

Measuring Health of College Students: Food Security, Diet Quality, and Physical Activity

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Abstract

A cross-sectional study was conducted to assess food security, diet quality, and physical activity in college students using a sample of NHANES data on the United States. Prevalence rates of participants achieving full food security, >50 Healthy Eating Index (HEI)-2010 composite score, and >150 minutes moderate or vigorous physical activity (MVPA) per week were measured. Results showed that 28.8% of college students were food insecure, 34.5% had an above-50 HEI score, and 58.2% achieve adequate physical activity per week. In comparison, adults in the general population have lower rates of food insecurity (22.4%), higher rates HEI above 50 (42.2%), and lower rates of adequate physical activity (35.6%), with $p < 0.05$ for all comparisons. These findings suggest that interventions to improve students' food access and diet quality may be important to implement by institutions of higher education.

Introduction

For students in the United States, the transition from living at home as a high school student to enrolling in institutions of higher education is often accompanied by major changes in lifestyle and thus changes in important features of health as well as well-being. Of particular importance, diet, nutrition and physical activity, have been noted to influence long-term health outcomes (Perry et al., 1994). The National Health and Nutrition Examination Survey (NHANES), administered by the Centers for Disease Control, provides an abundance of data sets documenting the health and nutritional status of adults and children in the United States. Hence, we aim to use data from the NHANES to assess the prevalence of the inadequacies of these lifestyle factors in the subpopulation of college students in order to understand their physical wellbeing.

Diet and nutrition

Diet is not only important to understand due to its significant influence on health, but also because of its complex external determinants that influence its quality. Food insecurity is a continuously prevalent issue in the United States, defined by the USDA as “household-level economic and social condition of limited or uncertain access to adequate food” (“USDA ERS - Definitions of Food Security,” 2017). It is necessary to understand which social groups do not have access to nutritious foods, education about nutrition, or habits to improve nutritional wellbeing.

With 14.5% of households in the United States classified as being food insecure in 2010 (Coleman-Jensen et al., 2011), food insecurity is a major problem in this nation. College students are particularly vulnerable to food insecurity, as they are under academic, cognitive, and financial stresses that may limit their ability to consume adequate quantities of healthy food (Patton-López et al., 2014). The consequences of food insecurity in college students are far-reaching, having the potential to decrease their overall health in addition to negatively impacting academic performance, mental health, and social health (Martinez et al., 2016). A 2014 study at a rural university in Oregon found that good academic performance was inversely associated with food insecurity (Patton-López et al., 2014). We hypothesize that in the U.S., the college student population experiences a higher prevalence of food insecurity than the general population.

Many college students undergo a major transitional period from guided eating and nutrition to independent decision-making regarding food choices. Upon first encountering the freedom to make their own food decisions, college students often choose foods that constitute a poor diet, impacting their eating behavior negatively (Marquis, 2005). Students tend to eat fewer

fruits and vegetables and report a high intake of high fat, high calorie foods (Brevard & Ricketts, 1996; Driskell et al., 2005; Racette et al., 2005).

The Healthy Eating Index (HEI), developed by the Center for Nutrition Policy and Promotion, is a continuously-updated metric of overall diet quality measured in terms of conformance to the Dietary Guidelines for Americans (Guenther et al., 2013). These guidelines are the basis of nutrition policy and guidance by the U.S. government. The HEI has been used extensively to investigate the importance of diet to health. For example, it was found that higher HEI scores are associated with significant reductions in chronic disease in men and women (McCullough et al., 2002). We speculate that some aspect(s) of the college lifestyle lead to poor diet, and that being in college would be associated with lower HEI scores compared to the general U.S. population. Findings would inform campus administration to take steps to improve diet quality.

Physical activity

Sedentary behaviors like excessive television watching are associated with obesity in children and adults (Gortmaker et al., 1996; Salmon et al., 2000). We sought to compare the physical activity levels in our college-aged sample versus the general U.S. population, as the college-aged sample may be disproportionately affected by this trend. It has been shown that physical activity levels tend to drop significantly and stagnate during adolescence, so much so that around 70% of adults in the United States are below healthy levels (Buckworth & Nigg, 2004). This period of late adolescence is crucial in forming long term physical activity habits. If young adults are significantly less physically active than the general population, such a finding would be indicative of a large population in danger of experiencing many negative health effects

later in life. Sedentary lifestyles lead to increased risk of several types of chronic diseases and health conditions such as diabetes and obesity (Janssen & LeBlanc, 2010). Thus, we seek to compare the physical activity level of the U.S. college student population to that of the general population.

Methods

Definitions

We choose to use the predefined NHANES categorization of adult food security, which is based on the USDA food security measures (Bickel et al., 2000). This categorization has been well-validated and used for many research analyses involving the measurement of food security (Coleman-Jensen et al., 2011).

The HEI, last updated in 2010, rates an individual's diet out of a score of 100. The score is calculated based on a nutritional density analysis to quantify the adequacy of 12 food categories in one's diet (Guenther et al., 2013). The metric has been validated and used extensively to compare diet qualities of different social groups (Guenther et al., 2014).

We measure physical activity by the total minutes of moderate or vigorous physical activity per week (MVPA). This metric has been demonstrated to be a reliable measure of physical activity that is a better predictor of weight gain than total physical activity (mean accelerometers counts per minute) or hours of sedentary behavior (Fisher et al., 2011).

Data

We used questionnaire data from the National Health and Nutrition Examination Survey (NHANES), a program of studies conducted by the Center for Disease Control ("NHANES -

National Health and Nutrition Examination Survey Homepage,” n.d.). The survey samples and aims to represent the noninstitutionalized civilian residents of the United States using a stratified multistage cluster design. In addition to the health behavioral, nutritional, demographic, and socioeconomic metrics of our interest, the NHANES collects other examination and laboratory data which we did not use. The NHANES has been used by various government agencies, such as the FDA and USDA, to make recommendations regarding public health.

Sample

Our sample included the following four two-year NHANES collection periods: 2007-2008, 2009-2010, 2011-2012, and 2013-2014, which were pooled together as a complete sample. To avoid collecting participants in high school, only men and women of age equal to or greater than 18 years were included. Women who reported pregnancy were excluded due to their unique health needs.

Two cohorts, case and control, were defined using the following variables:

- Demographics: Age (RIDAGEYR)
- Occupation data: Type of work done last week (OCD150), main reason did not work last week (OCQ380)

The case cohort (college student population) was defined by participants aged 18-24 who were “not working at a job or business” because they were “going to school”. The control cohort (general adult population) was defined by participants of greater than or equal to 18 years of age who did satisfy the college student criteria—this may include those working and those not working.

Outcomes

Outcome measures were defined using the following variables:

- Food security: Adult food security (FSDAD)
- Diet quality: HEI-2010 (calculated from reported foods consumed during NHANES Day 1)
- Physical activity: Minutes moderate recreational activities (PAD675), Minutes vigorous recreational activities (PAD660). Measured per week.

All outcome measures were encoded as binary outcomes: “adequate” or “inadequate”.

Adequacy for food security was satisfied by having “full food security” from the food security questionnaire. Adequacy for HEI was defined as having a score greater than 50 (out of 100).

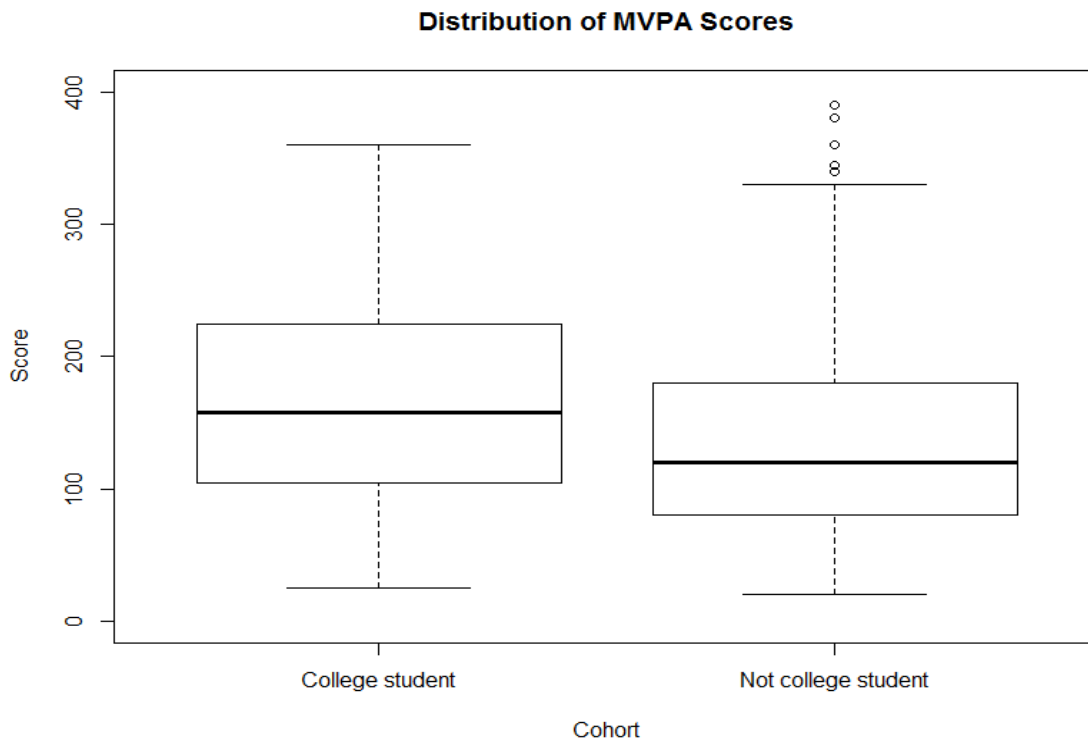
Adequacy for physical activity was defined to be no less than 150 minutes per week of the sum total of moderate physical activity and vigorous physical activity. All analyses were conducted using survey design methods with the R package, ‘survey’ (Lumley 2016, <http://r-survey.r-forge.r-project.org/survey/>).

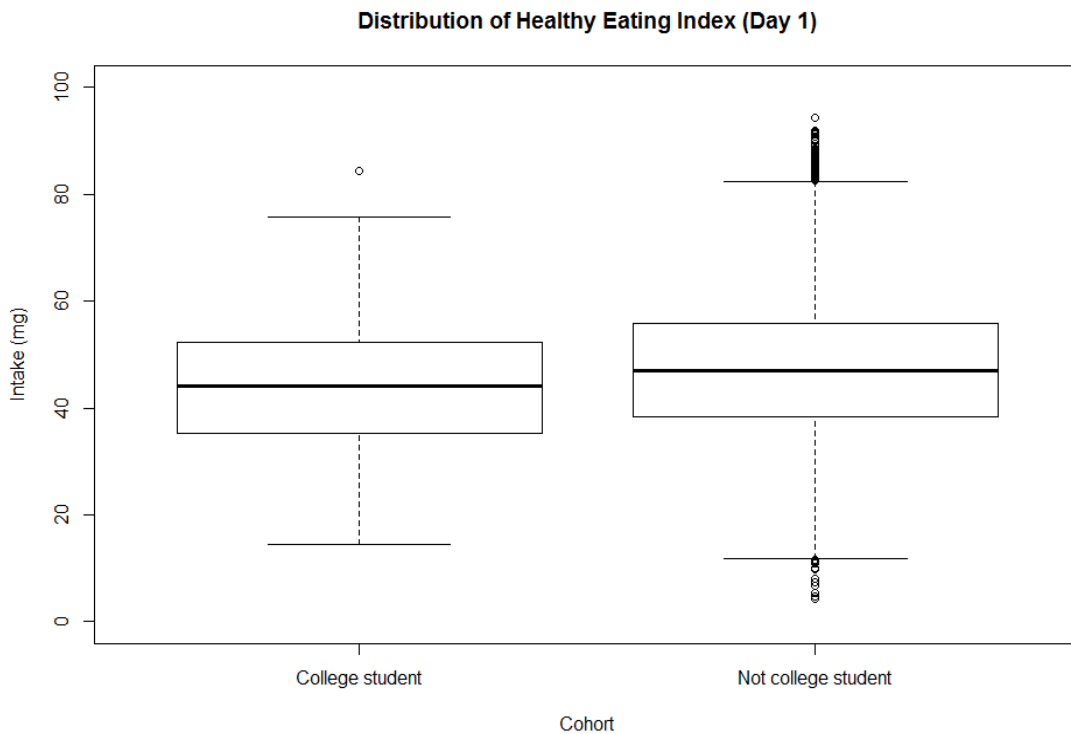
Results

Cohort	Prevalence: Full Food Security	N
College student	71.18%	566
Not college student	77.57%	21,218

Cohort	Prevalence: Adequate MVPA	N
College student	58.23%	168
Not college student	35.57%	2,838

Cohort	Prevalence: HEI Above 50	N
College student	34.47%	575
Not college student	42.19%	21,363





Food security

The college student cohort has a 71.18% prevalence rate of achieving full food security, while the non-college cohort has a prevalence rate of 77.57%. This difference was found to be statistically significant ($p < 0.01$). Thus, 28.82% of college students in the cohort experienced food insecurity, while only 22.43% of the general population cohort did.

HEI

The college student cohort has a 34.47% prevalence rate of achieving an HEI greater than 50, while the non-college cohort has a prevalence rate of 42.19%. This difference was found to be statistically significant ($p < 0.01$).

Physical activity

The college student cohort has a 58.23% prevalence rate of achieving 150 minutes of MVPA, while the non-college cohort has a prevalence rate of 35.57%. This difference was found to be statistically significant ($p < 0.01$).

Discussion

Food security

The results of our analysis support the hypothesis that college students are more likely to be food-insecure than other adults. There are a variety of factors that can contribute to this, including the well-known factor of income (Rose, 1999). However, there are challenges to measuring the economic status of college students in a way that is readily comparable with other populations. This is due to mixed sources of income and financial support that may include self-earned income, familial support, and governmental as well as institutional funding. In addition, the effect of economic factors confounds the outcomes because economic status influences food security and biases the sampling of the cohorts by also influencing the means to pursue higher education. This effectively results in a counterintuitive trend that a subpopulation with relatively high economic status does not achieve one of the most common features of high economic status.

The results of our study reaffirm the finding that food insecurity is relatively high amongst college students compared to adults and other age groups. According to the Hughes et al., 2011 study on food insecurity amongst university students, almost half of the student community was found to experience some degree of food insecurity (46.5%), with one quarter experiencing more extreme forms of food insecurity such as hunger (25.3%). Hughes also attributes the disparity to a misalignment of government policy that promotes tertiary education

with inadequate financial and other forms of support. It would be beneficial to investigate the direct relationships between food insecurity and academic performance to elucidate the mechanisms by which food insecurity influences the educational experience.

This research may have implications for food security assistance provided by universities. Recent findings such as ours on college students have created an increased push for nonprofit organizations and universities themselves to invest more into efforts to understand and address students' eating patterns.

HEI

The results of our analysis support the hypothesis that college students have lower quality diets than the general population. HEI is a validated and commonly-used metric for assessing nutritional quality (Guenther et al., 2014). Our results conflict with the findings of Hiza et al., 2002, who reported a state college's average HEI to be higher than national average. Though the report may be accurate regarding the state college studied, our results indicate that the average U.S. college student is subject to poorer nutrition compared to the general population.

Missing nutrients are the consequence of a lack of certain food groups. Brown et al., 2005 reported that in a college, participation in the prepaid campus meal plan appears to offer modest nutritional benefits to students through increased servings of foods from fruit, vegetable, and meat groups. The report indicates that students without a meal plan are more likely to have poor diets. Those without a meal plan frequently purchase food at various food courts and cafes on campus. Pelletier & Laska, 2013 reported that frequent food and beverage purchasing around campus was associated with less frequent breakfast consumption and higher fat and added sugar

intake. Thus, convenient alternatives to packing meals or eating from the dining hall may pose a threat to a nutritious and healthy diet.

Awareness of the nutritional profiles of foods is also an issue that may lead to this disparity of diet quality. Graham & Laska, 2012 report that college students who reported that they frequently read nutrition labels were more likely to have healthier dietary intakes (less fast food and added sugar; more fiber, fruits, and vegetables) compared to those who read labels sometimes or rarely. Appreciation of nutrition labels requires a degree of nutritional knowledge that may be lacking in a large part of the college population. Also important is awareness of the importance of a healthy diet, which would motivate students to check the nutrition labels more often.

The workload imposed on college students may result in disparities in their consumption of low nutrient density food. Larson et al., 2006 reported that food preparation by young adults is associated with better diet quality, and that the most common barrier to food preparation was lack of time. When faced with exams and projects, it is likely that college students would prioritize schoolwork over preparing healthy meals. Fast and convenient but potentially unhealthy, alternative food sources are likely to encourage this behavior.

There are steps colleges can take to address the nutritional situation of their students. Colleges may establish programs that provide easy access to low-cost groceries, especially when grocery stores are beyond walking distance. Nutrition awareness campaigns, targeted especially to those without a meal plan, may also improve the situation. Lastly, colleges may benefit their students by providing nutritional and health warnings against the consumption of unhealthy fast foods and beverages.

Physical activity

Understanding population trends regarding physical activity can help identify social groups to target with intervention efforts. Andersen et al., 1998 suggests that increased sedentary activities like television watching are causing younger cohorts to exercise less. However, we found that our college-aged sample had a significantly higher percentage of people who attain adequate moderate and vigorous physical activity than the general population sample.

Though MVPA is a reliable measure of physical activity involving weight gain predictions, the methodology of studying such data in this investigation was different from other studies in terms of what pieces of NHANES-provided data were actually used. For example, other studies have analyzed total physical activity by using mean accelerometer counts per minute (Troiano et al., 2008) and hours of sedentary behavior (Fisher et al., 2011) as metrics.

Our finding that college students are more likely to achieve adequate physical activity compared to the general population is consistent with how physical activity was shown to be highest in childhood and adolescence, decreasing with age (Troiano et al., 2008). Thus, though our results are contrary to our hypothesis, our data makes sense in the context of certain other reports.

Conclusion

There are a few limitations of the study that could be improved in future studies. The first limitation is the longitudinal issues associated with the NHANES data sets that were used. Although the data sets were effective in showing the trends in our variables of interest over time, they inherently have panel attrition due to participants dropping out, thus invalidating their earlier collected data. A second limitation of the study is that there are differences in the levels of

what qualifies as adequate HEI, food insecurity, and physical activity across sources, making it hard to compare results from one study to another. In addition, it is possible that not everyone in our case cohort is a college student, since the criteria were simply to be of 18-24 years of age and to report “not working at a job or business” because they were “going to school”. Furthermore, we did not control for possibly confounding covariates such as income, education, current health status, and race/ethnicity. Exploring these covariates and their relationship to our response variable is a necessary avenue for further research.

Institutions of higher education face the challenge of monitoring and improving the student experience. Health is of critical importance to the success and general wellbeing of students both in the short term and in the long run. Thus, in order for colleges to implement appropriate institutional policies, it is necessary to quantitatively assess the health needs of its students.

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