



Short Communication

Differences in college students' aerobic physical activity and muscle-strengthening activities based on gender, race, and sexual orientation

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ABSTRACT

Aerobic physical activity and muscle-strengthening activities are beneficial to both physical and mental health, though disparities in these behaviors exist based on social determinants. The purpose of this study was to examine differences in college students' aerobic physical activity and muscle-strengthening activities based on gender, race, and sexual orientation. Undergraduates enrolled in general education health and wellness courses at a large northeastern University in the United States responded to an online survey in August 2018 that assessed their demographics and physical activity behaviors. Differences in physical activity behaviors based on social determinants were examined using independent-samples *t*-tests and chi-square tests for independence. Less than half (40.3%) of participants ($n = 606$) met both aerobic physical activity and muscle-strengthening recommendations. No differences were found in physical activity based on sexual orientation. However, significantly more non-Hispanic white participants met aerobic physical activity (74.4% vs. 63.8%) and muscle-strengthening recommendations (47.2% vs. 37.6%); and, men reported significantly greater vigorous physical activity ($p = .034$, $\eta^2 = 0.01$) and participation in muscle-strengthening activities ($p < .001$, $\eta^2 = 0.06$), and were more likely to meet muscle-strengthening recommendations compared to women (50.8% vs. 41.4%). Findings demonstrate disparities in physical activity based on race and sex, particularly with respect to muscle-strengthening activities. Findings are of concern given the importance of muscle-strengthening activities to both physical and mental health. Colleges should consider ways in which they can facilitate increased participation of racial/ethnic minorities and women in muscle-strengthening activities.

1. Introduction

Physical activity (PA) tends to be lower among women than men across the lifespan (Caspersen et al., 2000), and college is no exception (Grubbs and Carter, 2002; McArthur and Raedeke, 2009; Miller et al., 2005; Suminski et al., 2002; Dodd et al., 2010; El-Gilany et al., 2011; Nanakorn et al., 1999; Schmidt, 2012). Moreover, college women studying in the United States have been found to be less likely to participate in intramural sports (Kiger, 1996; Center for the Study of Student Life, 2016), use campus recreational facilities (Miller et al., 2008; Milton and Patton, 2011; Zizzi et al., 2004; Smith, 2011; Ryerson Students' Union, 2014), and lift weights (Suminski et al., 2002). Further to gender disparities, PA tends to follow a social gradient, with those more advantaged typically more regularly physically active, and less likely to experience adverse health outcomes associated with inactivity (Ball et al., 2015). With respect to non-binary gender identities, evidence suggests that those identifying as non-binary engage in less PA

(Jones et al., 2017). Similar to national data (CDC, n.d.), while findings are relatively mixed, evidence suggests that racial/ethnic minority college students are typically less active (Miller et al., 2005; Smith, 2011; Stanek et al., 2015). Finally, though there is no evidence in college students, findings indicate that non-heterosexual individuals may be less active than their heterosexual peers (Conron et al., 2010).

Benefits of muscle-strengthening include enhanced bone health, increased lean body mass, and improved muscular endurance (Haskell et al., 2007), as well as better mental health (Gordon et al., 2018). Yet, less than half of college-aged individuals meet muscle-strengthening recommendations, and participation declines with age (CDC, n.d.). Thus, college represents an ideal opportunity to promote PA and address disparities. It is a time when individuals can access a wealth of health promotion resources (Plotnikoff et al., 2015), and is influential in the adoption of an active lifestyle that may continue throughout life. The purpose of this study was to examine differences in college students' aerobic PA and muscle-strengthening activities based on gender,

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race, and sexual orientation.

2. Methods

2.1. Participants and procedures

This cross-sectional study took place at a large, northeastern United States university. Data were collected on health behaviors and demographics using an online survey (Qualtrics, Provo, UT). Undergraduates enrolled in general education health and wellness (e.g. physical activity, wellness) courses in August 2018 were recruited via direct email. Instructors encouraged participation, though participation was voluntary and did not impact grades. An informed consent statement was presented to students upon opening the survey. The Pennsylvania State University Institutional Review Board approved this study.

2.2. Measures

2.2.1. Demographics

Participants self-reported age, gender identity, race/ethnicity, sexual orientation, and student-athlete status.

2.2.2. Physical activity behaviors

The global PA questionnaire, a reliable and valid measure (Bull et al., 2009; Herrmann et al., 2013), assessed minutes/week of leisure time PA (Armstrong and Bull, 2006). Weekly moderate and vigorous PA were computed using PA frequency and duration. Muscle-strengthening activity participation was assessed by asking the weekly frequency and duration of participation in moderate or high intensity muscle-strengthening activities for at least 10 min continuously in a typical week. Participants were categorized based on whether they met national recommendations for aerobic and muscle-strengthening activities (2018 Physical Activity Guidelines Advisory Committee, 2018).

2.2.3. Statistical analyses

Gender, race, and sexual orientation were dichotomized. Participants identifying as non-binary were excluded from the sex variable; those not identifying as non-Hispanic white were condensed into an “other” group for race; and, those identifying as non-heterosexual were condensed into a group for sexual orientation. Differences PA behaviors based on sex, race, and sexual orientation were examined using independent samples *t*-tests. Chi-square tests for independence examined differences in meeting, or not meeting, aerobic or muscle-strengthening activity recommendations based on sex, race, and sexual orientation. All analyses were run using SPSS 25.0 (IBM, Armonk, NY), with significance levels set at $p < .05$. Effect sizes, or Eta-squared (η^2) were calculated using the formula ($t^2/(t^2 + (N-1))$).

3. Results

Seven hundred and forty-nine participants responded to the survey. Seven participants who did not respond to muscle-strengthening activity items were excluded from analyses, as were 52 that did not specify their gender identity. Finally, 84 participants who indicated they were club or varsity athletes were excluded. Analyses were conducted on the remaining 606 participants.

3.1. Participant characteristics

The mean age of participants was 20.35 ± 1.49 years. Participant characteristics are displayed in Table 1. The majority of the sample identified as women, non-Hispanic white, and heterosexual.

3.2. Physical activity recommendations

Among all participants, 71.0% met aerobic PA recommendations,

Table 1
Participant characteristics.

	n	%
Gender identity		
Men	191	31.5
Women	409	67.5
Non-binary	6	0.9
Race		
Non-Hispanic White	417	69.2
Non-Hispanic Asian American	57	9.5
Non-Hispanic Other Race	44	7.3
Hispanic or Latino	43	7.1
Non-Hispanic Black or African American	23	3.8
Non-Hispanic Mixed Race	18	3
Non-Hispanic Pacific Islander	1	0.2
Sexual orientation		
Straight (heterosexual)	546	90.8
Non-heterosexual	55	9.2

whereas 44.4% met muscle-strengthening recommendations, and 40.3% met both aerobic and muscle-strengthening activity recommendations.

3.3. Physical activity differences

Analyses revealed no statistically significant differences in minutes per week of moderate PA, vigorous PA, or muscle-strengthening activities between those identifying as non-Hispanic white and other ethnicities, nor those identifying as straight (heterosexual) and non-heterosexual. However, while moderate PA did not differ significantly between men and women, men reported significantly greater vigorous PA and muscle-strengthening activity compared to women (Table 2).

3.4. Physical activity recommendation differences

While no differences in meeting PA recommendations were found based on sexual orientation, significant differences emerged in relation to race and sex. With respect to race, significantly more non-Hispanic white students met aerobic PA recommendations (74.4%vs.63.8%), $\chi^2(1, n = 580) = 6.23, p = .013, \phi = -0.108$; and, muscle-strengthening recommendations (47.2%vs.37.6%), $\chi^2(1, n = 603) = 4.43, p = .035, \phi = -0.089$. As far as sex, no differences were found in relation to aerobic PA recommendations ($p = .503$), but significantly less women met muscle-strengthening recommendations (41.4%vs.50.8%), $\chi^2(1, n = 606) = 4.37, p = .037, \phi = -0.088$.

4. Conclusions

Consistent with the literature, women in this study reported significantly lower vigorous aerobic (Grubbs and Carter, 2002; McArthur and Raedeke, 2009; Miller et al., 2005; Suminski et al., 2002), as well as muscle-strengthening activity (Suminski et al., 2002; CDC, n.d.). Furthermore, less women reported meeting muscle-strengthening

Table 2
Sex differences in physical activity.

	Men		Women		p	η^2
	M	SD	M	SD		
Moderate physical activity (min/week)	209.52	226.27	195.38	221.13	0.472	0
Vigorous physical activity (min/week)	150.71	168.80	121.17	132.12	0.034	0.01
Muscle-strengthening (min/week)	129.74	170.15	50.69	80.71	< 0.001	0.06

recommendations. Findings also revealed racial/ethnic disparities exist with respect to meeting aerobic and muscle-strengthening recommendations. These findings are concerning given the importance of muscle-strengthening activities to both physical and mental health.

A major limitation was the recruitment of students enrolled in general health and wellness courses at one institution as potential self-selection bias, limiting the generalizability of findings to students in the general population or at other institutions. Despite this being a major limitation, it also arguably makes the findings even more concerning, given disparities are potentially greater among the general student population.

Future researchers should recruit larger, more diverse samples to enable analyses of differences between more than two groups with respect to race/ethnicity and sexual orientation, as a relatively small sample size prevented such analyses in this study. Examination of differences between men, women, and non-binary gender identities is also warranted, as are differences between religions (Koenig and Shohaib, 2014). A more comprehensive investigation of how PA behaviors differ based on individual and intersecting social determinants should allow for addressing issues of equity by determining whether programs and facilities are truly inclusive of all students regardless of background.

Future researchers may also want to consider using more objective measures of PA, as well as examining why muscle-strengthening activity participation differs between men and women so as to inform interventions and/or policy changes to increase the participation of women in muscle-strengthening and reduce disparities.

Declaration of competing interest

The authors declare no conflicts of interest and do not have any financial disclosures.

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