# A Community-Based Obesity Prevention Program Decreased the Body Mass Index of University-Affiliated Participants

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*Obesity is a national health concern and the focus of many health promotion programs. The purpose of this study was to evaluate the behavioral impact of a 12-week obesity prevention program on a university campus. Participants were provided questionnaires with weights, heights, and body mass indices (BMIs) determined at the pre-phase weigh-in and post-phase weigh-out. At the weigh-in, participants received pedometers and information about upcoming educational sessions to assist them with reaching their health behavior goals. A total of 247 (38.2% of 646) individuals (79.4% women) completed the program. A mean weight loss of 1.8 kg caused a decrease in BMI from 29.3 at weigh-in to 28.7 at weigh-out ($p = .002$). Pre- and post-questionnaires indicated increases ($p < 0.001$) in physical activity; using pedometers; and intakes of fruits, vegetables, and water at the end of the program. The 6-month follow-up questionnaire (33.2% response rate) indicated healthy habits were being maintained for fruit and vegetable consumption. Further intervention development to incorporate innovative strategies for promoting healthy behaviors among students and employees on university campuses could help decrease the prevalence of obesity.*

*Keywords:* obesity, health promotion program, fruit and vegetable intake, physical activity

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## Introduction

Obesity is a national concern and health indicators for both Mississippi and the United States iterate the necessity for addressing this concern. Over one-third of adults in the United States are obese (Ogden, Carroll, Kit, & Flegal, 2014). Mississippi adults have an especially high rate of overweight and obesity (67.9%), indicated by a body mass index (BMI) of 25.0 or greater, and an obesity prevalence of 34.6%, indicated by a BMI of 30.0 or greater (Centers for Disease Control and Prevention [CDC], 2014). Overweight and obesity occur in all age groups, and young adults are especially vulnerable. Mokdad et al. (1999) stated that 18- to 29-year olds were one of three groups that experienced the greatest magnitude in the increase of obesity. Many young adults gain more weight during the ages of 18 and 24 compared to other ages (Morrell, 2011), and weight gain in college students has been well-documented (Cluskey & Grobe, 2009).

Diet and physical activity play pivotal roles in the prevention of obesity; however, diet and physical activity behaviors of many young adults deteriorate while attending college leading to high fat diets, low intakes of fruits and vegetables, and inadequate physical activity (Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). Colleges and universities may be prime settings for obesity prevention for young adults since a large proportion of this population enrolls in postsecondary institutions (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). In addition to being a unique setting for reaching young adults (college students), universities can reach other adult ages (university employees) in an attempt to influence healthy behaviors, such as fruit and vegetable consumption and physical activity.

A healthy diet containing fruits and vegetables is important for overall health and obesity prevention. Fruits and vegetables provide the body with nutrients, fiber, antioxidants, and other disease-fighting compounds that protect the body's cells and improve physiologic function. However, 37.7% of adults in America and 50.8% of adult Mississippians reported eating fruit less than once a day; Mississippi had the lowest prevalence of fruit consumption (National Center for Chronic Disease Prevention and Health Promotion [NCCDPHP], 2013). Also, 22.6% of Americans and 32.3% of Mississippians reported eating vegetables less than once a day (NCCDPHP, 2013). Overall, only 10.3% of Mississippians reported eating fruits and vegetables five or more times a day (Trust for America's Health & Robert Wood Johnson Foundation, 2012). As a group, college students tend to have low intakes of fruits and vegetables (Huang et al., 2003; Nelson et al., 2008; Racette, Deusinger, Strube, Highstein, & Deusinger, 2008).

Physical activity also plays a major role in obesity prevention. In the Trust for America's Health and Robert Wood Johnson Foundation "F as in Fat" (2012) report, Mississippi had the highest rate of adult physical inactivity (36.0%) and obesity (34.9%). In the current Trust for America's Health and Robert Wood Johnson Foundation (2014) report, Mississippi continues to have the highest rate of adult physical inactivity (38.1%) and obesity (35.1%). Physical activity levels decrease in young adults transitioning to college, and this contributes to the increase in obesity

seen in young adults (Tucker & Irwin, 2011). The physical activity levels in college students are of concern, and 40-50% of college students are physically inactive (Keating, Guan, Piñero, & Bridges, 2005). Nelson et al. (2008) stated that the majority of college students fail to meet national recommendations for physical activity.

Due to the large number of Americans that are overweight or obese and the deterioration of college students' physical activity and eating habits, universities are in a unique situation to influence health-conscious audiences of various ages. The Mississippi In Motion (MIM) program is a 12-week community-based program that promotes healthy eating habits and physical activity behaviors, encourages social support, and builds self-efficacy (Lee, 2008; Mississippi State University [MSU] Extension Service, 2014). MIM's priority population includes people living in Mississippi, and towns, counties, businesses, schools, and universities may participate. The program includes health fairs, educational sessions, and pre- and post-questionnaires at the weigh-ins and weigh-outs, respectively. MIM has three goals: participants are encouraged to (1) eat 5-9 servings of fruits and vegetables per day and follow the Dietary Guidelines for Americans (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010), (2) participate in 30 minutes of physical activity per day, and (3) attend at least 7 of 10 educational sessions. The purpose of this study was to evaluate the behavioral impact of MIM within a university-affiliated population. Developing strategies and interventions to promote healthy diet and physical activity behaviors on university campuses could help reduce the prevalence of overweight and obesity.

## Methods

The MIM program was developed by the MSU Extension Service (2014) based upon the tenets of the social cognitive theory and ecological model (Lee, 2008). The program was pilot tested using a community-based sample of participants in Oktibbeha County, Mississippi, with validation of the questionnaire by a researcher employed by the MSU Extension Service. The program had been implemented in many towns, counties, and several worksites, such as furniture factories and other industries, in Mississippi prior to being offered at a school or university. MSU was the first university to implement MIM. The program was promoted by advertisements in the university newspaper; pre-approved campus-wide emails to all students, staff, and faculty; personal contacts; and flyers posted on bulletin boards on campus. The university's recreation center served as the location for the pre-phase weigh-in and post-phase weigh-out, which were conducted by trained personnel, including registered nurses and dietitians, graduate students experienced with collecting anthropometric data, and research assistants. The university's Institutional Review Board approved all program and research protocols. This study was in compliance with the Health Insurance Portability and Accountability Act of 1996. Each participant provided written, informed consent prior to participation.

Participants included teams of two to five persons and individuals who joined the 12-week program. Males and females who were at least 18 years old and attending or employed at the university were eligible to participate. Each participant paid a $5.00 fee with proceeds used for prizes and awards at the end of the program. Participants attending the weigh-in (held at the campus recreation center) completed a consent form and a two-page pencil-and-paper questionnaire (pre-evaluation), were weighed and measured, and had their BMI calculated. Additionally, participants received a pedometer with instructions for its use, an activity record log, and information on upcoming educational sessions. Participants were asked to self-record the number of steps they walked each day via the pedometer and to record various physical activities performed in their activity record logs to assist them with reaching their goals. Pedometers have been used as motivational and monitoring tools for physical activity (Tudor-Locke et al., 2004). Additionally, pedometers are inexpensive, easy-to-use, and a method for promoting physical activity (Aittasalo, Miilunpalo, Kukkonen-Harjula, & Pasanen, 2006).

The MIM program contains 12 ready-to-use, peer-reviewed educational lessons: (1) Goal Setting, (2) Becoming Physically Active, (3) MyPyramid (has been updated to MyPlate) and Serving Size, (4) Cooking Healthy, (5) Better Meals with Better Planning, (6) Physical Activity and Walking, (7) Flexibility and Strength Training, (8) Eating Out Smart, (9) Healthy Heart, (10) Controlling Diabetes, (11) Stress and Emotional Eating, and (12) Fad Diets. Educational sessions are offered weekly, last one hour, and provide opportunities for participants to ask questions and share challenges and success stories. The Better Meals with Better Planning and Cooking Healthy lessons were combined into one educational session as were the Stress and Emotional Eating and Fad Diets presentations.

Local professionals were asked if they would like to be a speaker/presenter for the MIM program. They were told that the PowerPoint presentations were pre-prepared and included scripts and speakers' notes. They were instructed that they did not have to use the scripts but must use the presentations. Several people volunteered as speakers, and the sessions were presented by a variety of professionals from the university and surrounding community, which included a medical doctor from the campus student health center, a certified diabetes educator from the local hospital, a registered nurse with a doctorate in health promotion from the university, two registered dietitians with doctorates in nutrition, two exercise physiologists (one was the director of the local hospital's wellness center and the other worked at the campus recreation center), and an administrator who was the director of the student health center.

**Intervention**

The first week of the MIM program was the weigh-in, with ten educational sessions provided during weeks 2 through 11. The weigh-out was conducted in week 12 at the campus recreation center with the same procedures followed as at the weigh-in: participants completed the post-questionnaire, were weighed, and turned in their activity logs. Obtaining weights and calculating

BMIs were conducted similarly as at the weigh-in. For consistency, each participant was weighed on the same digital scale at both the weigh-in and weigh-out. After 12 weeks, teams and individuals who met attendance, weight loss (if desired), and physical activity goals were recognized, and prizes/awards, such as cookbooks containing healthy recipes and gift cards, were given to the top three teams and the top three individuals.

A 6-month follow-up questionnaire was sent via email to all participants who completed the program. Two weeks after the 6-month follow-up questionnaires were sent, a reminder email was sent to all participants to return questionnaires. The follow-up questionnaire examined if behaviors taught in MIM had continued to be practiced by the participants. Prior to use, all questionnaires were reviewed by experienced researchers. The pre- and post-questionnaires were already being used in other MIM implementations. However, the 6-month follow-up questionnaire was developed for this study, reviewed by experienced researchers, and pilot-tested using twelve participants that included students, staff, and faculty at the university. The 6-month questionnaire was edited for clarity according to comments received from the reviewers and pilot-test participants. All three questionnaires (pre, post, 6-month follow-up) included items pertaining to demographics; physical activity; use of pedometers; and intakes of fruits, vegetables, and water. The 6-month follow-up questionnaire included additional questions about self-reported current weight and BMI.

Anthropometric measurements obtained were heights and weights at the weigh-in and weigh-out. Participants were asked to remove their shoes, outerwear, and items from pockets prior to measurements. Heights were measured to the nearest 0.25 inch from a tape measure attached to the wall. A Tanita BWB-800 digital scale (HealthCheck Systems, Inc., Brooklyn, NY) was used to determine body weights, which were recorded to the nearest 0.1 pound. Body mass indices were quickly determined using the equation [weight (lbs)/height $(in)^2$] x 703. For statistical analyses, heights were converted to meters (m), weights were converted to kilograms (kg) and BMIs were recalculated using Quetelet's index of $kg/m^2$.

**Statistical Analysis**

The Statistical Package for Social Sciences (SPSS, Inc., version 18.0, Chicago, IL) was used for all data analyses. Descriptive statistics were reported for demographic information and self-reported number of fruit and vegetable servings per day and cups of water intake. Paired *t*-tests were used to determine significant differences between pre- and post-items, including weight; BMI; and fruit, vegetable, and water intakes. Independent *t*-tests were used to compare items from the post- and 6-month questionnaires. The items pertaining to exercise and the use of a pedometer were categorical (yes/no) items and therefore analyzed using McNemar 2x2 chi-square tests to determine differences between pre- and post-questionnaires. Degrees of freedom varied among the analyses due to participants sometimes not answering all items on the

questionnaires. An $\alpha$ level of 0.05 ($p \leq 0.05$) was used for all statistical tests to determine significance. Means and standard deviations are reported for all continuous variables.

## Results and Discussion

### Participants

The MIM program implemented on a university campus had 646 individuals participate in the weigh-in. The weigh-in was available to all students, staff, and faculty; pre-selection or pre-registration was not required. Two hundred forty-seven individuals completed the program by attending the weigh-out and attending at least seven of the ten educational sessions. This was a 38.2% completion rate and within the range of other studies' completion ranges of 32-47% (Chan, Ryan, & Tudor-Locke, 2004; Schneider, Bassett, Thompson, Pronk, & Bielak, 2006). Most of the participants (79.4%) were women, and racial demographics indicated 72.9% were White, 19.4% were Black, and 2.4% were Hispanic (See Table 1). Six months after the completion of MIM, the follow-up survey was emailed to all 247 participants that completed the program with 82 returned (33.2% return rate). The demographics of the follow-up survey were similar to the initial demographic data reported at the beginning of MIM (See Table 1).

Overall, there was a large age range of participants, and 76 (30.8%) were 40 to 49 years old, while 56 (22.7%) were 18 to 29 years old (See Table 1). More non-college-aged individuals participated in the program than college-aged individuals. LaRose, Gorin, Clarke, and Wing (2011) discussed potential challenges of engaging college students in weight gain prevention programs. More young men indicated they were less willing to join a prevention program than women (LaRose et al., 2011), which was evidenced in the current study with more women participating in MIM than men.

### Impact Evaluation for Body Mass Index

During the 12-week MIM program, the BMI for the group ($n$ = 247) significantly decreased from 29.3 to 28.7 with a loss of 1.8 kg ($p$ = 0.002; See Table 2). The anthropometric data from all MIM pre-evaluations ($N$ = 646) indicated there was not a significant difference ($p$ = 0.258) between mean BMIs of the participants who completed the program (BMI = 29.3 (11.9), $n$ = 247) and those who did not complete the program (BMI = 30.2 (7.7), $n$ = 399). For the participants who completed the program, 63.1% were classified as normal or overweight (BMI = 18.5-29.9), and 35.3% were classified as obese (BMI = 30.0 or greater). The BMIs of individuals not completing MIM included 56.1% classified as normal or overweight and 43.2% classified as obese, which is a higher obesity rate than Mississippi's 34.6% rate of obesity (CDC, 2014). However, the program may have attracted more obese individuals interested in weight management.

## Impact Evaluation for Fruit, Vegetable, and Water Intakes

Participants responded to the pre- and post-questions, *On average, how many servings of fruit do you eat each day?* and *On average, how many servings of vegetables do you eat each day?* Initially 26.6% of participants reported consuming no fruit per day, and after completing MIM, this decreased to 6.5% of participants. Similarly, 5.3% of participants reported consuming no servings of vegetables per day, and after completing the program, only 1.6% of participants reported consuming no vegetables. Significant increases in fruits, vegetables, and water were reported from the beginning to the end of the 12-week program ($p < 0.001$; See Table 2). Non-significant $p$ values for intakes of fruits ($p = 0.086$) and vegetables ($p = 0.694$) at the 6-month follow-up evaluation indicated that the increases in fruits and vegetables observed at the post-evaluations were being maintained (See Table 2). This indicated that the intervention was successful in assisting participants to consume more fruits and vegetables. Water intake for the participants increased but was not maintained (See Table 2). Participants decreased their water intake from an average of approximately four cups per day at the post-evaluation to approximately two cups per day at the 6-month follow-up survey; they were drinking approximately three cups per day at the pre-evaluation.

The pre-evaluation indicated 31.1% of the participants were consuming two or more servings of fruits per day, and 22.9% reported consuming three or more servings of vegetables per day. Racette et al. (2008) also reported low intakes of fruits and vegetables with less than one-third of participants consuming recommended amounts, which was also observed by Lowry et al. (2000). Huang et al. (2003) also discovered a high percentage of their university respondents had low intakes of fruits and vegetables (69.4% ate less than five servings per day). Additionally, Greene et al. (2011) reported low fruit and vegetable intakes in college students; 22.9% met the MyPyramid fruit recommendation, and only 12.4% met the vegetable recommendation. After participants completed the MIM program, 54.7% were consuming two or more servings of fruits per day, and 40.6% reported consuming three or more servings of vegetables per day.

## Impact Evaluation for Physical Activity

There was a significant increase ($p < 0.001$) in participants' reporting that they exercised regularly at the post-evaluation compared to the pre-evaluation (See Table 2). Participants reported using pedometers to monitor their walking (physical activity); however, fewer participants were using their pedometers than anticipated. Eighty-two individuals reported not using their pedometers at the post-evaluation (See Table 2), and reasons included forgetfulness, loss of pedometer, not interested or not important to them, or a malfunctioning pedometer. Forgetfulness and loss of pedometer are consistent with findings by Garbers, Nelson, Rosenberg, and Chiasson (2006). Participants in the present study responded to a question about the number of days per week they were physically active or exercised (124 participants responded at the weigh-in, and 204 responded at the weigh-out). Overall, participants increased ($p < 0.05$) the

number of days they exercised comparing pre- and post-evaluations, from 3.4 to 3.9 days per week, but did not maintain this level after six months, which indicated participants ($n$ = 81) exercised an average of 3.2 days per week.

***Table 1. Demographics of Mississippi In Motion Participants at Pre- and Post-Evaluations and Six Months After Program Completion***

| Variable | Pre- and Post-Evaluation *n* (%) | Follow-Up Evaluation *n* (%) |
|---|---|---|
| **Gender** | | |
| Male | 50 (20.2) | 22 (26.8) |
| Female | 196 (79.4) | 59 (72.0) |
| No response | 1 (0.4) | 1 (1.2) |
| **Age (years)** | | |
| 18 – 29 | 56 (22.7) | 22 (26.8) |
| 30 – 39 | 47 (19.0) | 15 (18.3) |
| 40 – 49 | 76 (30.8) | 24 (29.3) |
| 50 – 59 | 56 (22.7) | 18 (22.0) |
| 60 and older | 11 (4.5) | 2 (2.4) |
| No response | 1 (0.4) | 1 (1.2) |
| **Race** | | |
| White | 180 (72.9) | 64 (78.0) |
| Black | 48 (19.4) | 10 (12.2) |
| Hispanic | 6 (2.4) | 3 (3.7) |
| Other | 9 (3.6) | 4 (4.9) |
| No response | 4 (1.6) | 1 (1.2) |

**BMI[a] Classification[b] of Participants at Pre-Evaluation (Weigh-In) Who Did and Did Not Complete the Program**

| | Completed *n* (%) | Did Not Complete *n* (%) |
|---|---|---|
| Underweight (18.4 or less) | 4 (1.6) | 3 (0.8) |
| Normal weight (18.5 – 24.9) | 69 (27.9) | 103 (25.8) |
| Overweight (25.0 – 29.9) | 87 (35.2) | 121 (30.3) |
| Obese – Class 1 (30.0 – 34.9) | 55 (22.3) | 90 (22.6) |
| Obese – Class 2 (35.0 or greater) | 32 (13.0) | 82 (20.6) |

[a]Body mass index, calculated as $kg/m^2$ from measured heights and weights from all 247 participants.
[b]BMI classification according to the National Institutes of Health and the National Heart, Lung, and Blood Institute (1998).

***Table 2. Comparisons of Participants' Weight; BMI; and Fruit, Vegetable, and Water Intakes; Exercising; Pedometer Use Between Pre- and Post-Evaluations and Post and 6-Month Follow-Up Evaluations[a]***

| Items | Pre-Evaluation *M* (*SD*)[b] | Post-Evaluation *M* (*SD*) | *p* Value Comparing Pre- and Post-Evaluations | 6-Month Follow-Up Evaluation *M* (*SD*) | *p* Value Comparing Post- and Follow-Up Evaluations |
|---|---|---|---|---|---|
| Weight (kg) (*n* = 247) | 83.4 (20.4) | 81.7 (20.1) | < 0.001* | NA[b] | NA |
| BMI[c] (kg/m$^2$) (*n* = 247) | 29.3 (6.7) | 28.7 (6.6) | 0.002* | NA | NA |
| Fruit Intake[d] (*n* = 244) | 1.2 (1.1) | 1.8 (1.1) | < 0.001* | 1.5 (1.1) (*n* = 80) | 0.086 |
| Vegetable Intake[d] (*n* = 243) | 1.9 (1.0) | 2.4 (1.0) | < 0.001* | 2.3 (1.1) (*n* = 80) | 0.694 |
| Water Intake[e] (*n* = 242) | 2.3 (1.3) | 2.9 (1.4) | < 0.001* | 1.9 (0.4) (*n* = 81) | < 0.001* |
| **Frequency (%)** | | | | | |
| Do you currently exercise regularly? | | | | | |
| Yes | 123 (49.8) | 201 (81.4) | < 0.001* | 70 (85.4) | NA |
| No | 122 (49.4) | 44 (17.8) | | 12 (14.6) | |
| No response | 2 (0.8) | 2 (0.8) | | 0 | |
| Do you currently use a pedometer? | | | | | |
| Yes | 7 (2.8) | 159 (64.4) | < 0.001* | 24 (29.3) | NA |
| No | 237 (96.0) | 82 (33.2) | | 57 (69.5) | |
| No response | 3 (1.2) | 6 (2.4) | | 1 (1.2) | |

[a]Comparisons of participants' weight, BMI, and fruit, vegetable, and water intakes were analyzed using matched pair *t*-tests for pre- and post-evaluations, and independent *t*-tests for post and 6-month follow-up evaluations; exercise and pedometer questions were analyzed using McNemar 2x2 chi square tests.
[b]Not available, *p* values were not calculated. Heights and weights were not measured at the 6-month follow-up evaluation and we were not able to test for 6-month follow-up for last two items.
[c]Body mass index, calculated as kg/m$^2$ from measured heights and weights.
[d]Means represent number of servings consumed daily (Choices were *0, 1, 2, 3, 4, 5, 6 or more servings*)
[e]Means represent number of 8 oz cups consumed daily (Choices were 0 = *0*, 1 = *1-2*, 2 = *3-4*, 3 = *5-6*, 4 = *7-8*, 5 = *9 or more cups*).
*Significant at $p < .05$

## Process Evaluation of the Program

On the post-evaluation, participants were asked to identify the educational sessions they found most helpful. Participants indicated that Becoming Physically Active (*n* = 87, 35.2%), Eating Out Smart (*n* = 83, 33.6%), and Goal Setting (*n* = 74, 30.0%) were the most helpful educational

sessions. Participants were also asked to respond to the statement, *This program met or exceeded my expectations* with responses ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The mean response was 3.9 (0.8), indicating participants *agreed* that MIM met or exceeded their expectations. Some participants commented they enjoyed hearing experts and local healthcare professionals present the educational sessions, and questions and answers at the end of each session were interesting.

Overall, the MIM program included characteristics of successful worksite health promotion programs, such as convenience and easy accessibility to employees and students, inexpensive, allows participants to develop self-efficacy, and provides opportunities for social support system development through friendly team competition (Abood, Black, & Feral, 2003). It is well-known that worksite health promotion programs offer benefits to the employees (participants) and the organization (Bull, Gillette, Glasgow, & Estabrooks, 2003).

## Limitations

This study had limitations, such as the use of a convenience sample. It did not include a control group and had low numbers of male and minority participants; however, the participants were similar to the university's racial demographics. Additionally, there was a high attrition rate of 61.8%; individuals who participated in the weigh-in could have been contacted when it was known they were not attending the educational sessions (as the sessions used sign-in sheets for attendance) to encourage them to participate or inquire about their non-participation. If the MIM program is going to be implemented at other universities in Mississippi and college-age participants are a priority population, recruitment strategies and intervention techniques need to be altered to attract young adults. Morrell (2011) stated the effectiveness of weight gain prevention strategies in college-age young adults may be most successful if tailored and web-based approaches could be adopted. Lastly, the MIM program uses BMI as a screening tool, but BMI is not accurate for determining adiposity. Therefore, the distribution of fat should be examined, since excess abdominal fat is a risk factor for cardiovascular disease. Perhaps the use of waist circumferences should be added to the program.

## Conclusions

The MIM program, which uses pre-evaluation weigh-ins and post-evaluation weigh-outs and includes ten weekly educational sessions delivered by community professionals, was successful in increasing fruit and vegetable consumption even six months after program completion. Additionally, a significant decrease in BMI from 29.3 to 28.7 occurred at the end of the program. Implementing MIM at a university was beneficial in regards to influencing a variety of age groups. Because universities have access to a variety of age groups from students to faculty to staff, they are ideal environments for worksite health promotion programs encouraging healthy eating and physical activity habits. Developing long-term strategies and interventions to

promote healthy lifestyle behaviors on Mississippi university campuses could help reduce the high incidence of obesity in Mississippi. Further research is needed to incorporate innovative interventions, such as programs with social media components, for promoting healthy behaviors among the student population and the faculty and staff employed on campuses.

## References

Abood, D. A., Black, D. R., & Feral, D. (2003). Nutrition education worksite intervention for university staff: Application of the Health Belief Model. *Journal of Nutrition Education and Behavior, 35*(5), 260–267. doi:10.1016/S1499-4046(06)60057-2

Aittasalo, M., Miilunpalo, S., Kukkonen-Harjula, K., & Pasanen, M. (2006). A randomized intervention of physical activity promotion and patient self-monitoring in primary health care. *Preventive Medicine, 42*(1), 40–46. doi:10.1016/j.ypmed.2005.10.003

Bull, S. S., Gillette, C., Glasgow, R. E., & Estabrooks, P. (2003). Work site health promotion research: To what extent can we generalize the results and what is needed to translate research to practice? *Health Education & Behavior, 30*(5), 537–549. doi:10.1177/1090198103254340

Centers for Disease Control and Prevention (CDC). (2014). *Adult obesity facts*. Retrieved from http://www.cdc.gov/obesity/data/adult.html

Chan, C. B., Ryan, D. A. J., & Tudor-Locke, C. (2004). Health benefits of a pedometer-based physical activity intervention in sedentary workers. *Preventive Medicine, 39*(6), 1215–1222. doi:10.1016/j.ypmed.2004.04.053

Cluskey, M., & Grobe, D. (2009). College weight gain and behavior transitions: Male and female differences. *Journal of the American Dietetic Association, 109*(2), 325–329. doi:10.1016/j.jada.2008.10.045

Garbers, S., Nelson, J. A., Rosenberg, T., & Chiasson, M. A. (2006). Using pedometers to promote physical activity among working urban women. *Preventing Chronic Disease, 3*(2), 1–3. Retrieved from http://www.cdc.gov/pcd/issues/2006/apr/05_0157.htm

Greene, G. W., Schembre, S. M., White, A. A., Hoerr, S. L., Lohse, B., Shoff, S., . . . Blissmer, B. (2011). Identifying clusters of college students at elevated health risk based on eating and exercise behaviors and psychosocial determinants of body weight. *Journal of the American Dietetic Association, 111*(3), 394–400. doi:10.1016/j.jada.2010.11.011

Huang, T., Harris, K. J., Lee, R. E., Nazir, N., Born, W., & Kaur, H. (2003). Assessing overweight, obesity, diet, and physical activity in college students. *Journal of American College Health, 52*(2), 83–86. doi:10.1080/07448480309595728

Keating, X. D., Guan, J., Piñero, J. C., & Bridges, D. M. (2005). A meta-analysis of college students' physical activity behaviors. *Journal of American College Health, 54*(2), 116–126. doi:10.3200/JACH.54.2.116-126

LaRose, J. G., Gorin, A. A., Clarke, M. M., & Wing, R. R. (2011). Beliefs about weight gain among young adults: Potential challenges to prevention. *Obesity, 19*(9), 1901–1904. doi:10.1038/oby.2011.203

Lee, M. L. (2008). *Implementation and evaluation of a health promotion program on university campuses*. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (UMI No. 3331397)

Lowry, R., Galuska, D. A., Fulton, J. E., Wechsler, H., Kann, L., & Collins, J. L. (2000). Physical activity, food choice, and weight management goals and practices among U.S. college students. *American Journal of Preventive Medicine, 18*(1), 18–27. doi:10.1016/S0749-3797(99)00107-5

Mississippi State University (MSU) Extension Service. (2014). *Health: Education programs*. Retrieved from http://msucares.com/health/programs_description.html

Mokdad, A. H., Serdula, M. K., Dietz, W. H., Bowman, B. A., Marks, J. S., & Koplan, J. P. (1999). The spread of the obesity epidemic in the United States, 1991–1998. *The Journal of the American Medical Association, 282*(16), 1519–1522. doi:10.1001/jama.282.16.1519

Morrell, J. S. (2011). Preventing weight gain among coeds: The need for web-based and tailored approaches. *American Journal of Lifestyle Medicine, 5*(2), 123–126. doi:10.1177/1559827610393130

National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP). (2013). *State indicator report on fruits and vegetables 2013*. Retrieved from http://www.cdc.gov/nutrition/downloads/State-Indicator-Report-Fruits-Vegetables-2013.pdf

National Institutes of Health, & National Heart, Lung, and Blood Institute. (1998). *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: The evidence report.* (NIH Publication No. 98-4083). Retrieved from http://www.nhlbi.nih.gov/files/docs/guidelines/ob_gdlns.pdf

Nelson, M. C., Story, M., Larson, N. I., Neumark-Sztainer, D., & Lytle, L. A. (2008). Emerging adulthood and college-aged youth: An overlooked age for weight-related behavior change. *Obesity, 16*(10), 2205–2211. doi:10.1038/oby.2008.365

Ogden C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2014). Prevalence of childhood and adult obesity in the United States, 2011–2012. *The Journal of the American Medical Association, 311*(8), 806–814. doi:10.1001/jama.2014.732

Racette, S. B., Deusinger, S. S., Strube, M. J., Highstein, G. R., & Deusinger, R. H. (2005). Weight changes, exercise, and dietary patterns during freshman and sophomore years of college. *Journal of American College Health, 53*(6), 245–251. doi:10.3200/JACH.53.6.245-251

Racette, S. B., Deusinger, S. S., Strube, M. J., Highstein, G. R., & Deusinger, R. H. (2008). Changes in weight and health behaviors from freshman through senior year of college. *Journal of Nutrition Education and Behavior, 40*(1), 39–42. doi:10.1016/j.jneb.2007.01.001

Schneider, P. L., Bassett, D. R., Jr., Thompson, D. L., Pronk, N. P., & Bielak, K. M. (2006). Effects of a 10,000 steps per day goal in overweight adults. *American Journal of Health Promotion, 21*(2), 85–89. doi:10.4278/0890-1171-21.2.85

Trust for America's Health & Robert Wood Johnson Foundation. (2012). *F as in fat: How obesity threatens America's future, 2012*. Washington, DC: Trust for America's Health. Retrieved from http://healthyamericans.org/assets/files/TFAH2012FasInFatFnlRv.pdf

Trust for America's Health & Robert Wood Johnson Foundation. (2014). *The state of obesity: Better policies for a healthier America, 2014*. Washington, DC: Trust for America's Health. Retrieved from http://healthyamericans.org/assets/files/TFAH-2014-ObesityReport%20FINAL.pdf

Tucker, P., & Irwin, J. D. (2011). University students' satisfaction with, interest in improving, and receptivity to attending programs aimed at health and well-being. *Health Promotion Practice, 12*(3), 388–395. doi:10.1177/1524839908330814

Tudor-Locke, C., Bell, R. C., Myers, A. M., Harris, S. B., Ecclestone, N. A., Lauzon, N., & Rodger, N. W. (2004). Controlled outcome evaluation of the First Step Program: A daily physical activity intervention for individuals with type II diabetes. *International Journal of Obesity, 28*(1), 113–119. doi:10.1038/sj.ijo.0802485

U.S. Department of Agriculture & U.S. Department of Health and Human Services. (2010). *Dietary guidelines for Americans, 2010* (7th ed.). Washington, DC: U.S. Government Printing Office. Retrieved from http://www.cnpp.usda.gov/sites/default/files/dietary_guidelines_for_americans/PolicyDoc.pdf

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