The Effect of Physical Activity on the Stress Management, Interpersonal Relationships, and Alcohol Consumption of College Freshmen

Simone Wilson-Salandy and Mary A. Nies

Abstract
The aim of this study was to assess the changes of health behaviors in college students as they transition through their freshman year. The author surveyed 167 freshmen, ages 18 to 25, to examine the effects of physical activity on the stress management, interpersonal relationships, and alcohol consumption in college freshmen. The participant’s responses were at baseline to 3-month outcome and 3-month to 6-month outcome. The Health-Promoting Lifestyle Profile-II questionnaire and the Daily Drinking Questionnaire examined the health behaviors and drinking consumption. Students with moderate physical activity had nearly half the odds of better stress management as compared with students with higher physical activity. However, this result was not statistically significant, OR = 0.49, 95% CI = [0.24, 1.01], and OR = 0.52, 95% CI = [0.25, 1.29]. Few studies have evaluated physical activity and the health behaviors of stress management, interpersonal relationships, and alcohol consumption in college students. This study can provide further understanding of health promotion behaviors in college students.

Keywords
physical activity, college students, health promotion

Physical Activity and College Students
Researchers have documented the benefits of regular physical activity for a healthy life. Regular physical activity reduces the risk of hypertension, heart disease, diabetes, and some cancers (Allender, Hutchinson, & Foster, 2008). Engaging in regular physical activity improves psychosocial health and decreases stress (Economos, Hildebrant, & Hyatt, 2008). This is particularly important for college freshman, who are at increased risk of developing unhealthy behaviors with the transition into a new environment. Common stressors that create unhealthy behaviors and physical inactivity for college students include chronic illnesses, academic load, social life, campus residence, and family events (Economos et al., 2008). College students between the ages of 18 and 25 have the lowest amount of regular physical activity compared with other adults. On average, they engage in less than the recommended daily 30 min of moderate to vigorous exercise (Centers for Disease Control and Prevention, 2010). One study that evaluated changes in the physical activity of female freshman found that in the transition from home to college, physical activity levels decreased (Butler, 2004). This is alarming particularly because research has shown that students develop their health behaviors in college. These health behaviors then become well established and are extended for long periods after graduation (Laska, Larson, Neumark-Sztainer, & Story, 2010). Freshmen college students who live on campus are often negatively affected by their new independence. They are left to make their own physical activity choices and their practice of regular exercise may be circumvented by the distractions of college life. Physical activity is also affected by many other factors, including race and ethnicity. Research has shown that race and ethnicity are highly correlated with physical activity intentions. One study of physical activity intentions of college students evaluated 238 African American students and 197 Caucasian American students (Blanchard et al., 2008; McArthur & Raedeke, 2009). This study found that the African American students exercised significantly less than their Caucasian American counterparts.

Physical Activity and Stress Management of College Students
Stress may directly affect health behaviors (Nguyen-Michel, Unger, Hamilton, & Spruijt-Metz, 2006). Stress occurs when

1Northrop Grumman, Falls Church, VA, USA
2University of North Carolina at Charlotte, USA

Corresponding Author:
Simone Wilson-Salandy, University of North Carolina, 9201 University City Blvd., Charlotte, 28223, USA
Email: swils123@uncc.edu
persons view a situation, demand, or challenge as exceeding their available coping resources (Nguyen-Michel et al., 2006). College students are vulnerable to several stress factors, including academic and social pressures and along with the challenges of being in a new environment. A recent study that assessed 145 college students found that those with high levels of stress had poorer eating habits and were less physically active (Hudd et al., 2000). This study also found that females and student athletes were more likely than males who were not athletes to practice healthy behaviors, such as a regular daily exercise regimen (Hudd et al., 2000). The authors explain that gender differences and stress have been well documented in previous literature, and students with higher levels of stress perceive themselves as less healthy and have lower self-esteem. All of this contributes to poorer health habits (Hudd et al., 2000). One study that evaluated a diverse sample of 841 students found that males and females who engaged in regular physical activity had lower levels of stress at all ages (Ah, Ngamvitroj, Park, & Kang, 2004). Another study that assessed 232 college students found that those who were physically active were less likely to be stressed and also had better problem solving and coping skills (Largo-Wight, Peterson, & Chen, 2005). Previous research has shown that high stress levels in college are also associated with depression, anxiety, and less overall life satisfaction (Weinstein & Laverghetta, 2009). A study of 188 male and 193 female undergraduate students found that those who engaged frequently were less likely to be depressed and also exhibited higher self-esteem (Ryan, 2008). Enhanced interpersonal relationships have been associated with healthier lifestyles. In particular, the risk of many chronic illnesses is much lower for individuals who have good interpersonal relationships and social support (Viswanath & Bond, 2007). These individuals have exhibited better health behaviors (Viswanath & Bond, 2007). The social environment and ability to maintain meaningful interactions with others are often correlated with leading healthy lifestyles (Uchino, 2004; Viswanath & Bond, 2007). There is limited literature available on the association of interpersonal relationships and physical activity in college. Previous research has largely focused on social support and social connectedness and physical activity (Aanes, Mittlemark, & Hetland, 2010). A recent study of 3,268 individuals found that health outcomes were affected by interpersonal relationships and physical activity (Aanes et al., 2010). The authors hypothesized that an individual’s health outcomes are intertwined with their stress levels and social environments. The study also found that individuals with lower levels of stress experienced stronger social connectedness and increased physical activity (Aanes et al., 2010).

**Physical Activity and Alcohol Consumption of College**

Alcohol consumption among college students is frequent; however, the misuse or abuse of alcohol can lead to many adverse health outcomes (Hingson, Heeren, Zakocs, & Kopstein, 2002). The high rate of alcohol consumption in college students has continued to increase and is now a critical public health concern (Demantini, 2009; Hingson et al., 2002; U.S. Department of Health and Human Services, 2007). In particular, binge drinking among college students is at an all-time high: 66% of college students engage in alcohol use; 44% of these students binge drink with binge drinking defined as a pattern of drinking alcohol that brings the blood alcohol concentration to 0.08 or above (Beets, Flay, Vuchinich, Acoc, & Snyder, 2009; Kuntsche, Knibble, Gmel, & Engels, 2005; The National Institute of Alcohol and Alcoholism [NIAAA], 2002). Excessive alcohol use can result in many unintended consequences, including academic failure, car accidents, injuries, pregnancies, and suicide attempts (Grzywacz, Almeida, Neupert, & Ettner, 2004; Johnson & Werch, 2008; Nelson, Lust, Story, & Ehlinger, 2008). Previous studies have focused largely on the socioeconomic status of college students and their health status in relation to alcohol use (Lloyd-Richardson, Luceroa, DiBelloa, Jacobsona, & Wing, 2008). There is limited information on the role of college students’ physical activity in relation to their drinking (Musselman & Rutledge, 2010; Weinstock, 2010). The studies that have assessed the relationship of physical activity to alcohol consumption in college students have found a positive relationship. One study, which evaluated the drinking behaviors of undergraduate freshmen, found that the students who exercised frequently consumed higher amounts of alcohol (Correia, Carey, Simons, & Borsari, 2003). The authors suggest that the positive association between physical activity and alcohol consumption may have been due to students who are selecting environments and activities that are compatible with substance use (Pender, 1975).

**Conceptual Model**

The conceptual model that guided this study was the health promotion model (HPM) developed by Pender (1975). The HPM defines health as a positive dynamic state, not merely the absence of disease. Health promotion is directed at increasing an individual’s level of well-being. The HPM describes the multidimensional nature of people as they interact within their environment to pursue health (Pender, 1975; Wu & Pender, 2002). The model focuses on three areas: individual characteristics and experiences, behavioral specific cognitions, as well as behavioral outcomes.

A modified model was used in the study to assess the relationship between physical activity and alcohol consumption of college students. The HPM notes that each person has unique personal characteristics and experiences that affect the person’s subsequent actions. Health promoting behavior is the desired behavioral outcome and the endpoint in the HPM. Health promoting behaviors should result in improved health, enhanced functional ability, and a better quality of life. Past studies have...
used the HPM model to examine the relationship of social support of family to increased physical activity in adolescents (Garcia et al., 1995).

**Individual Behavior and Characteristics**

The purpose of this study was to determine the degree to which college freshmen engage in health promoting lifestyles, the ways in which college students’ health behaviors change over their first 6 months of college, and the demographic factors that contribute to a health promoting lifestyle. Specifically, this study assessed the effects of physical activity on the participants’ interpersonal relationships, stress management, and alcohol consumption. The literature supports the following hypotheses:

1. **Hypothesis 1:** College students who engage in regular physical activity will have lower levels of stress.
2. **Hypothesis 2:** College students who engage in regular physical activity will have better interpersonal relationships.
3. **Hypothesis 3:** College students who engage in regular physical activity will consume less alcohol.

**Method**

This study was a substudy of an existing longitudinal study designed to prevent drinking in college students (Kazemi, Sun, Nies, Dmochowski, & Walford, 2011). In the main study, a brief motivational intervention to prevent drinking was administered to college freshmen at baseline and follow-up at 3 and 6 months. As part of this longitudinal study, a substudy was conducted by adding one measure, the Health-Promoting Lifestyle Profile–II (HPLP-II; Walker, Sechrist, & Pender, 1987), to determine the health promoting lifestyles of college freshman at baseline, 3 months, and 6 months. This article reports the physical activity associations using the HPLP-II measure in a subset of college students.

**Procedures**

Participants were freshmen from a public university in the Southeastern United States that participated in a healthy lifestyle survey that measured health behaviors and drinking patterns. Eligibility requirements included being a college freshman between the ages of 18 and 25, drinking alcohol within the past 90 days, and possessing the ability to read and speak English. This questionnaire included demographic information such as age, gender, race/ethnicity, education level, and place of residence. Students were recruited from freshmen seminar classrooms and residence halls on campus. They were screened by telephone to determine their eligibility to participate in the study. Participation was voluntary. Institutional review board approval was obtained. Students signed an informed consent prior to completing the questionnaire. Participants received a US$20 gift card to the university bookstore after completion of the baseline visit. Eligible students (N = 167) who agreed to be in the study were administered the HPLP-II and Daily Drinking Questionnaire DDQ (Collins, Parks, & Marlatt, 1985) at baseline, 3 months, and 6 months. A subset of participant information from the main study on the prevention of drinking in college freshman (N = 167) formed the database for this study. Data were collected from students who completed the HPLP-II and the DDQ.

**Instrumentation**

The DDQ35 measures drinking patterns, including quantity and frequency over a typical week. The DDQ was used to assess drinking patterns of a “typical week” occurring within the last month and the number of drinks consumed on a specific day. Alcohol consumption was calculated by averaging the number of drinks consumed per day during a week’s period (Monday-Sunday). The DDQ has been tested and found to have a reasonable level of internal consistency, with Cronbach alphas of .66 and .75 (Collins, Parks, & Marlatt, 1985). The HPLP-II (Walker et al., 1987) is a 52-item instrument that assesses individuals’ endorsement of health promotion behaviors. The HPLP-II is a 4-point Likert-type scale ranging from “never” to “routinely.” In this study, only three of the six subscales were used which included physical activity, interpersonal relationships, and stress management. The HPLP has a high internal consistency (α = .92). The alphas for the three subscales in this study are as follows: physical activity = .85, interpersonal relationships = .87, and stress management = .79 (Walker et al., 1987). Mean scores range between 1.00 and 4.00 with means closer to 1.00 representing a lack of health promoting behaviors and 4.00 representing an optimal healthy lifestyle (Walker et al., 1987).

**Independent Variable of Interest**

Physical activity is defined as any form of activity that gets the body moving and exercise that involves regimented moderate or vigorous physical activity (Centers for Disease Control and Prevention, 2010). Physical activity was computed using eight items of the HPLP questionnaire, which assessed the frequency of moderate to vigorous exercise and whether the respondents followed a planned exercise regimen. The subscale on physical activity is scored by summing the values for each of the eight items and dividing by the number of items. Mean scores range from 1.00 to 4.00. A score ≤2.5 represents moderate physical activity and a score >2.5 represents a person with high physical activity. These cut points for the physical activity measure were determined by the distribution of the data.
Dependent Variables/Outcomes

Stress management involves controlling and reducing the tension that occurs in stressful situations by making emotional, physiological, and physical changes (Earnest & Dwyer, 2010). Successful stress management involves identifying the amount of stress and making the changes. Stress management was computed by using eight items of the HPLP questionnaire, which assessed a participant’s method of controlling stress, amount of sleep received, tiredness, and relaxation practices. The subscale stress management is scored by summing the values for each of the eight items and dividing by the number of items. Mean scores range from 1.00 to 4.00. A score ≤2.5 PubMed represents moderate stress management and a score >2.5 represents high stress management. The cut points for stress management were determined by the distribution of the data. Interpersonal relationships involve using communication to achieve a sense of intimacy and closeness in meaningful relationships with others (Aanes et al., 2010). Communication involves sharing thoughts and feelings through verbal and nonverbal messages (Aanes et al., 2010). Interpersonal relationships were assessed with nine items of the HPLP questionnaire that assess a participant’s ability to have meaningful and fulfilling relationships with others. The subscale of interpersonal relationships is scored by summing the values for each of the nine items and dividing by the number of items. Mean scores range from 1.00 to 4.00. A score ≤3.25 PubMed represents moderate interpersonal relationships and a score >3.25 represents high interpersonal relationships. The cut points for interpersonal relationships were determined based on the distribution of the data. Alcohol consumption was evaluated by assessing the mean number of drinks per week. An average score between 7 and 14 drinks per week represents moderate alcohol consumption. An average score between 15 and 45 drinks per week represents high alcohol consumption.

Statistical Analysis

Participants’ scores were entered into Microsoft Excel. Next, data were imported into SAS 9.2 statistical software. Percentages were computed for questions pertaining to age, gender, race, and place of residence. Percentages were also used to represent the areas of health behaviors (physical activity, interpersonal relations, and stress management) based on the participants’ responses. Mean scores were used to assess three measures of health behaviors from the HPLP-II completed by the participants. The mean number of drinks consumed over a week was used to assess alcohol consumption. Logistic regression analysis was performed to evaluate the effect of physical activity related to stress, interpersonal relationships and alcohol consumption. All analyses were performed using SAS 9.2. Given the modest sample size, \( p < .15 \) was used for the backward elimination procedure to select variables for inclusion in the adjusted models.

Results

Participant Characteristics

Students were between the ages of 18 and 20; 75% were 18, and 24% were between 19 and 20. The students’ race/ethnicity included 61% Caucasian American, 19% Black, and 19.1% Other. Other includes participants who identified themselves as Multiracial, Asian, and Other. Place of residence included Greek house 21.5%, dormitory/apartment 68.2%, and with parents 10.1%. Participant characteristics are shown in Table 1. The final model shows the relationship of physical activity and the three outcomes are shown in Tables 2 and 3 at the two time points: baseline to 3 months and 3 months to 6 months. In the final model, none of the demographic variables of age, race, gender, and place of residence were statistically significant at the 0.05 level. However, the gender odds ratio (OR) suggested that men had a lower likelihood than women to have better stress management, higher interpersonal relationships, and lower alcohol consumption.

| Variable                      | n   | %   |
|-------------------------------|-----|-----|
| Age                           |     |     |
| 18 years                      | 126 | 75.4|
| 19-20 years                   | 41  | 24.6|
| Gender                        |     |     |
| Male                          | 66  | 37.7|
| Female                        | 101 | 62.2|
| Race                          |     |     |
| Caucasian                     | 103 | 61.7|
| African American              | 32  | 19.1|
| Other                         | 32  | 19.1|
| Place of residence            |     |     |
| Greek house                   | 36  | 21.5|
| Dormitory/apartment           | 114 | 68.2|
| With parents                  | 17  | 10.1|
| Stress management             |     |     |
| Moderate (≤2.5)               | 69  | 41.4|
| High (≥2.5)                   | 97  | 58.6|
| Interpersonal relationships   |     |     |
| Moderate (≤3.25)              | 84  | 50.9|
| High (>3.25)                  | 83  | 49.1|
| Alcohol consumption           |     |     |
| Moderate (7-14) drinks/week   | 70  | 41.6|
| High (15-45) drinks/week      | 97  | 58.4|
| Physical activity             |     |     |
| Moderate (≤2.5)               | 82  | 49.4|
| High (>2.5)                   | 85  | 50.6|
### Table 2. Final Model of the (Baseline to 3 Month) Association on the Effect of Physical Activity on the Stress Management, Interpersonal Relationships, and Alcohol Consumption in College Freshmen

|                          | Stress management | Interpersonal relationships | Alcohol consumption |
|--------------------------|-------------------|-----------------------------|---------------------|
| **Physical activity**    |                   |                             |                     |
| Moderate ≤ 2.5           | 0.49 [0.24, 1.01] | 0.85 [0.41, 1.74]          | 0.59 [0.23, 1.10]   |
| High > 2.5               | 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| **Age**                  |                   |                             |                     |
| 18 years                 | 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| 19-20 years              | 0.43 [0.28, 1.13] | 0.87 [0.40, 1.89]          | 0.24 [0.01, 4.10]   |
| **Gender**               |                   |                             |                     |
| Male                     | 0.67 [0.32, 1.37] | 0.67 [0.36, 2.65]          | 0.92 [0.32, 2.37]   |
| Female                   | 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| **Race**                 |                   |                             |                     |
| Caucasian                | 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| African American         | 0.58 [0.24, 1.42] | 0.36 [0.22, 3.31]          | 0.60 [0.41, 4.12]   |
| Other                    | 0.66 [0.36, 2.70] | 0.66 [0.36, 2.70]          | 0.66 [0.36, 2.70]   |
| **Place of residence**   |                   |                             |                     |
| Greek house              | 0.24 [0.19, 1.51] | 0.82 [0.28, 3.18]          | 0.82 [0.28, 3.18]   |
| Dormitory/apartment house| 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| With parents             | 0.91 [0.31, 2.67] | 0.74 [0.46, 1.27]          | 0.74 [0.46, 1.27]   |

### Table 3. Final Model of the (3 to 6 Months) Association on the Effect of Physical Activity on the Stress Management, Interpersonal Relationships, and Alcohol Consumption in College Freshmen

|                          | Stress management | Interpersonal relationships | Alcohol consumption |
|--------------------------|-------------------|-----------------------------|---------------------|
| **Physical activity**    |                   |                             |                     |
| Moderate ≤ 2.5           | 0.52 [0.25, 1.29] | 0.61 [0.27, 1.38]          | 0.57 [0.23, 1.41]   |
| High > 2.5               | 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| **Age**                  |                   |                             |                     |
| 18 years                 | 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| 19-20 years              | 0.70 [0.26, 1.88] | 0.36 [0.20, 5.04]          | 0.48 [0.25, 3.22]   |
| **Gender**               |                   |                             |                     |
| Male                     | 0.43 [0.18, 1.02] | 0.92 [0.83, 4.47]          | 0.29 [0.11, 0.73]   |
| Female                   | 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| **Race**                 |                   |                             |                     |
| Caucasian                | 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| African American         | 0.61 [0.26, 4.26] | 0.64 [0.27, 2.69]          | 0.83 [0.27, 2.47]   |
| Other                    | 0.82 [0.23, 1.94] | 0.89 [0.51, 6.93]          | 0.35 [0.10, 6.01]   |
| **Place of residence**   |                   |                             |                     |
| Greek house              | 0.62 [0.51, 5.05] | 0.22 [0.03, 1.38]          | 0.69 [0.15, 1.33]   |
| Dormitory/apartment house| 1.00 Referent     | 1.00 Referent               | 1.00 Referent       |
| With parents             | 0.95 [0.42, 4.07] | 0.39 [0.19, 2.31]          | 0.98 [0.29, 4.13]   |

Note: OR = odds ratio; CI = confidence interval. There were no confounders retained in the final model.
Physical Activity and Stress Management

For both periods, there was no significant association between regular physical activity and stress management. Although the OR suggests a protective relationship between physical activity and stress management, 95% confidence intervals (CI) were not statistically significant: baseline to 3 months OR = 0.49, 95% CI = [0.24, 1.01], and 3 to 6 months OR = 0.52, 95% CI = [0.25, 1.29].

Physical Activity and Interpersonal Relationships

For both periods assessed, there was no association between physical activity and interpersonal relationships. Although the OR suggests an association between physical activity and stress level, 95% CI were not statistically significant: baseline to 3 months OR = 0.85, 95% CI = [0.41, 1.74], and 3 to 6 months OR = 0.61, 95% CI = [0.27, 1.38].

Physical Activity and Alcohol Consumption

For both periods assessed, there was no association between physical activity level and alcohol consumption. Although the OR suggests a negative relationship between physical activity and alcohol consumption, 95% CI and were not statistically significant: baseline to 3 months OR = 0.59, 95% CI = [0.23, 1.10], and 3 to 6 month OR = 0.57, 95% CI = [0.23, 1.41].

For all three models, a backward elimination approach was used so that only those variables significant at the 0.15 level remained in the final model. The demographic variables were not found to be confounders and the unadjusted results remained. Results for the regression analyses are presented in Tables 2 and 3.

Discussion

This research is unique in that there are limited studies that have collectively researched these three health behaviors and their relationship to physical activity in college students. This study found that no statistically significant relationships.

Studies based on larger samples, however, have found associations of healthier lifestyles of students who consume less alcohol (Johnson & Werch, 2008; Kuntsche et al., 2005). In particular, studies assessing interpersonal relationships have found that individual physical activity is not only determined by at the individual level, but also is greatly affected by the social environment (Emmons, 2000). College students who experience more social support are more physically active than other groups of students (Uchino, 2004). The relationship of stress and college student health has been widely studied; these studies show that students who exercise frequently exhibit lower levels of stress (Hudd et al., 2000). Similarly, alcohol use in college students has been extensively studied; students who are physically active are shown to consume less alcohol (Musselman & Rutledge, 2010). The benefits of regular physical activity are widely known and have been shown to positively affect wellness by reducing stress and creating better relationships in college students. Although none of the results of this study were significant, most likely due to the modest sample size, larger studies have documented the importance of health promotion activities in the 1st year of college life.

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**Bios**

**Simone Wilson-Salandy** is an experienced health scientist with experience in survey methodology, large complex surveys, and dissemination of public health data. She currently works for Northrop Grumman Corporation supporting public health research of the Centers for Disease Control and Prevention.

**Mary A. Nies** is a nurse scientist with a research focus on health promotion across the life span in vulnerable populations. Her scientific expertise lies in health promotion and intervention research in the community, using quantitative and qualitative approaches. She has extensive experience working with multidisciplinary research teams.