits and vegetables.” Intervention participants noted the utility of setting one's goals (e.g., “It gave you a chance to choose the area you wanted to work on for that week.”) and the tips provided by the program, (e.g., “The tip: A meal isn't a meal without a vegetable” and “Continuously gave me insight on the right habits I needed to acquire in order to be healthy.”).

Importantly, only about half of the participants commented on the least helpful components of the program. Of those who did note concerns, aspects deemed least useful by control participants included a preference for higher frequency of e-mails, whereas intervention participants frequently noted too many e-mails that felt repetitive. One intervention participant noted that the program felt too demanding.

Comment

The current study supported existing literature that many African-American college students are overweight or obese, have body compositions that place them at risk for medical comorbidities, and report suboptimal nutrition behaviors.^{4,40,41} Most importantly, given these findings, there is significant need for interventions among this population that can be easily and widely distributed. The current study is the first to our knowledge to demonstrate that an e-mail-delivered intervention to ameliorate these challenges to health is both feasible and acceptable amongst African-American college students, making it an important future direction for both research and intervention on college campuses.

The use of accelerometers in this population appears not to be feasible, given the poor adherence to use. Given this, the validity of the findings regarding physical activity should be viewed carefully, although it does suggest that this population is engaging in insufficient physical activity. Specifically, time spent in sedentary behavior is displacing a substantial amount of time that could be spent performing activities of light-intensity, which would boost participants' daily level of energy expenditure. Participants did, however, report a desire to improve eating and exercise behaviors. Given this, the challenge is to find innovative, low-cost, acceptable, and easily disseminated methods for this effort.

The current study supported previous research indicating that the use of an e-mail-based intervention to promote health behaviors and prevent excess weight gain appears to be feasible in this population.^{25,26} In just 6 weeks of recruitment, 68% of those assessed for

eligibility enrolled in the study. Of note is that none of those assessed were ineligible for participation, indicating that a large number of students would be eligible for participation if a program were to be more widely distributed or recruitment time lengthened. The study maintained a 79% retention rate across 24 weeks, despite the fact that participation included coming to at least four study assessment visits at an off-campus location which presents a greater burden than simply participating in the e-mail program alone. Recommendations to improve feasibility in this area in future intervention programs include locating study visits in an easily accessible place on campus, reducing number of in-person contacts required, and lengthening the recruitment period.

The current study found that the participants engaged in the intervention program, reported learning about and changing health behaviors, and expanded that knowledge to their social circles. Specifically, intervention participants noted the utility of the goal setting and practical tips for behavior change. This suggests that perhaps the intervention program was successful in supporting participants to be an active participant in setting their health goals and provided useful suggestions for how to increase access to healthful foods and opportunities for physical activity. However, intervention participants noted that additional assistance to reduce stress and find ways around associated cost would improve the program. The barriers noted in the current project, especially time, cost, and access, are consistent with those noted in existing literature.^{30,42}

Aspects of the program that supported engagement amongst participants were the frequent reminders and e-mails supporting program goals. The vast majority of participants reported reading at least half of the e-mails they received. These data indicate that the use of an e-mail-based intervention in African-American students is indeed feasible and provides a format which engages these students in an area in which they report desire for additional support. Moreover, almost all participants reported at least some interest in completing the program for course credit. If the program proves successful for improving health behaviors and preventing excess weight gain in this population, it could be a low cost way for disseminating the program.

The majority of participants reported satisfaction and engagement with the program. For example, 100% of intervention participants reported that they learned at least something and changed at least a few behaviors as a result of their participation in the program. Although control participants noted that they wanted more specific tips, more frequent reminders, and more interactive features, the intervention participants noted a number of aspects of the program they found valuable including the reminders, goal setting, and practical tips, along with a desire for even more specific tips relevant to their lives and mindful of their budgets. These findings suggest that college students benefit from and enjoy more than basic educational material but desire and engage with a more interactive format that provides tailored tips for their goals and lifestyles. This is consistent with previous literature examining important components of weight gain prevention programs in college students.³⁰ The current data suggest that the intervention is highly acceptable in this population. Recommendations to improve acceptability are to increase the number of practical tips, provide reminders in multiple formats (e.g., text, Facebook, Twitter), and utilize social networking to leverage findings that a majority of intervention participants discussed diet/

exercise with a friend or family as a result of this program and most participants would recommend the program to a friend.

Limitations

A primary limitation of the study is the sample size. Future research needs to study a larger sample to determine whether these findings are generalizable and if the program is efficacious in the prevention of weight gain. Participants in the study were self-selected as those who wanted to improve their health. There may be less engagement amongst participants who had not sought out such a program. Because participants were initially motivated to improve their health and invested substantial time engaged in the study protocols, they may have reported higher satisfaction levels than other potential participants. Therefore, the estimates obtained in the current sample may be higher in terms of program satisfaction than in a larger sample. Additionally, the age range was limited and reflected only a third of the population from which the sample was drawn.⁴³ The use of accelerometers in this population did not appear to be feasible and did not provide a valid assessment of this sample's physical activity. Future studies should validate the use of alternative, perhaps more acceptable, methods of assessing physical activity, such as commercially available personal activity monitors.

Conclusions

The current study found good evidence of the feasibility and acceptability of a novel e-mail intervention based in SCT to promote healthful behaviors in African-American college students. Future research will include a larger sample with sufficient power to evaluate the efficacy of this program. Possibilities for dissemination include offering such a program for course credit which has the possibility of engaging a large number of college students at very low cost, which may have a significant impact on public health of these students.

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References

1. Reilly JJ, Kelly J. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *Int J Obes.* Jul; 2011 35(7): 891–898.
2. Swinburn BA, Caterson I, Seidell JC, James WP. Diet, nutrition and the prevention of excess weight gain and obesity. *Public health nutrition.* Feb; 2004 7(1A):123–146. [PubMed: 14972057]
3. Wang Y, Beydoun MA, Liang L, Caballero B, Kumanyika SK. Will all Americans become overweight or obese? estimating the progression and cost of the US obesity epidemic. *Obesity.* Oct; 2008 16(10):2323–2330. [PubMed: 18719634]
4. McCracken M, Jiles R, Blanck HM. Health behaviors of the young adult U.S. population: behavioral risk factor surveillance system, 2003. *Preventing chronic disease.* Apr.2007 4(2):A25. [PubMed: 17362616]
5. Sharma S, Cao X, Arcan C, et al. Assessment of dietary intake in an inner-city African American population and development of a quantitative food frequency questionnaire to highlight foods and nutrients for a nutritional intervention. *Int J Food Sci and Nut.* 2009; 60(Suppl 5):155–167.

6. Arnett JJ. Emerging adulthood. A theory of development from the late teens through the twenties. *The American psychologist*. May; 2000 55(5):469–480. [PubMed: 10842426]
7. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. *Obesity*. Oct; 2008 16(10): 2205–2211. [PubMed: 18719665]
8. Anderson DA, Shapiro JR, Lundgren JD. The freshman year of college as a critical period for weight gain: an initial evaluation. *Eating behaviors*. Nov; 2003 4(4):363–367. [PubMed: 15000962]
9. Vella-Zarb RA, Elgar FJ. The ‘freshman 5’: a meta-analysis of weight gain in the freshman year of college. *J of ACH*. Sep-Oct;2009 58(2):161–166.
10. Kasperek DG, Corwin SJ, Valois RF, Sargent RG, Morris RL. Selected health behaviors that influence college freshman weight change. *J of ACH*. Jan-Feb;2008 56(4):437–444.
11. Racette SB, Deusinger SS, Strube MJ, Highstein GR, Deusinger RH. Weight changes, exercise, and dietary patterns during freshman and sophomore years of college. *J of ACH*. May-Jun;2005 53(6):245–251.
12. Hoffman DJ, Policastro P, Quick V, Lee SK. Changes in body weight and fat mass of men and women in the first year of college: A study of the “freshman 15”. *J of ACH*. Jul-Aug;2006 55(1): 41–45.
13. Tope AM, Rogers PF. Metabolic syndrome among students attending a historically black college: prevalence and gender differences. *Diabetology & metabolic syndrome*. 2013; 5(1):2. [PubMed: 23311455]
14. Savoye M, Nowicka P, Shaw M, et al. Long-term results of an obesity program in an ethnically diverse pediatric population. *Pediatrics*. Mar; 2011 127(3):402–410. [PubMed: 21300674]
15. US Department of Health and Human Services, National Center for Health Statistics. [Accessed September 21, 2012] Health, United States, 2006 with Chartbook Trends in the Health of Americans. 2012. <http://www.cdc.gov/nchs/data/hsus/hsus06.pdf/>
16. Zhang Q, Wang Y. Trends in the association between obesity and socioeconomic status in U.S. adults: 1971 to 2000. *Obesity research*. Oct; 2004 12(10):1622–1632. [PubMed: 15536226]
17. Laska MN, Pelletier JE, Larson NI, Story M. Interventions for weight gain prevention during the transition to young adulthood: a review of the literature. *The Journal of adolescent health*. Apr; 2012 50(4):324–333. [PubMed: 22443834]
18. Deatherage S, Servaty-Seib HL, Aksoz I. Stress, coping, and internet use of college students. *J of ACH*. 2014; 62(1):40–46.
19. Stelfoxson M, Hanik B, Chaney B, Chaney D, Tennant B, Chavarria EA. eHealth literacy among college students: a systematic review with implications for eHealth education. *Journal of medical Internet research*. 2011; 13(4):e102. [PubMed: 22155629]
20. Mauriello LM, Ciavatta MM, Paiva AL, et al. Results of a multi-media multiple behavior obesity prevention program for adolescents. *Preventive medicine*. Dec.2010 51:451–456. [PubMed: 20800079]
21. Pellegrini CA, Verba SD, Otto AD, Helsel DL, Davis KK, Jakicic JM. The comparison of a technology-based system and an in-person behavioral weight loss intervention. *Obesity*. Feb; 2012 20(2):356–363. [PubMed: 21311506]
22. Polzien KM, Jakicic JM, Tate DF, Otto AD. The efficacy of a technology-based system in a short-term behavioral weight loss intervention. *Obesity*. Apr; 2007 15(4):825–830. [PubMed: 17426316]
23. Hamel LM, Robbins LB. Computer- and web-based interventions to promote healthy eating among children and adolescents: a systematic review. *Journal of advanced nursing*. Jan; 2013 69(1):16–30. [PubMed: 22757605]
24. Tate, DF. Application of innovative technologies in the prevention and treatment of overweight in children and adolescents. In: Jelalian, E.; S, G., editors. *Handbook of Child and Adolescent Obesity*. New York, NY: Springer; p. 2009p. 387–404.
25. Napolitano MA, Hayes S, Bennett GG, Ives AK, Foster GD. Using Facebook and text messaging to deliver a weight loss program to college students. *Obesity*. Jan; 2013 21(1):25–31. [PubMed: 23505165]

26. Gow RW, Trace SE, Mazzeo SE. Preventing weight gain in first year college students: an online intervention to prevent the “freshman fifteen”. *Eating behaviors*. Jan; 2010 11(1):33–39. [PubMed: 19962118]
27. Schulz KF, Altman DG, Moher D. CONSORT 2010 statement: updated guidelines for reporting parallel group randomized trials. *Annals of internal med*. 2010; 152:726–732.
28. Block G, Sternfeld B, Block CH, et al. Development of Alive! (A Lifestyle Intervention Via Email), and its effect on health-related quality of life, presenteeism, and other behavioral outcomes: randomized controlled trial. *Journal of medical Internet research*. 2008; 10(4):e43. [PubMed: 19019818]
29. Bandura A. Health promotion from the perspective of social cognitive theory. *Psychology and Health*. 1998; 13:623–649.
30. Strong KA, Parks SL, Anderson E, Winett R, Davy BM. Weight gain prevention: identifying theory-based targets for health behavior change in young adults. *Journal of the American Dietetic Association*. Oct; 2008 108(10):1708–1715. [PubMed: 18926139]
31. Chobanian AV, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*. May 21; 2003 289(19):2560–2572. [PubMed: 12748199]
32. Block G, Woods M, Potosky A, Clifford C. Validation of a self-administered diet history questionnaire using multiple diet records. *Journal of clinical epidemiology*. 1990; 43(12):1327–1335. [PubMed: 2254769]
33. US Department of Agriculture. [Accessed May 15, 2014] Food and Nutrient Database for Dietary Studies. 2008. <http://www.ars.usda.gov/services/docs.htm?docid=7673>
34. Rothney MP, Schaefer EV, Neumann MM, Choi L, Chen KY. Validity of physical activity intensity predictions by ActiGraph, Actical, and RT3 accelerometers. *Obesity*. Aug; 2008 16(8): 1946–1952. [PubMed: 18535553]
35. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults--The Evidence Report. National Institutes of Health. *Obesity research*. Sep; 1998 6(Suppl 2):51S–209S. [PubMed: 9813653]
36. Vanderbilt University. [Accessed September 17, 2012] Body Fat Percentage. 2011. <http://healthandwellness.vanderbilt.edu/news/2011/09/body-fat-percentage/>
37. Zhu S, Heymsfield SB, Toyoshima H, Wang Z, Pietrobelli A, Heshka S. Race-ethnicity-specific waist circumference cutoffs for identifying cardiovascular disease risk factors. *The American journal of clinical nutrition*. Feb; 2005 81(2):409–415. [PubMed: 15699228]
38. Centers for Disease Control and Prevention. [Accessed September 14, 2012] How many fruits and vegetables do you need?. 2012. <http://www.cdc.gov/nutrition/everyone/fruitsvegetables/howmany.html>
39. US Department of Agriculture. [Accessed May 27, 2014] Dietary Guidelines for Americans. 2010. <http://www.health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf>
40. Ford DS, Goode CR. African American college students' health behaviors and perceptions of related health issues. *J of ACH*. Mar; 1994 42(5):206–210.
41. Owens CS. Diabetes and obesity risks in African American young adult freshmen attending a historically black college/university. *J of health care for the poor and underserved*. Nov; 2008 19(4):1096–1118.
42. Pelletier JE, Laska MN. Balancing healthy meals and busy lives: associations between work, school, and family responsibilities and perceived time constraints among young adults. *Journal of nutrition education and behavior*. Nov-Dec;2012 44(6):481–489. [PubMed: 23017891]
43. Howard University. FACTS. 2013

Figure 1. CONSORT Flow Diagram

Table 1
Descriptive Statistics of Study Variables at Baseline

	Baseline	
	Males (n=12)	Females (n=35)
Body Fat (%)	19.89 (7.07)	29.51 (7.41)
Body Mass Index (in kg/m ²)	24.83 (2.54)	24.57 (4.20)
Waist Circumference (cm)	84.36 (8.72)	80.03 (10.98)
Blood Pressure (mmHg)		
Systolic	119.95 (10.45)	110.78 (8.18)
Diastolic	63.55 (7.92)	65.16 (8.53)
Dietary Intake		
Added Sugar (% daily kcal)	0.18 (0.13)	0.16 (0.09)
Saturated Fat (% daily kcal)	0.09 (0.02)	0.07 (0.02)
Fruit (cups/d)	1.35 (0.81)	1.53 (1.08)
Vegetables (cups/d)	1.21 (0.97)	2.06 (1.52)
Energy (kcal/d)	1926.28 (796.53)	1184.55 (427.01)

Note. Results presented as Mean (Standard Deviation). Body Fat was assessed by whole body air-displacement plethysmography. The waist was measured at the right suprailiac crest. Saturated fat and added sugar were calculated as g/d, then standardized and expressed as a percentage of total daily energy intake.