Changes in Weight and Health Behaviors from Freshman through Senior Year of College

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ABSTRACT

Objective: To assess weight changes, exercise and diet behaviors among college students from the beginning of freshman year until the end of senior year.

Design: Longitudinal observational study.

Setting: Private university in St. Louis, Missouri.

Participants: College students (138 females, 66 males).

Main Outcome Measures: Weight and height were measured, body mass index (BMI) was calculated, and exercise and dietary behaviors were assessed by questionnaire.

Analysis: Changes in weight, BMI, exercise, and dietary patterns from the beginning of freshman year to the end of senior year.

Results: Females gained 1.7 ± 4.5 kg (3.75 ± 9.92 lb) [mean ± SD] from freshman to senior year, and males gained 4.2 ± 6.4 kg (9.26 ± 14.11 lb) (both P < .001). Weight changes were highly variable between students, however, ranging from −13.2 kg to +20.9 kg (−29.10 to +46.08 lb).

Conclusions and Implications: Weight gain was common but variable among college students. Importantly, exercise and dietary patterns did not meet the recommended guidelines for many college students, which may have long-term health implications.

Key Words: body mass index, exercise, physical activity, diet, students

INTRODUCTION

The national importance of student health on college campuses is evident in Healthy Campus 2010,1 a companion document to Healthy People 20102 that contains more than 200 health objectives toward which America’s colleges and universities should strive. Physical activity and overweight/obesity are 2 of the leading health indicators, yet data from the National College Health Assessment3 and the College Health Risk Behavior Survey4,5 indicate that physical activity and dietary patterns of many college students do not meet the recommendations of health professionals, and 29.9% of students are overweight or obese based on self-reported height and weight values.

The greatest increase in overweight and obesity has been observed between 18 and 29 years of age,6 the age range of more than 10 million full-time college students in the United States.7 Because the nation is moving further away from, rather than toward, the body mass index (BMI) goals established in Healthy People 2010,2 it is important to understand the influence that college life has on this trend.

Whether college life promotes substantial and inappropriate weight gain is controversial, and some authors state that their data “verify” the “freshman fifteen” phenomenon of weight gain,8 whereas others describe the “freshman fifteen” as a “myth.”9 Few studies have assessed weight changes beyond freshman year10,11 and it is not clear whether any studies have followed students longitudinally through senior year. Given the escalating rates of obesity and inactivity among all ages, it is important to determine whether the prevalence of overweight and obesity increases during college. Therefore, the purpose of this study was to assess changes in body weight and BMI from the beginning of freshman year to the end of senior year of college.
DESCRIPTION OF THE EVALUATION

The research design was a prospective, longitudinal, observational study involving a convenience sample of undergraduate students, as described previously.11 Freshman students attending Washington University in St. Louis, Mo were invited to participate in this study when they arrived on campus in August of their freshman year in either 1999 or 2000. Recruitment strategies included announcements mailed to students via campus mail or electronic mail, flyers posted in freshman residence halls, and verbal communication from residence hall resident advisors. Eligible students were at least 18 years of age with BMI at least 18.0 kg/m² (39.68 lb/3.28 ft²). As an incentive to participate, students were given either a gift certificate to the campus bookstore or cash of equal value. The study was approved by the Human Studies Committee of Washington University School of Medicine. Signed, informed consent was obtained from each participant.

Assessments were conducted during the first 2 weeks of the fall semester of freshman year, and during the final 2 to 3 weeks of the spring semester of senior year. Height was measured with a stadiometer to the nearest 0.1 cm (.328 in), and body weight was measured on a balance scale to the nearest 0.1 kg (.2205 lb) (without shoes, hats, outer garments or belts, and with pockets emptied). Body mass index was calculated as weight divided by height squared (kg/m²).

The adult BMI criteria12 were used to categorize students as underweight, normal weight, or overweight/obese, because the Centers for Disease Control and Prevention BMI-for-age growth charts13 do not apply to 22-year-old college seniors.

A demographic questionnaire was used to obtain information on self-reported sex, race, ethnicity, and type of residence (eg, residence hall, apartment). Demographic information for all freshman students entering Washington University was obtained from the registrar’s office, confirming that the sample was representative of this institution. The exercise and diet questionnaires were based on the transtheoretical model of behavior change.14,15 The exercise questionnaire was used to determine whether participants performed aerobic, strengthening, and stretching exercises on a regular basis using the following criteria based on the American College of Sports Medicine guidelines16: aerobic exercise 3 to 5 days per week, 20 to 60 minutes per day; strengthening exercises 2 or 3 days per week, 8 to 10 repetitions per day for the largest muscle groups; and stretching exercises 2 or 3 days/week. The diet questionnaire was used to assess whether students were meeting the guidelines established by the 5 A Day campaign17 to eat at least 5 fruits and vegetables daily; limiting intake of fried foods to a maximum of 2 times during the previous week; and limiting high-fat fast foods to a maximum of 2 times during the previous week.

Statistical analyses were performed using SPSS statistical software (version 11.01, 2001, SPSS Inc., Chicago, Ill). Simple descriptive statistics were used to describe the overall characteristics of the sample; differences between females and males were examined using either 2-sample t tests (for continuous variables) or chi-square tests (for categorical variables). Changes in outcome measures from the beginning of freshman year to the end of senior year were evaluated using paired samples t tests (for continuous variables) and McNemar’s change test (for categorical variables). Results are presented as mean ± SD. Significance was accepted at an alpha level of .05.

FINDINGS

Two hundred four students (68% female, 32% male, 18 ± 0 years) completed assessments at both time points and are included in these analyses. Ninety-seven of the 204 students were from the freshman class enrolled in 1999, and 107 were from the freshman class enrolled in 2000. Because the characteristics of the 2 cohorts were not different, their data were combined in all analyses. The racial/ethnic distribution was 75% Caucasian, 11% Asian, 6% African American, 3% Hispanic, and 5% of other or unknown background.

As freshmen, 5% of participants were classified as underweight, 80% were normal weight, and 15% were overweight or obese. By the end of senior year, the prevalence of overweight/obesity increased to 23% (P = .004 relative to freshman year). The BMI categorizations for females and males are shown in the Figure. As shown in the Table, weight, height, and BMI increased (P < .001) among both females and males from freshman to senior year. The weight changes were highly variable between students, however, ranging from a loss of 13.2 kg (29.10 lb) to a gain of 20.9 kg (46.08 lb).

As freshmen, 59% of students engaged in aerobic exercise regularly, 45% in strengthening exercises, and 31% in stretching exercises; 29% of students did not exercise reg-

**Figure 1.** Body mass index (BMI) categories for students at the beginning of freshman year (striped bars) and at the end of senior year (solid bars).
**DISCUSSION**

This study is the first to provide longitudinal, measured body weights of college students from freshman year to senior year. The major finding of the present study is that body weight and BMI increased significantly, although modestly, during 4 years of college. Importantly, these results suggest that the rapid rate of weight gain observed previously during freshman year\(^8,11\) does not continue throughout college. However, weight changes in the present study were highly variable between students, which is consistent with shorter-term studies.\(^9,10,18\)

Although one cannot compare the weight changes observed over the entire college career in the present study to results of previous studies, it is interesting to project long-term weight changes based on the weight changes that have been observed during freshman year. Although relatively small weight changes ranging from −0.7 kg (−1.54 lb) to +0.7 kg (+1.54 lb) have been observed during freshman year,\(^9,19,20\) Levitsky et al\(^8\) reported a weight gain of 1.9 kg (4.19 lb) among 60 college freshmen during their first semester, and it has been previously shown that body weight after 2 semesters of freshman year increased 2.5 ± 5.0 kg (5.51 ± 11.02) among 118 females and males (\(P < .001\)).\(^11\) If the high rate of weight gain observed during 1 semester were to continue throughout 4 years of college and beyond, the result would be a dramatic increase in the incidence of overweight and obesity among young adults. Fortunately, such trends do not appear to continue, as the average gain by the end of 4 years of college was more modest in the present study, averaging 0.4 kg (0.9 lbs) per year in females, and 1.1 kg (2.3 lbs) per year in males. In comparison, among adults aged 18-30 years in the Coronary Artery Risk Development in Young Adults study, weight gain averaged 12.8 kg (28.22 lb) over 15 years,\(^21\) or 0.85 kg (1.87 lb) per year. Among 5,247 adults aged 35 years and older in the third National Health and Nutrition Examination Survey, 10-year weight gain ranged between 0.5 and 5.3 kg (1.10 and 11.68 lb) (ie, 0.05-0.5 kg/year [0.11-1.10 lb/year]) among the men and between 3.0 and 8.5 kg (6.61 and 18.74 lb) (ie, 0.3-0.8 kg/year [0.66-1.76 lb/year]) among the women, with the greatest gains among those who had quit smoking during the 10-year follow-up period.\(^22\) It is likely, however, that a portion of the observed weight gain in the present study was attributable to increases in lean body mass, as suggested by the increases in height. Future studies should include a measure of body composition to distinguish lean body mass gains from fat mass gains.

Another important observation in the present study was that exercise patterns during freshman and senior years did not meet the recommended guidelines for nearly one third of students, which is consistent with college students nationwide.\(^3\) Furthermore, the finding that 59% of freshmen engaged in aerobic exercise regularly is in accord with a study in which 58% of freshmen met the recommended guidelines for moderate and vigorous exercise.\(^23\) Because only about 25% of adults in America engage in the recommended levels of physical activity,\(^24\) it appears that exercise habits decline following college graduation.
A concerning dietary pattern was that fewer than one third of the participants in this study consumed the recommended servings of fruits and vegetables during freshman or senior assessments. Similarly, 31% of college students in a previous study met the 5 A Day goal, whereas a strikingly low 6.9% of students nationwide achieved this goal on a daily basis, highlighting the need for nutrition education on college campuses.

A limitation of the present study was the relatively small sample of students. The low return rate during senior year (204 of 764 students who were assessed as freshmen) may have been attributable to the seniors’ off-campus living arrangements and competing time demands (eg, final exams, job interviews). Although the baseline characteristics of students who returned were indistinguishable from the remainder of the cohort, the investigators acknowledge that students who gained the most weight may have been less likely to return, which would have skewed the results toward smaller weight changes than actually occurred among the larger sample.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The results of this study demonstrate that college students do experience statistically significant increases in weight and BMI during 4 years of college. Although some of the observed weight gain probably was attributable to normal growth and maturation, a portion likely represents adipose tissue gains that may increase health risks if these trends continue throughout adulthood. Assessments of body composition are needed in future studies of college weight changes to differentiate gains in adipose tissue, lean body mass, and bone mineral content.

Importantly, self-reported exercise and dietary behaviors did not meet the recommended levels for many students in the present study, which may have adverse health consequences independent of the potential contribution to weight gain. University efforts to enhance health awareness and promote favorable exercise and dietary behaviors are essential and should be incorporated into undergraduate curricula.

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