A Retrospective Analysis of Employee Education Level on Weight Loss Following Participation in an Online, Corporately Sponsored, Weight Loss Program

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Objective: To examine weight loss characteristics relative to education for employees participating in an online weight loss program. Methods: We examined percent weight loss (primary outcome), the achievement of clinical cut-points (secondary outcome) by class attendance, and education strata (High School and Trade through Post-Graduate). Results: Overall, the pooled cohort lost a significant percentage of their starting weight (-2.05%, 95% CI, -2.07, -2.04). Women (-1.95%, 95% CI, -1.97, -1.94) lost significantly less than men (-2.38%, 95% CI, -2.14, -2.35). Those attending less than or equal to seven classes lost significantly less weight (0.75% [95% CI, -0.77, -0.74]) vs more than or equal to eight classes (3.50%, 95% CI, 3.52, 3.48). Class attendance was significantly correlated to weight loss (r = 0.57, P < 0.001) and was consistent across education strata. Conclusions: Online weight loss programming is effective across education strata and class participation is essential to participant success. Keywords: corporate health, digital health, education, online, prevention, web-based, weight loss.

It is well recognized that obesity is a modifiable disease.1,2 It is also well documented that multicomponent behavioral interventions in adults with obesity can lead to significant improvements in weight status, subsequently reducing the prevalence of various comorbidities.3 Despite advances in obesity treatment, less is known about online, workplace programming efforts targeting weight loss, and weight management. Previous work by our group has demonstrated that multicomponent behavioral interventions in adults with obesity can lead to significant improvements in weight status, subsequently reducing the prevalence of various comorbidities.3–7 Others have also demonstrated similar findings in overweight and obese employees,8,9 where active participants lost an average of 3.5% body weight, a cut point synonymous with “clinically beneficial,” with 29% of participants achieving 5% weight loss or what is considered to be “clinically significant.”10–12 Finally, the aforementioned analysis showed that program completers lost an average of 4.3% body weight, with 36% of the cohort achieving a 5% weight loss. While findings such as these attest to the utility of online, worksite programming, further elucidation towards specific worksite sub-populations is needed. In this paper, we will examine the effects of such online programming in employees stratified by their education level.

Overall, studies examining weight loss and education level have shown that lower educational achievement is associated with a higher prevalence of obesity.13,14 In a 2017 report, Ogden et al.13 published a report via the Centers for Disease Control and Prevention showing that education strata categorized as (1) high school graduate or less, (2) some college, and (3) college graduates, that the prevalence of obesity was lower among women (27.8%) and men (27.9%) who were college graduates versus women and men with some college (41.2%, 40.0%, respectively). The prevalence for male and female graduates or with less than a high school education was 45.3% and 35.5%, respectively. It is interesting to note that the reported desire to lose or maintain weight in the Ogden study increased with education level.

Serdua et al.15 have reported that among men and women, the odds of trying to maintain versus doing nothing about losing weight increases with education. Specifically, the odds ratios of those trying to lose weight increased versus less-than-high school educations (odds ration [OR] 1.0, referent) versus high school graduates (OR 1.24 [95% confidence interval (CI), 1.11, 1.38]), some college or technical school (OR 1.54 [95% CI, 1.38, 1.72]), and college graduates (OR 2.18 [95% CI, 1.95, 2.44]). Similar findings were observed for women: less-than-high school education (OR 1.0, referent) versus high school (OR 1.53 [95% CI, 1.40, 1.66]), some college or technical school (OR 1.94; 95% CI, 1.78–2.12) and college graduate (OR 2.12, 95% CI, 1.93, 2.33). These findings present a potentially interesting scenario relative to the year of a participant’s completed education and the availability of online/internet access.

If one back-calculates the publication dates of these studies, it is reasonable to postulate that much of the education data for these studies was obtained from individuals receiving their education at the cusp of the internet’s broad popularity (ie, mid-1990s). This is of potential importance as Madden16 at the Pew Research Center reported that internet penetration for adults in the United States only reached approximately 13% of adults in 1995. This number has increased to 89% of adults in 2018.17–18 Finally, it was not until approximately 1994 that the advocacy for the internet’s use for medical education was advocated in a paper by Krupper et al.18 Though the exact date for such advocacy may not be precise, the early trends for internet education on weight loss were in its infancy, if not yet existent. Moving forward to today’s technology environment, the internet now lends itself to delivering programming efforts directly to one’s home, mobile phone, and the workplace. These assertions lend themselves to two considerations.

First, online worksite programming is now clearly considered to be a viable means of program delivery.5,9,19,20 Second, program...
attendance appears to be a key component of programing success defined as the amount of weight lost by participants. In this paper, we further explore the results of corporately sponsored, online, weight loss programming efforts by accounting for class attendance and education levels. Different from our previous reports, this study examines the effectiveness of online programming based on the foundational component of the program (ie, the first 10 class sessions). Our primary outcome was percent weight loss by educational level. As a secondary outcome, we examined our cohort relative to individuals achieving less-than-3% weight loss, clinically beneficial (3% to 4%), and clinically significant (more than or equal to 5%) weight loss. We hypothesized that (1) online weight loss programming offered to employees would be equally effective across various levels of education and that (2) greater class attendance will impact overall weight loss and that (3) regardless of education level, online programming will demonstrate a similar pattern of effectiveness.

METHODS

Participants and Recruitment

The current report describes the examination of an initial database of 196,058 individuals participating in an online behaviorally oriented, commercialized weight loss course for company employees from various states within the United States. Unlike our previous reports which analyzed longer-term participation, we now describe the effectiveness of weight loss programming relative to the foundational component (ie, the initial 10 class sessions, described below) of the course curriculum. Class attendance was monitored via a centralized system. Ninety-five percent of participants starting a class session completed the session in its entirety. The analysis is categorized by self-reported education level: (1) high school graduate, (2) some college, (3) college graduate, (4) some postgraduate, (5) postgraduate and (6) trade. The study was reviewed by an ethics committee (Chesapeake IRB, Columbia, MD) and determined not to require IRB oversight according to the tenets of the US Department of Health and Human Services regulations at 45 CFR 46. Bodyweight was assessed throughout the program and recorded individually by each participant online. Data were fully de-identified and did not contain employee names, respective places of employment, or the city/state of their residence.

Course Curriculum

Participants volunteered through their employers to participate in a corporately-sponsored weight loss course (Naturally Slim, Inc., Dallas, TX). The Foundational aspect of the program is composed of 10 weekly classes, based on Specific, Measurable, Attainable, Realistic, Time-based (SMART) behavioral goal-setting practices. Participants were recruited via emails delivered by their employer, mailers, and flyers placed at the worksites. The foundational curriculum focused on specific elements found in standard behavioral health programs such as self-monitoring, goal setting, stimulus control, modification of eating habits and problem-solving, while concentrating on mindful, healthy eating, and understanding hunger signals. Participants were encouraged to engage in moderate-intensity physical activity, primarily walking, per NIH consensus development panel on physical activity guidelines. The current report examines the effects of weight loss, relative to participants’ education level.

The foundational aspect of programming is as follows: (1) Mindful Eating and Portion Control, Stimulus Control, Medical Considerations & Weight Loss, (2) Stop Eating Cues, Introduction to Physical Activity, (3) Stress and Emotions, Mindless Eating, Goal Setting and Problem Solving, Physical Activity, (4) Hidden Sugar, Mindful Activities, Energy Balance, (5) Nutrition 10, Stress Management, Physical Activity & Weight Maintenance, (6) Weight Fluctuations, Food Cravings versus Easily Accessible Food, CDC Exercise Recommendations, (7) Emotions and Eating, Importance of Self-Monitoring, Making Exercise A Habit, (8) Grocery Shopping and Meal-Planning, Metabolic Syndrome, Cognitive Behavioral Techniques, (9) Serving Sizes, Social Support, Dealing with Saboteurs, and (10) Review of Eating Skills and Tools, Maintaining Motivation, and Long-Term Action Planning. An outline of all course objectives has been previously published (4).

While the classes do not eliminate or focus on a specific food group or macronutrient, per se, an emphasis is placed on reducing carbohydrate and sugar intake, particularly refined sugar, and maintaining a protein intake of 25% to 30% of total calories. Curriculum lessons used a web-based, distance-learning platform, and participants could watch their lessons any place with Internet access based on individual convenience and did not have to be watched continuously. All participants were examined via a self-reporting questionnaire regarding their awareness of metabolic risk factors as communicated to them by their physician which specifically asked, “Has a health care provider ever told you”: (1) high blood pressure, (2) low HDL-C, (3) NAFLD, (4) osteoarthritis, (5) pre-diabetes, (6) sleep apnea, (7) high triglycerides, (8) Type 2 diabetes, or (9) gestational diabetes?

STATISTICS

We prioritized our analysis to examine percent weight loss (primary outcome) relative to educational level and class attendance. As a secondary outcome, we examined our cohort relative to individuals achieving less-than-3%, clinically beneficial (3% to 4%), and clinically significant (more than or equal to 5%) weight loss. Class attendance was defined as attending less than or equal to seven classes or more than or equal to eight classes. This cut point was chosen based on a mean and median class attendance of seven. While the primary outcome was stratified by sex, our secondary outcome analysis of clinical benefits was not stratified by sex given a paucity of data within each cell to adequately perform the analysis and therefore represents the pooled data for the whole cohort. Eligible participants presented to the study with a BMI more than or equal to 25 kg/m2. All analyses were performed using Chi-Square General Linear Models (GLM) analyses. Between-group comparisons were corrected for potential experiment-wise error rates using Bonferroni methods. Finally, as a tertiary exploration, we examined the relationship between class attendance and percent weight loss via Pearson correlations. Data were initially examined without adjustments. All reported levels of significance are two-sided and reported as mean (SD), mean change (95% CI), or N (%) unless otherwise noted.

RESULTS

We initially examined 196,058 (25% male) participants who registered for the program. After accounting un-recorded follow-up weight data, 140,445 participants were subsequently analyzed. Participants in the study averaged 47 years of age, weighed 97.37 kg (22.32), and had a body mass index (BMI) of 34.66 kg/m2 (7.48). Examination by BMI further demonstrated that 40,998 (30%) were overweight, 42,174 (30%) were class I obese, 27,682 (20%) were class II obese, and 27,476 (20%) were class III obese (Table 1). Further, 70,040 (53%) of the cohort attended seven or fewer classes, while 47% (n = 66,405) attended more than eight classes. Finally, 99,071 (78%) of the cohort achieved less-than-3% weight loss. Sixteen percent (n = 22,551) achieved clinically beneficial weight loss and 13% (n = 18,823) achieved clinically significant weight loss. We have presented the overall characteristics of the cohort, stratified by sex, in Table 1. Similar tables are by education strata for women (Table 2) and men (Table 3). Our analysis of the clinical cut points, by education, is presented in Table 4.
TABLE 1. Characteristics of the Study Participants (N = 140,445)

|                      | All (N = 140,445) | Means | SD/% | Mean/N | SD/% |
|----------------------|------------------|-------|------|--------|------|
| Age, y               |                  |       |      |        |      |
| <35 y                | 22,880           | 16%   | 17,733 | 16% | 5,147 | 16% |
| 35–44 y              | 33,701           | 24%   | 26,139 | 24% | 7,562 | 23% |
| 45–54 y              | 41,388           | 29%   | 32,200 | 30% | 9,188 | 29% |
| 55–65 y              | 34,751           | 25%   | 26,643 | 25% | 8,108 | 25% |
| >65 y                | 7,723            | 5%    | 5,506  | 5%  | 2,217 | 7%  |
| Race                 |                  |       |      |        |      |
| White                | 103,166          | 77%   | 77,252 | 75% | 25,914 | 85% |
| Black                | 24,196           | 18%   | 21,743 | 21% | 2,453 | 8%  |
| Asian                | 3,561            | 3%    | 2,215  | 2%  | 1,346 | 4%  |
| Native American      | 3,067            | 2%    | 2,407  | 2%  | 660  | 2%  |
| Ethnicity            |                  |       |      |        |      |
| Non-Hispanic         | 128,762          | 92%   | 99,361 | 92% | 29,401 | 91% |
| Hispanic             | 11,683           | 8%    | 8,861  | 8%  | 2,822 | 9%  |
| Class attendance     | 6.10             | 3.74  | 6.09*  | 3.72 | 6.11* | 3.81 |
| Height, m            | 1.68             | 0.1   | 1.64*  | 0.07 | 1.79* | 0.08 |
| Height, cm           | 167.53           | 6.93  | 164.08* | 7.17 | 179.09* | 7.6 |
| First weight, kg     | 97.37            | 22.32 | 94.05* | 21.12 | 108.54* | 22.64 |
| Last weight, kg      | 95.39            | 22.13 | 92.24* | 21.02 | 105.97* | 22.47 |
| Absolute weight loss, kg | -1.98         | 2.61  | -1.81* | 2.4  | -2.56* | 3.15 |
| Relative weight loss (%) | -2.05          | 2.61  | -1.95* | 2.53 | -2.38* | 2.84 |
| First BMI, kg/m²      | 34.66            | 7.48  | 34.91* | 7.67 | 33.79* | 6.75 |
| Last BMI             | 33.96            | 7.45  | 34.24* | 7.63 | 32.99* | 6.73 |

Values in the same row and sub-table not sharing the same subscript are significantly different at P < 0.05 in the two-sided test of equality for column means.

BMI, body mass index; HDL-C, high density lipoprotein cholesterol; NAFLD, non-alcoholic fatty liver disease.

Primary Outcome: Percent Weight Loss

Upon examination, the pooled cohort lost a significant percentage of their starting weight (−0.205, 95% CI, −2.07, −2.04). Further examination showed that women (−1.95%, 95% CI, −1.97, −1.94) lost significantly less of their starting weight than men (−2.38%, 95% CI, −2.14, −2.35). Those attending less than or equal to seven classes lost significantly less weight (0.7%, 95% CI, −0.74) versus more than or equal to eight classes attended (−3.5%, 95% CI, −3.52, −3.48). These patterns were consistent across education strata (Fig. 1). Class attendance was significantly correlated to percent weight loss (r = 0.57, P < 0.001, Fig. 2A) and was consistent for education (Fig. 2B). Collectively, the average weight loss by participating more than or equal to eight classes would be classified as clinically beneficial.10–12

Secondary Outcome: Clinical Significance

When examined by clinical cut points, 99,071 (71%) participants lost less-than-3% of their starting weight, 22,551 (16%) achieved clinically beneficial weight loss, and 18,823 (13%) achieved clinically significant weight loss. When examined by sex, 77,814 (72%) of women achieved less-than-3% weight loss, with 17,034 (16%) and 13,374 (12%) achieving clinically beneficial and clinically significant weight loss, respectively. For men, 21,257 (66%) achieved less-than-3% weight loss, with 5517 (17%) and 5449 (17%) achieving clinically beneficial and clinically significant weight loss, respectively. When examined by class attendance, 92% (n = 67,829) of individuals attending less than or equal to seven classes achieved less-than-3% weight loss versus significantly fewer of participants attending more than or equal to eight class attendees 31,242 (47%, P < 0.001). For those achieving “clinically beneficial” weight loss, 6% (n = 1640) were less than or equal to seven class attendees versus a significantly greater number of individuals in the eight-or-more class attendee group (n = 17,980, P < 0.001). This pattern of achievement was similar for those achieving “clinically significant” weight loss: less than or equal to seven class attendees (n = 1640 [2%]) versus more than or equal to eight class attendees (n = 17,183, 26%, P < 0.001).

DISCUSSION

In the current study, we examined the efficacy of class attendance on weight loss relative to the education level of study participants undertaking the foundational portion of the Naturally

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TABLE 2. Characteristics of Female Participants by Education

| Race          | Non-Hispanic | Hispanic | Class attendance | Height, m | Weight loss, kg | Postgraduate |
|---------------|--------------|----------|-----------------|-----------|-----------------|--------------|
| White        | 7,480        | 85%      | 163.10 ± 7.09   | 1.63 ± 0.07 | 1.63 ± 0.07    | 33.75 ± 9.22 |
| Black        | 1,122        | 13%      | 163.76 ± 7.10   | 1.64 ± 0.07 | 1.64 ± 0.07    | 33.75 ± 9.22 |
| Asian        | 49           | 1%       | 164.22 ± 7.15   | 1.64 ± 0.07 | 1.64 ± 0.07    | 33.75 ± 9.22 |
| Native American | 199         | 2%       | 164.38 ± 7.20   | 1.65 ± 0.07 | 1.65 ± 0.07    | 33.75 ± 9.22 |

Values in the same row and sub-table not sharing the same subscript are significantly different at P < 0.05 in the two-sided test of equality for column means.

Tests are adjusted for all pairwise comparisons within a row of each innermost sub-table using the Bonferroni correction.

BMI, body mass index; HDL-C, high density lipoprotein cholesterol; NAFLD, non-alcoholic fatty liver disease.

These findings are important for several reasons relative to societal internet penetration and worksite internet-based programming efforts for all employees of various educational levels within the workplace. Our findings also help to fill the gap cited by the US Preventive Services Task Force (2011), which concluded that there is a significant gap related to understanding the characteristics of employees participating in worksite intervention studies. Specifically, the internet has now evolved to a point where programming can be delivered to the worksite and personal devices such as home computers, mobile phones and tablets, showing within all educational strata. Though it could be argued that internet access is not available to everyone, data from the Pew Research Centers Internet and Technology Generations study report several characteristics that are important to our findings.

In a 2016 report, Horrigan reported that 52% of “personal learners” used the internet for learning, but observed a 15% gap between the generations examined. Therefore, we accept our research hypothesis.
not proceed past high school used the internet for a personal learning activity versus 58% among those with college degrees higher. Forty percent of employed adults in the high school graduate group pursued professional learning via the internet versus 64% for college-educated individuals. It was further noted that “college or more” obtained such training at venues away from the workplace (49%) versus 35% those with “some college” and “high school or less” education.

Other evaluations of online interventions demonstrated the utility of internet-based programming. Tate et al demonstrated that in a behaviorally-based weight loss program delivered via the Internet to hospital employees, those given website links only. As with our current study, programming efforts focused on the behavioral aspects of losing weight. Other evaluations of online interventions using self-reported weight loss outcomes associated with a commercially intensive lifestyle intervention delivered electronically have shown similar results. For example, in a study examining class attendance and weight loss, participants attending at least one session, lost an average of 2.8% of their body weight, while 23%...
### TABLE 4. Achievement of Clinically Beneficial or Clinically Significant Weight Loss

|                          | Less Than 3% | Clinically Beneficial (3–4%) | Clinically Significant (>5%) |
|--------------------------|--------------|------------------------------|------------------------------|
|                          | N            | Row N %                      | N                            | Row N %                      |
| All                      | 99,071       | 71%                          | 22,551                       | 16%                          |
| Women                    | 77,814       | 72%                          | 17,034                       | 16%                          |
| Men                      | 21,257       | 66%                          | 5,517                        | 17%                          |
| High School Graduate     | 8,375        | 70%                          | 1,895                        | 16%                          |
| Seven or fewer classes   | 5,910        | 91%                          | 397                          | 6%                           |
| Eight or more classes    | 2,465        | 44%                          | 1,498                        | 27%                          |
| Some College             | 18,078       | 72%                          | 3,898                        | 15%                          |
| Seven or fewer classes   | 12,983       | 91%                          | 889                          | 6%                           |
| Eight or more classes    | 5,095        | 46%                          | 3,009                        | 27%                          |
| College Graduate         | 33,506       | 70%                          | 7,682                        | 16%                          |
| Seven or fewer classes   | 22,489       | 92%                          | 1,496                        | 6%                           |
| Eight or more classes    | 11,017       | 48%                          | 6,186                        | 27%                          |
| Some postgraduate         | 5,656        | 71%                          | 1,312                        | 16%                          |
| Seven or fewer classes   | 3,931        | 92%                          | 261                          | 6%                           |
| Eight or more classes    | 1,725        | 47%                          | 1,051                        | 28%                          |
| Postgraduate              | 26,670       | 71%                          | 6,143                        | 16%                          |
| Seven or fewer classes   | 17,765       | 92%                          | 1,182                        | 6%                           |
| Eight or more classes    | 8,905        | 48%                          | 4,961                        | 27%                          |
| Trade                    | 6,786        | 69%                          | 1,621                        | 17%                          |
| Seven or fewer classes   | 4,751        | 91%                          | 346                          | 7%                           |
| Eight or more classes    | 2,035        | 45%                          | 1,275                        | 28%                          |

**FIGURE 1.** Data represent relative weight loss by education and class participation. Data are mean percent weight lost (95% CI). Data presented with the notations “a” (between gender difference) and “b” (between class attendance categories) are significantly different (P < 0.001).
achieved more than or equal to 5% weight loss. This latter cut point is considered clinically significant. Participants with greater levels of participation lost an average of 3.5% body weight, that is, clinically beneficial, with 29% achieving 5% weight loss. Finally, those completing the program lost an average of 4.3% body weight and 36 achieved more than or equal to 5% weight loss. As with our current study, greater amounts of weight loss were exhibited by individuals engaged in greater levels of participation. An important feature of the current study is the observation that a greater prevalence of those losing weight was present within all education strata for those attending more than eight versus less than or equal to seven classes. This was matched by a significantly greater magnitude of weight loss across education strata. Several factorial challenges should also be considered when examining education levels, obesity, and weight loss.

Empirical studies, for example, suggest that education level has a positive impact on health and general well-being, particularly in poorer communities. This, in turn, interacts with other related health factors such as a decreased likelihood for smoking, excessive drinking, illegal drug use, complemented by a greater likelihood of exercising, obtaining preventive care (eg, flu shots, vaccines, mammograms, pap smears, colonoscopies, etc). Further, Swinburn et al have reported that protective etiological factors associated with the strategies targeting the reduction of obesity include regular physical activity, a high intake of dietary non-starch polysaccharides (fiber, and supportive home and school environments for children). To the contrary, risk factors for obesity were considered to be sedentary lifestyles, a high intake of energy-dense, micronutrient-poor foods, heavy marketing of energy-dense foods, sugar-sweetened soft drinks, and fruit juices. Many, but not all of these factors are addressed in the online program examined in this report. While our results reinforce the viability of delivering an internet-based curriculum to the workplace and that class attendance plays a major role in the success of such programming efforts, some limitations should be considered.

**LIMITATIONS**

Limitations to our study include the lack of a control group and the absence of dietary records. However, a 2012 systematic review and meta-analysis by Waters et al showed that no change in control group weight is typically observed in trials using control groups and that control groups receiving standard care typically lose ~1 kg more than control groups receiving no intervention. Secondly, our data relied upon self-reporting, which is systematically biased, with overweight and obese people more likely to under-report weight. We also cannot report on follow-up data showing
potential changes or other CVD risk factors; however, in previous reports, we have reported significant reductions in hypertension, metabolic syndrome, and associated risk factors. A strength of our study is that we examined a large cohort of individuals demonstrating a net weight synonymous with clinically beneficial and clinically significant weight loss across various educational strata and that worksite programming effectively bringing a behaviorally oriented, personal learning environment to employees of different educational backgrounds.

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