



Associations between physical activity and perceived stress/hassles in college students

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Summary

Physical activity is often recommended as a strategy for managing stress. Although associations among physical activity, stress, and hassles have been documented among adults and children, they have not been studied extensively in college populations. This cross-sectional study employed an ethnically diverse sample of 814 male and female students from three types of colleges in southern California to examine the relationship between physical activity and two indices of stress. Anonymous paper-and-pencil questionnaires were used to assess a number of psychosocial and behavioral constructs, including perceived stress, hassles, and leisure time physical activity. Significant gender, ethnic and college differences were found in levels of physical activity, perceived stress, and hassles. Hierarchical linear models showed a significant negative relationship between physical activity and hassles. Considering the deleterious effects of stress and sedentary behavior on health, these results have implications for lifetime physical and mental health. Thus, health promotion programs for college students may benefit from incorporation of physical activity strategies to reduce stress. Copyright © 2006 John Wiley & Sons, Ltd.

Key Words

physical activity; perceived stress; hassles; multi-level regression; college students

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Introduction

The transition from childhood to young adulthood, often marked by beginning college, may be a particularly stressful time (McNamara, 2000). In fact, one study that assessed the cardiovascular health needs of college students found that nearly 60 per cent of the students rated their stress levels as high or very high (Makrides, Veinot, Richard, McKee, & Gallivan, 1998). Campbell, Svenson, and Jarvis (1992) found that undergraduate women whom were asked how they perceived their stress level, reported experiencing unacceptable levels of stress. The literature also shows that college students report using ineffective stress management techniques (Lawrence

& Schank, 1993). One study found that some students considered their methods of dealing with stress to be a 'serious problem' (Page, 1987).

Research has shown that physical activity is an effective means of reducing anxiety and various indices of stress among adults (Bhui, 2002; Dunn, Trivedi, & O'Neal, 2001). However, only a few studies have addressed this issue among college populations. In a sample of undergraduates at a private university, Brown (1991) found that self-reports of physical activity as well as objective measures of fitness both buffered the effects of stress (as measured by life events) on health (assessed by reports of illness). However, when considering visits to a health center, only objective measures of fitness showed this effect. It has also been shown that sports participation may be protective for mental health, where it was found that college athletes reported less perceived stress and psychological symptoms than non-athletes (Skirka, 2000). In a study comparing leisure time physical activity versus aerobic fitness, it was found that leisure time physical activity was sufficient to buffer the deleterious effects of hassles in a sample of undergraduate psychology and kinesiology students (Carmack, Boudreaux, Amaral-Melendez, Brantley, & de Moor, 1999).

Given the potential for elevated levels of perceived stress and hassles in college populations and the potential for physical activity to attenuate resulting negative effects, additional research with college students would add to the generalizability of the association of physical activity with perceived stress and hassles as well as bring to light other issues that may need consideration. Comprehensive reports also show that college type, often associated with socio-economic status (SES), is related to vast arrays of health behaviors. Therefore, the study of this relationship in samples that include students from private, public, and community colleges would also seem warranted.

While physical activity might help college students to deal more effectively with perceived stress and hassles, available literature suggests that college students and other young adults are generally not meeting recommendations for physical activity. The 1995 National College Health Risk Survey (CDC, 1997) revealed that fewer than one fifth of college students engaged in recommended amounts of moderate physical activity, and less than 40 per cent in vigorous physical activity. The rates of moderate activity are much

lower than the 36 per cent of employed adults, ages 18–24 years old, who reported engaging in this level of activity (CDC, 2000). Irwin's (2004) review of physical activity revealed that over half of American and Canadian students were not engaging in sufficient physical activity to be beneficial to health, with similar international results.

Other more recent smaller scale studies also show that college students are still relatively inactive and many are not meeting daily recommendations. A study that assessed changes in physical activity in the transition from home to college in female freshman found decreases in physical activity and fitness (Butler, Black, Blue, & Gretebeck, 2004). Huang *et al.* (2003) reported that, on average, students exercised (aerobic exercise and strength training) less than 3 days in one week. Additional studies have shown large proportions of inactivity as well, for example, almost 30 per cent of freshman reported not exercising in a study of weight, exercise and dietary patterns in college students (Racette, Deusinger, Strube, Highstein, & Deusinger, 2004). Studying is a very time consuming part of student life; in one study, nearly half of the approximately 30 h of sedentary activity were spent studying.

A health needs assessment showed that students were interested in receiving information about physical activity and stress management (Katz, Davis, & Findlay, 2002). Further, Campbell *et al.* (1992) found that women reported the need to increase activity levels in order to reduce their perceived levels of stress. In another study, students with more knowledge about cardiovascular disease also engaged in more physical activity (Makrides *et al.*, 1998).

As part of a cross-sectional study of college health, the associations of physical activity to perceived stress and to hassles were studied in college students from a private university, a state university, and a community college in southern California. It was hypothesized that the relationships between leisure time physical activity and perceived stress and between physical activity and hassles would generalize to an ethnically diverse college population. Gender, ethnicity, and college type are included in the model, as the literature shows that these factors are associated with measures of stress and physical activity. Men were expected to engage in more physical activity (CDC, 1997) and be less stressed (Campbell *et al.*, 1992) than women. It was also predicted that Whites (CDC, 2000; Perez-Stable, Marin, &

Marin, 1994) would be more active, and experience less stress, considering the differing experiences of minority groups, including acculturative stress (Chavez, Moran, Reid, & Lopez, 1997) and discrimination (Williams, 1999; Williams, Spencer, & Jackson, 1999). The study was conducted in three types of colleges because it has been shown that particular health behaviors vary by type of college (CDC, 1997; Wechsler, Rigotti, Gledhill-Hoyt, & Lee, 1998), including levels of physical activity. Based on this data, it was anticipated that community college students would be the least active (CDC, 1997).

Materials and methods

Sample

Participants were 814 college students from three southern California colleges (post-secondary educational institutions). Students were predominantly first and second year students from diverse ethnic backgrounds. These participants were asked to complete a survey that assessed various health behaviors, such as physical activity, and associated psychosocial constructs, including perceived stress and hassles. The questionnaire also contained items used to obtain demographic information, including gender, age, and ethnicity.

Three different types of colleges were recruited to take part in this study, a private 4 year institution, a public 4 year institution, and a community college. Colleges were approached through the student health offices.

Student recruitment and procedures

Of the three colleges, two preferred that a mail-out survey method was employed and thus the investigators were provided with address labels for a random sample of 2000 freshman and sophomores. A paper-and-pencil questionnaire was mailed to this random sample of 4000 students along with a consent document, a postage paid return envelope, and one dollar as incentive to return the questionnaires. Approximately 30 min were required to complete the questionnaire. There was a 13.4 per cent response rate for the private university ($n = 268$) and a 17.2 per cent response rate for the community college ($n = 345$). This resulted in a 15.3 per cent return rate

for the mail out survey. These numbers are comparable to return rates on annual university health center mail-out survey response rates of these two colleges.

The third university preferred that recruitment was made through classes. Professors of required general education courses were approached to allow data collection in class. General education courses are those that are required to be taken by all students, therefore are believed to be representative of the undergraduate population. Trained data collectors, not previously acquainted with these students, distributed the questionnaires in the classroom and supervised questionnaire completion and collection. Questionnaires with return envelopes were provided for absent students and those who did not finish in class. Data were collected in two classes; a total of 261 students in those classes were invited to participate, with a classroom response rate of 77 per cent. Consent procedures, as well as the research itself, were approved by the University of Southern California Institutional Review Board (IRB) as well as by the IRBs of the three participating institutions.

Measures

Physical activity. Physical activity was assessed by a total weekly leisure activity score developed and validated by Godin and Shephard (1985). This score is comprised of three items that inquire about the number of times mild (e.g. easy walking), moderate (e.g. easy bicycling), and strenuous (e.g. running) activity is engaged in in a given week during 'free time.' Number of times this type of activity is engaged in per week is multiplied by three, five, and nine metabolic equivalents (METs), respectively. MET is defined as the intensity of a particular activity, derived from the ratio of work metabolic rate to a standard resting metabolic rate (Ainsworth et al., 2000). The sum of these products is computed to obtain the total leisure time activity score.

Perceived stress. The environmental stress subscale of the Graduate Stress Inventory (Rocha-Singh, 1994) was used to measure perceived stress, which taps global perception of situations. This measure was developed and validated extensively with graduate student populations (Rocha-Singh, 1994). These items also appear in the 21-item College Stress Inventory (Solberg, Hale,

Villarreal, & Kavanagh, 1993), which was developed from the Graduate Stress Inventory in order to be used with Latino undergraduate populations. Due to constraints of space and time and the expectation that a very heterogeneous sample was going to be obtained for the present study (not just Latinos), the College Stress Inventory was not used. The presence of these items in the College Stress Inventory offers validation of the use of this subscale in undergraduate populations.

The modified Graduate Stress Inventory was made up of eight items, which asked subjects to report how much they have worried about particular issues related to campus environment and social interactions in the last year. These items touched on issues such as 'lack of same race partners on campus' and 'faculty treating you differently than your peers.' Students were asked to rate each item as a 'big worry,' 'medium worry,' 'sometimes a worry' and 'no worry at all.' Perceived stress scores were computed by taking the mean score of these items. Higher scores indicate higher levels of perceived stress (Cronbach's alpha = 0.83).

Hassles. Hassles were measured via the Brief College Student Hassle Scale for which good validity and reliability has been established (Blankstein, Flett, & Koledin, 1991). This scale includes 26 items about hassles experienced in the last month. Examples of these items include 'contact with partner,' 'financial security,' 'academic bureaucracy,' 'preparing meals,' and 'family expectations.' Participants rated items with the following terms: 'Big hassle,' 'medium hassle,' 'not usually a hassle,' and 'no hassle at all.' The mean score of these items was used as the hassles score. Higher scores indicate the experience of more hassles (Cronbach's alpha = 0.87).

Age. This was measured by self-reported age in whole years.

Ethnic categorization. Ethnicity was based on self-report of ethnic background by an item that asked, 'How do you usually describe yourself' followed by an extensive list of 31 possible ethnicities. The checklist of ethnic groups represented the ethnic identity labels most frequently reported in previous studies of Los Angeles adolescents (Unger *et al.*, 2004). Students were instructed to mark all ethnicities that they felt applied to them. Most students marked only one ethnicity (87.2 per cent). Those who chose two or more ethnicities

were categorized as 'multi-ethnic.' Because several of the groups had small sample sizes, overall sample was then recoded into four groups: White, Hispanic/Latino, Asian, and other/multi-ethnic.

Parents' education level. A proxy measure of SES was created from two variables, father's and mother's level of education. Education level has been used as a measure of SES in previous studies and has been found to be associated with health outcomes throughout the life span (Bradley & Corwyn, 2002). Further, use of student income may not be an appropriate measure since incomes may include loans and financial assistance from parents. The mean of two variables was taken to obtain our measure of parent education level. Respondents were asked what the highest grade or year of school their mother and father completed, which were answered on a scale from 1–7, where 1 = less than eighth grade, and 7 = advanced degree (Cronbach's alpha = 0.79).

Data analysis

Demographic characteristics of the three college samples. All data analyses were performed using SAS v8.2 (SAS Institute). Means and frequencies were obtained to report demographic characteristics, including age, gender, ethnicity, and parents' education as well as sample physical activity, perceived stress, and hassles scores for each school type.

Demographic correlates of physical activity, perceived stress, and hassles. The demographic variables that were significantly associated with physical activity, perceived stress, and/or hassles were included in multilevel models to determine the unique sources of variation in those scales, using SAS PROC MIXED (Singer, 1998). Because the data contained a nested structure, students (level one) nested within colleges (level two), college was included in the model as a random effect. Age, gender, ethnicity, and parents' education were included as fixed effects.

Associations between physical activity and levels of perceived stress and hassles. To test the hypothesis that physical activity is associated with lower levels of perceived stress and hassles, additional multilevel models were evaluated. The

predictor variables were the fixed main effect of physical activity, the demographic covariates, and the random effect of college. Covariates were included in the model if they had been found to be significantly associated with perceived stress, hassles, and/or physical activity in the analyses described earlier. The model was run twice: once with perceived stress as the dependent variable and once with hassles as the dependent variable. Interaction terms were added to the model, after the main effects, to determine whether the effect of physical activity varied according to age, gender, ethnicity, parents' education, or college. All categorical variables were recoded into dummy variables for inclusion in model analyses (Pagano & Gauvreau, 2000).

Results

Of the 814 college students who participated in the survey, 716 (88 per cent) provided complete data on all variables in this analysis. The proportion of students who provided complete data did not vary significantly across age, gender, ethnic groups, or parents' educational level. Compared with the students with missing data, the students who provided complete data reported higher levels of physical activity ($t = 2.69$, $p <$

0.05), but did not differ on perceived stress or hassles. The 716 students with complete data included in the analyses are described below.

Table I shows the demographic characteristics of the respondents from the three colleges. The mean age of the respondents was 22.4 years (standard deviation, SD = 7.3 years). Mean age differed significantly across colleges, with the community college having the highest mean age (26.1 years) and the state university having the lowest mean age (19.5 years). The sample was 70 per cent female and 30 per cent male. The gender distribution did not vary significantly across colleges. The sample was 43 per cent White, 17 per cent Asian-American, 13 per cent Hispanic/Latino, and 26 per cent other ethnicities. The ethnic distribution differed significantly across the colleges, with a higher proportion of Asian-Americans in the private university, a higher proportion of Whites in the community college, and a higher proportion of Hispanic/Latinos in the state university. Parents' education was highest in the private university (69 per cent college graduates or above) and lowest in the community college (50 per cent college graduates or above). Physical activity, perceived stress, and hassles also differed significantly across the three colleges, as shown in Table I. Students in the private university sample reported the highest levels of physical

Table I. Demographic characteristics of respondents.

	Private university ($n = 245$)		Community college ($n = 303$)		State university ($n = 168$)	
Age ^a	20.0	(3.6)	26.1	(9.4)	19.5	(2.7)
Gender ^b						
Female	169	69%	205	68%	126	75%
Male	76	31%	98	32%	42	25%
Ethnicity ^b						
Asian-American	50	20%	48	16%	25	15%
Hispanic/Latino	25	10%	33	11%	37	22%
Other/multi	74	30%	63	21%	51	30%
White	96	39%	159	52%	55	33%
Parents' education ^b						
High school or less	25	10%	72	24%	42	25%
Some college	52	21%	77	25%	34	20%
College graduate	75	31%	95	31%	60	36%
Advanced degree	93	38%	59	19%	19	19%
Physical activity score ^a	40.04	(38.16)	32.86	(28.37)	37.27	(24.30)
Perceived stress score ^a	1.65	(0.52)	1.41	(0.50)	1.64	(0.57)
Hassles score ^a	2.18	(0.43)	2.08	(0.51)	2.22	(0.49)

^aMean values are shown with SDs shown in parentheses.

^bNumber of students (n) are shown together with percentage value.

activity, and students in the community college sample reported the lowest. Perceived stress and hassles scores were significantly lower among the community college students than among the students in the private university and state university.

Table II shows the demographic correlates of physical activity, perceived stress, and hassles. All standardized betas (which represent the change in the dependent variable that would be expected from a one standard deviation change in the independent variable) shown in Table II are fixed effects and are adjusted for the random effect of college. Perceived stress and hassles were both associated inversely with age. Physical activity scores were higher among men than among women. Relative to Whites, Asian-Americans reported higher levels of perceived stress and hassles, and lower levels of physical activity. Relative to Whites, Hispanic/Latinos reported higher levels of perceived stress and lower levels of

physical activity. Students of 'other' ethnic groups reported higher levels of perceived stress and hassles relative to Whites. Higher parents' education was associated with lower levels of perceived stress and hassles, and higher levels of physical activity.

The results of the multilevel regression models of physical activity as a correlate of perceived stress and hassles are shown in Table III. After controlling for the demographic covariates and for the random effect of college, higher levels of physical activity were associated significantly with lower levels of hassles. The association between physical activity and perceived stress was similar in magnitude (with a standardized beta of -0.055 compared with -0.085 for hassles), however this comparison only approached, but did not reach statistical significance ($p = 0.1201$). Other variables significantly associated with lower levels of perceived stress and hassles were age, non-White ethnicity, and lower parents' edu-

Table II. Demographic variation in perceived stress, hassles, and physical activity.

	Perceived stress		Hassles		Physical activity	
	Standardized beta	<i>p</i> -Value	Standardized beta	<i>p</i> -Value	Standardized beta	<i>p</i> -Value
Age	-0.176	0.0001	-0.138	0.0003	-0.040	0.3058
Female	-0.003	0.9154	0.062	0.091	-0.125	0.0006
Ethnicity ^a						
Asian	0.325	0.0001	0.142	0.0004	-0.134	0.0008
Hispanic/Latino	0.127	0.0001	0.032	0.4249	-0.115	0.0042
Other/multi	0.166	0.0001	0.109	0.0066	-0.069	0.0835
Parents' education	-0.139	0.0002	-0.100	0.0121	0.142	0.0003

Note: All parameter estimates (standardized betas) are adjusted for the random effect of college.

^a Effects of non-White ethnicity.

Table III. Associations between physical activity and perceived stress/hassles.

	Stress		Hassles	
	Standardized beta	<i>p</i> -Value	Standardized beta	<i>p</i> -Value
<i>Main effects</i>				
Age	-0.178	0.0001	-0.139	0.0004
Female	-0.011	0.7585	0.051	0.1658
Ethnicity ^a				
Asian	0.318	0.0001	0.130	0.0014
Hispanic/Latino	0.120	0.0016	0.021	0.5967
Other/multi	0.162	0.0001	0.102	0.0110
Parents' education	-0.132	0.0004	-0.087	0.0277
Physical activity	-0.055	0.1201	-0.085	0.0257

Note: All parameter estimates (standardized betas) are adjusted for the random effect of college.

^a Effects of non-White ethnicity.

cation (but not for the relationship between Hispanic/Latino participants and hassles).

Interaction terms were entered into the models after the main effects to determine whether the effects of physical activity were consistent across demographic groups. None of the interaction terms were significant predictors of perceived stress, indicating that the association between physical activity and perceived stress was consistent across demographic groups. The significant interaction of other ethnicity \times physical activity in the hassles model indicates that the protective effect of physical activity was stronger among other ethnic groups than among Whites. There were no significant differences across colleges in the strength of the association between physical activity and hassles.

Discussion

In this study, a modest association between physical activity and hassles, and no significant association with perceived stress were found. Although, the literature has shown relationships between physical activity and measures of stress, the strength of the findings in this study may not powerfully support this. In comparison to previous studies that used regression analyses, the beta estimates are about the same (Brown, 1991) and lower (Carmack et al., 1999).

Stress is a multifaceted construct and is affected by a large number of factors. Thus the relationship between physical activity and stress was studied in order to try to find out if physical activity could be a viable means of reducing stress. A significant relationship was found, but based on the beta estimates, physical activity may not produce a very large change in stress (if it is the case that this is the direction of association). The findings may be attributable to a number of factors, such as the influence of covariates in the model and measurement error.

For example, significant associations were found between ethnicity and parents' education to both perceived stress and hassles. The variance explained by these two factors may have parceled out some of the variance often attributed to stress. Acculturative stress may be an underlying mechanism operating in this association for these minority groups. The stress of meeting financial responsibilities may be accounted for in the relationships between parents' education and the measures of stress. The instruments also may not

have captured global measures of the constructs of interest, but only a portion of them. Thus, it may be possible that physical activity may have more influence on other components of stress than the ones assessed in this study. It could also be that leisure time physical activity has less of an influence on these measures of stress than would overall physical activity. Another possibility is that the scales used did not completely or accurately measure the constructs (discussed in more detail later).

An interesting finding of this study is that ethnic variation was found in the variables of interest. Although the aim of this study was not to assess ethnic differences in these constructs, the findings support previous literature. With respect to the association in question, ethnic variation was not found in these relationships, as evidenced by non-significant interactions. Ethnic variation in emotional expression is another issue that should be considered in the study of stress. Much research shows that there are definite differences in the way that emotions are expressed in different cultures (Parker, Gladstone, & Chee, 2001), therefore this study may not have fully captured levels of hassles or perceived stress. Although very specific ethnicity data was collected, these data were not used to their fullest extent because of the small numbers of participants in these subgroups. This disallowed more in-depth assessment of variability across more specific ethnic groups (e.g. Mexican-Americans within Latinos, Vietnamese-Americans within Asians, etc.). Variations in perceived stress, hassles, and physical activity across ethnic groups, gender, and colleges were found and thus support the inclusion of these variables as covariates in analyses.

The findings are of course affected by some limitations. The variation in data collection methods and resulting differential response rates affects the generalizability of results, and consideration of how this may have had an effect on comparisons made among the college types is important as well. The results of this study are generalizable to those college students who were willing and motivated to complete surveys on college health and answer questions about physical activity, hassles, and perceived stress. As is the case with virtually all studies, further research is needed to determine whether the results generalize to the entire undergraduate college population. The validity of self-reported data may also be a concern. However, the anonymity of the study may have helped to reduce this bias.

The measure of physical activity employed only assessed leisure time physical activity. This may not be an accurate depiction of total physically active behavior. Although many college students spend a good proportion of their time engaging in sedentary behavior (e.g. studying, sitting in class), many hold part-time jobs which may provide opportunities for physical activity. Student athletes are another group whose physical activity may not have been fully captured if these respondents did not consider these activities to be done in their 'free time.' Lastly, the wording of these items precludes the ability to assess whether or not students reported physical activity that was engaged in as a means of transportation (e.g. walking, skateboarding) in their responses. These other types of physical activity—occupational activity, participation in team sports, and transportation—may vary across college types, as well, depending on the students' economic self-sufficiency, their amount of free time, and the distance between their homes and the college campus. Additional studies to create and validate measures that fully capture all of these diverse forms of physical activity among college students seem warranted.

The original measure of perceived stress was developed and validated with graduate students. However, the items from the subscale employed in this study are included in the College Stress Inventory which was validated with undergraduate populations. Therefore, there is little reason to believe that this measure did not accurately capture the level of environmental perceived stress in this population. Nonetheless, the validity of the use of this subscale with undergraduate college students should be further evaluated in studies.

Another issue encountered in this study was the use of parental education level as a proxy measure of SES. Although both college and parents' education are proxy measures, and differences in parents' education level was found by college, these are certainly not perfect measures. The limitations of this indicator is more pronounced considering that the sample came from a college population in which parent's financial situation may no longer be an accurate reflection of these older students' SES. Assessing SES among college students is difficult. Some students receive financial support from their parents (and therefore may have low personal income), whereas others support themselves with part-time or full-time jobs (and therefore may have higher per-

sonal income, but less disposable spending money). Still other students receive scholarships, financial aid, or student loans, which may partially compensate for their lower pre-college SES. The development of valid measures of SES among college students, taking into account the SES of their families of origin, various sources of income and tuition assistance, and their disposable spending money is crucial for accurate assessment of SES in this population.

The cross-sectional design of this study did not allow for exploration of causality. It is hypothesized that the association between physical activity and stress/hassles would indicate that physical activity is a viable means of reducing stress, but it is quite reasonable to believe that the perception or experience of stress discourages participation in physically active behavior. For example, a heavy stress load may make people too tired to engage in physical activity or may not allow them time to do so (Thayer, 2001). Longitudinal studies are necessary to further explore the directionality of this association.

The findings provide moderate support for the relationship between physical activity and measures of stress found in other studies (Carmack *et al.*, 1999; Skirka, 2000), and therefore may be able to conclude that previous findings may generalize to a diverse college population. Despite the small estimate of association that resulted from analyses, the fact that there was still a significant relationship found after controlling for other important factors holds some merit, considering that the effects of these other variables plausibly have more influence on stress than physical activity. The effects of SES on physical activity and stress, among other health issues, have been studied elsewhere (Adler *et al.*, 1994), but are important issues for future research in order to better understand how SES impacts the relationship between these constructs.

Levels of mental health problems, such as anxiety and depression, both closely related to stress, have risen substantially in youth during the past few decades (Twenge, 2000). Stress and sedentary behavior have become major public health threats among college students, putting them at risk for a host of immediate and future health problems. Innovative and effective strategies are needed to reduce these major health risks. Much of the variance in perceived stress and hassles remains unexplained and additional studies are needed to address this. The potential for physical activity to reduce distress in college

students warrants further investigation, considering the benefits of ameliorating health problems related to both physical and mental health throughout the lifespan.

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