Examining the Weight Trajectory of College Students

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ABSTRACT

Objective: To examine the weight trajectory of students over 4 years of college.

Methods: Anthropometric assessments were completed at the beginning and end of students' freshman year and the end of senior year to calculate body mass index. Questionnaires assessing weight-related behaviors were completed in senior year.

Results: Of the original 117 students, 86 remained in the study for 4 years. Body mass index was significantly higher at the end of senior year (mean, 24.84; SD, 4.46) vs the beginning of freshman year (mean, 23.59; SD, 4.01; $t[85] = 5.61$; $P < .001$). Weight was significantly higher at the end of senior year (mean, 71.32 kg; SD, 15.60) vs the beginning of freshman year (mean, 66.94 kg; SD, 14.02; $t[85] = 6.60$; $P < .001$). Students' mean weight gain was 4.38 kg and the sample increased from 23% to 41% overweight/obese. No significant associations were found between BMI and lifestyle factors.

Conclusions and Implications: This study suggests that students gain weight throughout college, which highlights the need for weight control interventions to target more than just freshman college students.

Key Words: BMI change, college students, obesity, weight gain (*J Nutr Educ Behav*. 2017;49:137-141.)

Accepted October 19, 2016. Published online December 4, 2016.

INTRODUCTION

Young adults entering college are a specific population of concern for overweight and obesity because the transition from high school to college is a vulnerable time for weight gain.[1] Weight gain in first-year college students is so prevalent it has been termed the freshman 15. However, most studies debunk the myth that students gain 15 lb (6.8 kg) in their first year at college, and instead suggest that freshman weight gain is closer to 3–5 lb.[2] There is no established correlation between weight gain or body mass index (BMI) and lifestyle factors for college students. Yet, it is acknowledged that college students generally do not meet physical activity recommendations or fruit and vegetable consumption guidelines.[3] A trend has been observed of decreased fruit and vegetable intake paired with increased alcohol consumption when students enter college.[4] A preliminary pattern of freshman weight gain continuing throughout college has been suggested, but more research is needed.[5] Gropper et al[6] conducted one of the only studies examining the changes in 131 students' weight and body composition over 4 years of college. Significant gains in weight, percent body fat, and BMI were observed. Another study, by Racette et al,[7] tracked changes in weight, BMI, exercise frequency, and dietary patterns of 204 students from freshman to senior year. Participants gained an average of 2.5 kg in 4 years and met neither physical activity recommendations nor dietary guidelines.

College weight gain is an important area to study because one's weight as a young adult is a predictor of the trajectory of one's adult weight.[8] Thus, targeting college students could be an effective way to combat the rising rates of overweight and obesity. This study aimed to examine the weight trajectory of college students over their 4 years in college and to determine whether there were significant associations between obesity-related health behaviors and BMI in college seniors.

METHODS

Before beginning their first year at a northeastern public university in fall, 2011, incoming freshmen were recruited to participate in a 1-year study on physical activity, incentives, and height/weight change; this study was called *Burn & Earn*. Students were recruited via mailings to their homes during summer, 2011; 117 participants enrolled. Over the course of their freshman year, data on students' height and weight were collected 4 times: once at the beginning and once at the end of each semester. More information about this study and its results can be found elsewhere.[9,10] The University of Vermont's Committee on Human Research in the Behavioral and Social Sciences approved the study protocol.

For the current study, participants from the 2011 *Burn & Earn* study were

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Conflict of Interest Disclosure: The authors' conflict of interest disclosures can be found online with this article on www.jneb.org.

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http://dx.doi.org/10.1016/j.jneb.2016.10.014

contacted again in spring, 2015, when they were seniors, and asked to participate in an extension of the original study involving anthropometric assessments and information about their current health behaviors. Respondents scheduled a study assessment visit, when they completed a food frequency questionnaire (FFQ), an alcohol use disorders identification test (AUDIT), and a general questionnaire. The general questionnaire was exploratory and assessed behaviors previously shown to be related to weight, including physical activity frequency, living situation, grocery shopping habits, specific diet, relationship status, and work situation.[11,12] At the assessment visit, study personnel also measured students' height and weight. A digitally calibrated scale (model BW800S; Tanita, Arlington Heights, IL) was used to measure participants' weight; height (in centimeters) was assessed using a wall-mounted stadiometer (Seca, Hanover, MD). Upon completion of the assessment visit, students were compensated $50 for participation. The FFQs were submitted to Nutrition Quest (Berkeley, CA) for analysis and the remainder of the data was compiled in the university laboratory. Changes in height, weight, and BMI were calculated by comparing 2011–2012 data with 2015 data.

The researchers used SPSS (version 23, IBM Corporation, Armonk, NY, 2015) to analyze the data. A paired-samples *t* test was performed to examine anthropometric changes between freshman and senior years. An independent-samples *t* test was employed to examine differences in weight trajectory between originally overweight or obese students and originally normal weight students. The researchers performed regression analyses to determine associations between health behaviors and changes in BMI/weight.

RESULTS

Of the original 117 participants, 86 returned to the laboratory for follow-up measurements; this represented a 73.5% retention rate. Analyses of weight, BMI, and height change were performed using only the 86 participants who had complete data. Box plots of weight and BMI change indicated several outliers; however, there was no scientific justification for treating outliers differently. Histograms and q–q plots of weight change, BMI change, and the residuals of weight and BMI change indicated that the assumption of normality needed for valid *t* tests could be accepted. No significant difference was observed in BMI at the beginning of freshman year between those who participated in the senior year study and those who did not participate ($F_{1,115} = 0.14$, $P = .69$). Of the 86 students who completed the study, 58 were women and 28 were men. Average age was 21.5 years. Ninety-three percent of participants were white and 7% were Asian. Four students reported being Hispanic or Latino. As seen in the Table, there were significant increases in mean BMI, weight, and height from the beginning of freshman year to the end of senior year, as well as from the end of freshman year to the end of senior year. Mean weight gain was 4.38 kg over 4 years, 2.94 kg of which occurred after freshman year. Mean height increase from the beginning of freshman year to the end of senior year was 0.9 cm, when men gained 1 cm on average and women grew by 0.85 cm.

> Students experience continued weight gain over all 4 years of college.

The number of overweight (BMI = 25–29.9) and obese (BMI ≥30) students increased from 20 at the beginning of freshman year to 35 by the end of senior year. At the conclusion of senior year, 41% of the sample was overweight or obese (Figure). Only 11.6% of students maintained weight within 1 kg of freshman year weight. A total of 21% of students maintained weight within 3% of freshman year weight over 4 years. Stevens et al[13] proposed a 3% weight change as the definition of weight maintenance. Twenty-two students, or 26% of the sample, maintained BMI within ±3% of their freshman year BMI. There was no significant difference in total change in BMI over 4 years between those who entered their freshman year in the normal BMI range (n = 66) and those who entered with a BMI in the overweight/obese categories (n = 20) ($P = .93$).

Based on the results of the FFQ, students' average caloric intake was 1,889 kcal/d. Mean fruit and vegetable consumption was 1.06 and 1.46 cups/d, respectively. Students consumed an average of 203 kcal/d of alcohol. Women averaged 164 kcal of alcohol, whereas men averaged 284 kcal of alcohol. The AUDIT results showed that 62% of the sample consumed alcohol 2–3 times/wk, and the most frequent response for number of drinks when drinking was 3–4 drinks. The AUDIT scores also indicated that 96.5% of participants were at very low risk for problem drinking behavior. Regression analyses indicated that there were no significant associations between weight change or BMI and lifestyle factors, including how students commuted to campus, relationship status, or where they obtained their food. Only 15% of participants regularly met physical activity guidelines of achieving 30 minutes of moderate physical activity 5 times/wk.

Table. Mean Weight, Height, and Body Mass Index (BMI) Values for Participants at the Beginning and End of Freshman Year and End of Senior Year (n = 86)

	Weight, kg	Height, cm	BMI, kg/m^2
Beginning of freshman year (fall, 2011)	66.94 (14.02)	168.23 (8.88)	23.54 (4.00)
End of freshman year (spring, 2012)	68.26 (13.74)	168.51 (9.00)	23.98 (3.93)
End of senior year (spring, 2015)	71.32 (15.60)[a,b]	169.13 (8.95)[a,b]	24.84 (4.46)[a,b]

[a]Significantly different from beginning of freshman year to end of senior year ($P < .001$, paired-samples *t* test); [b]Significantly different from end of freshman year to end of senior year ($P < .001$, paired-samples *t* test).
Note: Data are shown as mean (SD).

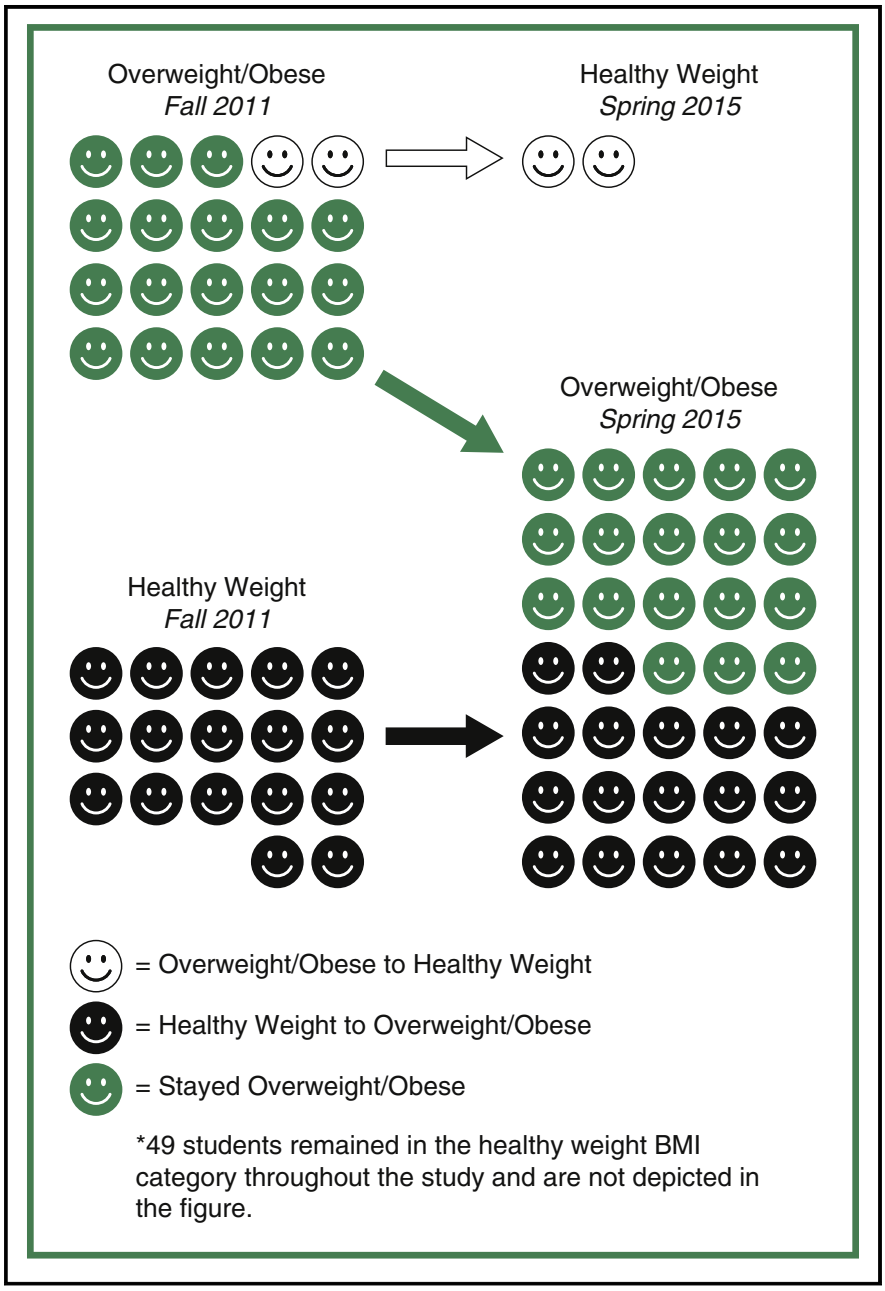

Figure. Movement between body mass index categories for participants who started freshman year in the overweight/obese category (fall, 2011) and for those who ended senior year in the overweight/obese category (spring, 2015).

DISCUSSION

These results suggest that a significant increase occurs in weight and BMI over the 4 years students spend at college. However, the origin of this weight gain remains unclear. Although there was a statistically significant increase in height over 4 years, it was ≤1 cm for both men and women, which was not clinically significant in that it did not plausibly account for the entire 4.38-kg weight gain observed. Furthermore, the significant increase in BMI indicated that height increase did not entirely account for the measured weight increase. Because the researchers assessed height using a stadiometer, measurement error also could have contributed to the small height increase observed.

The average reported daily caloric intake remained lower than the needs of most college students regardless of gender. This caloric deficit did not match the observed weight gain. Although the accuracy of self-report data is disputed, studies showed that the validity and reliability of FFQ data specifically are moderate to high on a population level.[14] However, previous studies on dietary recall found that those who are overweight or obese are more likely to underreport intake than are those of a healthy weight. These studies also indicated that individuals aged 19–29 years and women are likely to underreport.[15] Participants in this study fell into several of the subgroups most likely to underreport intake. Furthermore, an understanding of portion sizes is necessary for accurate FFQ reporting. It is possible that despite providing examples of various portion sizes for participants, they still might have underreported portion sizes, which might have resulted in the lower average calorie intakes recorded.

The FFQ data showed that mean fruit and vegetable consumption was below the recommended intake for young adults.[16] It is likely that energy-dense foods displaced fruits and vegetables, leading to this deficiency. Although the alcohol intake reported by this sample was generally not problematic, and in fact fell within the 2015 Dietary Guidelines for Americans, which recommend a maximum of 1 drink/d for women and 2 drinks/d for men, the majority of students reported drinking on only 2–3 d/wk. This suggests that alcohol calorie intake exceeded the guidelines on the days when alcohol was consumed. Average reported calories from alcohol were >10% of the total average reported daily calories. No associations were found between alcohol consumption and weight change, but alcohol contributed a meaningful number of calories to participants' diets.

Physical activity habits were another lifestyle factor hypothesized to be associated with weight or BMI change. The American Heart Association recommends at least 30 minutes of moderate-intensity aerobic activity 5 d/wk.[17] Only 15% of participants regularly met these physical activity guidelines, but the researchers found no associations between change in weight or BMI and meeting physical activity guidelines. However, it is possible that physical activity decreased from freshman to senior year, which may have contributed to the observed weight gain and BMI increase.

Although there were no associations between weight change and lifestyle

behaviors, the increase in the prevalence of overweight and obesity from the beginning of freshman year to the end of senior year was significant. These results were similar to findings of one of the only other studies examining weight change in college students over 4 years: Gropper et al[6] found an increase in overweight or obesity from 18% to 31%. That study also found an average weight gain of 3.0 kg in 4 years and an average increase in BMI of 1.0 kg/m^2 over 4 years. In comparison, the current study found an average increase of 4.38 kg in weight and 1.3 kg/m^2 in BMI. Both studies found significant increases in weight and BMI, but the current study found larger increases in both weight and BMI, as well as a greater increase in the prevalence of overweight and obesity. The significant increase in overweight and obesity is especially surprising given the recruiting method for the study. Participants originally signed up for a study on incentivizing physical activity. Theoretically, this should have been a motivated population that was more inclined to physical activity than a random sample. Furthermore, all participants were enrolled at a reputable 4-year university and the sample was predominantly white. Both lower education and minority race are factors associated with obesity.[18,19] These results suggest that even in populations considered to be at lower risk for obesity, small and consistent weight gains become significant over time.

> Need for health behavior–related interventions throughout students' 4 years at college rather than only in the freshman year.

The significant increases seen in BMI, weight, and the proportion of students in the overweight/obese BMI categories are concerning given the health risks associated with overweight/obesity in adolescence and young adulthood, as well as research indicating that BMI as a young adult is correlated with BMI later in life.[20,21] Obese young adults are more likely to experience hypertension, diabetes, polycystic ovarian syndrome, and psychosocial distress, all of which can be debilitating.[22] These health consequences may also track into adulthood, because research by The et al[21] indicated that the risk of becoming severely obese by age 30 years was much greater for obese adolescents than for overweight or normal weight adolescents. Perhaps most concerning, Zimmermann et al[23] found that the risk of mortality in adulthood was twice as great for obese young adults compared with normal weight young adults. The results of the current study combined with previous research on the negative outcomes of obesity in young adulthood suggest that more interventions are needed to help young adults maintain a healthy weight.

Strengths of the study include the longitudinal weight and BMI data, which span over 4 years. Researchers measured height and weight for participants in the laboratory rather than use self-reported height/weight data. This study had a sample size (86 participants) representing a 73.5% retention rate from the original study. Another strength was the magnitude of data collected from FFQs, AUDIT scores, and a lifestyle questionnaire.

Although the plethora of data was a strength of the study, except for weight and height, the majority of data are self-reported. Furthermore, the questionnaire asking about general weight-related behaviors such as living situation and relationship status was not a validated questionnaire, but rather an exploratory questionnaire meant to inform future research. Another limitation of this study was the absence of a control group to represent the weight trajectory of those who did not attend college. The sample lacked diversity but was representative of the New England state where the study was conducted. A final limitation was the gap in data between participants' freshman and senior years. It is unknown whether weight gain was consistent over these 4 years or whether a majority of the weight gain occurred at a certain time after freshman year. Based on the average weight change in freshman year and average weight change over all 4 years, it can be concluded that weight gain did not continue at the same rate of 1.44 kg/y. A study by Lloyd-Richardson et al[5] suggested that weight gain continues over students' sophomore year, but at a slower rate. More research is needed to determine the rate at which weight gain occurs over sophomore, junior, and senior years.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Future research with more frequent measurements over 4 years at college is necessary to expand on the current results. More objective measures of eating and physical activity would also strengthen future studies. Pairing a 4-year university with a 2-year community college or a sample of young adults not pursuing further education after high school would also provide valuable controls in future research. A more diverse sample would increase the ability of future studies to be applied to populations outside New England. In addition, more detailed body measurements could be used to differentiate muscle gain from fat gain.

The study's results, which suggest continued weight gain over all 4 years of college, are important for health practitioners targeting a college population. This study highlights the need for health behavior–related interventions throughout students' 4 years at college rather than only in the freshman year. The significant increase in BMI observed from freshman to senior year translated into a dramatic increase in the prevalence of overweight/obesity in the sample from 23% to 41% over 4 years. The mean weight gain of 4.38 kg was not explained by measured lifestyle behaviors including alcohol consumption or meeting diet and physical activity guidelines.

ACKNOWLEDGMENTS

This study was supported by a US Department of Agriculture HATCH Grant (Dr Pope, Principal Investigator). The authors thank Lucy Mower for help with data collection, and Alan Howard for assistance with the statistical analysis.

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CONFLICT OF INTEREST

The authors have not stated any conflicts of interest.