ASSOCIATIONS BETWEEN CARDIOVASCULAR DISEASE RISK FACTORS AND ACADEMIC SUCCESS IN THE FIRST SEMESTER OF COLLEGE

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Thanks!
Chris, Dr. Ludy, and Dr. Morgan

ASSOCIATIONS BETWEEN CARDIOVASCULAR DISEASE RISK FACTORS AND ACADEMIC SUCCESS IN THE FIRST SEMESTER OF COLLEGE

CHRISTOPHER WALLS

HONORS PROJECT

Submitted to the Honors College at Bowling Green State University in partial fulfillment of the requirements for graduation with UNIVERSITY HONORS May 2017

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ABSTRACT

Background: Most college students do not perceive themselves to be at risk of cardiovascular (CV) disease. This study’s purpose was to determine the prevalence of CV risk factors among first-semester college students and explore its relationship with academic success.

Methods: First-semester college students (n=66, 56.1% female, age 18.4±0.5, BMI 25.5±6.1 kg/m2) enrolled in a seminar course completed assessments for blood pressure (BP; automated cuff), CV recovery (YMCA 3-minute step test), and daily steps (FitBit) in August/September and November/December. Grade point average (GPA) was obtained from the university registrar. Paired t-tests were used to determine change from beginning to end of semester. Pearson correlation coefficients were used to identify associations between variables.

Results: During first semester of college, systolic BP increased (124.3±14.1 to 128.0±15.1 mmHg, p=0.043) and daily steps decreased (10,397±3392 to 7186±2658 steps). Diastolic BP (78.8±14.1 to 81.1±8.4 mmHg) and CV recovery (i.e., pulse following 3-step test; 110.2±22.1 to 111.3±22.7 beats/minute) did not change significantly. GPA and daily step change were positively correlated (r=0.557, p=0.001), meaning that higher GPA was associated with increases (or maintenance of) daily steps. GPA and cardiovascular recovery were negatively associated (r=-0.400, p=0.001), meaning that higher GPA was associated with better CV recovery (i.e., lower pulse following step test).

Conclusions: These data indicate CV risk factors are prevalent among college students and have implications on academic success. Targeted CV disease education warranted in college students.
BACKGROUND

Weight Change

As freshmen come to college campuses, many factors in their lives change. Their environment is different; their workload is different, and they’re involved with different activities on campus; as well as their friend group sometimes being different. With so many changes occurring in their life, this often times has an impact on their health and contributes to undesirable weight change.

Weight gain over the course of one’s freshman year is so common that the term “Freshman 15” was even coined to describe many freshmen’s weight gain. However, freshmen do not really gain 15 pounds on average during their freshman year and gain actually around 3 pounds (1).

Physical Activity

There are several reasons why freshmen gain weight as they enter college, but one factor that comes into play is their decreased amount of exercise. As college students progress throughout their education, they become more sedentary and exercise less (2). If college students become more sedentary, this slows down their metabolism allowing for more weight gain. But sometimes there are many barriers that come up that prevent freshmen from vigorous physical activity. Some of the barriers include heavy school workload, lack of sleep, social invitations, and simply a lack of motivation, though some of the short-term benefits of vigorous physical activity are weight control and decreased depression (3). This means that students should really try to keep up with their physical activity because it can help with their physical and emotional status while in school.

Cardiovascular Disease

As college freshmen enter their first semester of college, most of them don’t perceive themselves to be at risk of cardiovascular disease (CVD) (4, 5, 6). Some of them might not perceive themselves to be at risk because knowledge of CVD is generally low in college students (7). Whatever the case, college students do have CVD risk factors. Amongst these risk factors are elevated total cholesterol levels and elevated systolic and diastolic blood pressure (BP) levels (8). Though these CVD risk factors are already present, there are certain CVD risk factors that change during one’s college career and those are an increase in weight (9, 10, 11) and an increase in fat (10, 11). With this knowledge, it is important to be educating students of their CVD risk.
HYPOTHESES AND RESEARCH QUESTIONS

Overall, we expected that students over the course of the first semester in college would decrease in their physical fitness capabilities and that this would affect their academic performance. To address this, we investigated two research questions.

1. What is the prevalence of CVD risk factors among first-semester college students?

Our hypothesis was that CVD risk factors are prevalent in first-semester college students and worsen throughout their first semester of college. Specifically, we expected that BP would increase, CV recovery pulse would increase, and daily steps would decrease.

2. What is the relationship between CVD risk factors and academic performance in first-semester college students?

Our hypothesis was that CVD risk factors and academic performance are related, meaning that if someone has less CVD risk factors that they would have better academic performance.
METHODS

Participants

Participants were first year students who were members of BGSU’s Health, Wellness, and You Academic Learning Community (see Table 1). Students in this community were participating in health-related assessments as a required part of their classes and had the opportunity to share their data for research purposes (BGSU Human Subjects Review Board Approval #936799).

Table 1. Participant Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>29 (43.9%)</td>
<td>37 (56.1%)</td>
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<tr>
<td>Age</td>
<td>18.4±0.5</td>
<td>18.3±0.5</td>
</tr>
<tr>
<td>BMI</td>
<td>25.1±5.3</td>
<td>25.8±6.8</td>
</tr>
<tr>
<td>GPA</td>
<td>3.3±0.8</td>
<td>3.2±0.7</td>
</tr>
</tbody>
</table>

BMI = body mass index. GPA = grade point average.

Overall Design

At the beginning of the semester, in the months of August/September, we obtained the freshmen’s blood pressure, daily steps, and cardiovascular fitness scores. We then obtained these values again at the end of the semester in the months of November/December. In addition, we obtained the grade point average (GPA) of each of the students at the end of the semester from the registrar (see Table 2).

Table 2. Assessments

<table>
<thead>
<tr>
<th>In Person Assessments (beginning and end of semester)</th>
<th>Other Assessment (end of semester)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td>Grade point average</td>
</tr>
<tr>
<td>Cardiovascular fitness</td>
<td></td>
</tr>
<tr>
<td>Daily Steps</td>
<td></td>
</tr>
</tbody>
</table>
Blood Pressure

Blood pressure was measured using an automated cuff (Omron 5 Series, Omron Corporation, Kyoto, Japan). Measurements were taken on the non-dominant arm with participants in seated position, legs uncrossed. Prior to this measurement, participants were rested in a seated position for a minimum of 5 minutes. The cut-off measurements that were used were from the American Heart Association (12). For the normal BP range, it is a systolic value of less than 120 and a diastolic value of less than 80. For the Prehypertension range, it is a systolic value of 120-139 and a diastolic value of 80-89. For the High BP (Hypertension) Stage 1 range, it is a systolic value of 140-159 and a diastolic value of 90-99. For the High BP (Hypertension) Stage 2 range, it is a systolic value of 160 or higher and a diastolic value of 100 or higher. Lastly, for the Hypertensive Crisis (emergency care needed) range, it is a systolic value of higher than 180 and a diastolic value of higher than 110. If systolic and diastolic BP values are in different risk ranges, the higher risk category is used for classification.

Figure 1. Blood pressure (BP) was measured using an automated cuff. Image from: http://hhpblog.s3.amazonaws.com/blog/wordpress/wp-content/uploads/2014/10/bigstock-Blood-pressure-29817749.jpg
Cardiovascular Fitness

To analyze their cardio-respiratory fitness, we assessed recovery pulse using the 3-minute step test (13). For this test, we will be using a 12-inch step, metronome, and a stopwatch. We first demonstrated the stepping movement with the cadence provided by the metronome so that each beat was only one movement of one foot. The metronome cadence selected was 96 beats per minute and each participant did this for a total of 3 minutes. Once the participant was done, they immediately stopped, sat down, and remained still. Within 5 seconds, the participant counted his/her heart rate for a minute by placing their index and middle finger on their radial or carotid artery and the heart rate they got was their score for the test.

YMCA norms, for young adults aged 18-25, were used for classifying recovery pulse. Excellent was defined as 52-81 for women and 50-76 for men. Good was defined as 85-93 for women and 79-84 for men. Above average was defined as 96-102 for women and 88-93 for men. Average was defined as 104-110 for women and 95-100 for men. Below average was defined as 113-120 for women and 102-107 for men. Poor was defined as 122-131 for women and 111-119 for men. Very Poor was defined was 135-169 for women and 124-157 for men.

Figure 2. Three-minute step test. Image from: http://tinyurl.com/mwhh9qk.
Daily Steps

Steps were measured using the 7-day average from a FitBit Flex (14). The value that we recorded was their total number of steps the last week. We converted this to daily steps by dividing by 7.

Academic Performance

Academic performance was assessed using first-semester GPA. This was obtained from the university registrar at the end of the semester.

Statistical Analysis

Paired samples t-tests were used to identify differences between baseline (August/September) and end of semester (November/December) values. Pearson correlation coefficients were used to identify associations between GPA and other variables. P-values <.05 were considered statistically significant. IBM SPSS Statistics (Armonk, NY) was used for analysis.
RESULTS

Blood Pressure

*Systolic Blood Pressure.* Mean systolic BP tended to increase from 124.3±14.1 (Aug/Sept) to 128.0±15.1 (Nov/Dec) mmHg (p=0.043).

*Diastolic Blood Pressure.* Mean diastolic BP remained stable: 78.8±10.8 (Aug/Sept) to 81.1±8.4 (Nov/Dec) mmHg (p=0.102).

*Blood Pressure Risk Categorization.* Over the course of the first semester of college, the prevalence of individuals with BP in the normal to prehypertensive ranges decreased, while the number of individuals with BP in the hypertensive range increased (see Figure 3).

![Blood Pressure Risk Categorization](chart.png)

**Figure 3.** The percentage of students in the pre-hypertensive or hypertensive range increased from 77.3% at the beginning of their first semester in college to 81.8% at the end.

Cardiovascular Fitness

Mean pulse after 3-minute step test remained stable: 110.2±22.1 (Aug/Sept) to 111.3±22.7 (Nov/Dec) mmHg (p=0.678), which falls in the average to below average range for women and the below average to poor range for men.
Daily Steps

Mean daily steps decreased from 10,398±3,391 (Aug/Sept) to 7,186±2,659 (Nov/Dec) mmHg (p<0.001). Over the course of the first semester of college, the prevalence individuals taking 10,000 or more step per day decreased (see Figure 4).

Figure 4. The percentage of students who achieved 10,000+ steps per day decreased from 53.4% at the beginning of their first semester in college to 11.1% at the end.
Academic Performance

GPA was positively correlated with change in step count (daily step $\Delta = \text{post} - \text{pre}; r=0.557, p=0.001$). Higher GPA was associated with increases in (or maintenance of) daily steps (see Figure 5). GPA was negatively correlated with CV fitness (recovery pulse $\Delta = \text{post} - \text{pre}; r=-0.400, p=0.001$). Higher GPA was associated with improvements in (or maintenance of) CV fitness.

**Figure 5.** GPA is positively correlated with daily steps.
DISCUSSION

These data suggest that CVD risk factors are present among college students and related to academic performance. Significant increases in CVD risk factors during the first semester of college indicate that targeted CVD education is needed and these strategies may impact academic performance.

Limitations of this study include:
- Better than expected performance due to learning testing protocol (e.g., high pulse on baseline step test could partially relate to completing an unfamiliar procedure)
- Small sample size
- Large proportion of students who did not wear their FitBit at follow up, or did not wear it all 7 days of the week
- People who conducted the tests varied so could lead to inaccurate results
- Dates that people were tested on varied
REFERENCES