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# Relations of Physical Activity and Stress Vulnerability in University Students

Furong Xu

*University of Rhode Island, fxu2007@uri.edu*

Wenhao Liu

*See next page for additional authors*

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**Authors**

Furong Xu, Wenhao Liu, Jepkorir Rose Chepyator-Thomson, and Robert Schmidlein

Running Head: RELATIONS OF PHYSICAL ACTIVITY AND STRESS VULNERABILITY

RELATIONS OF PHYSICAL ACTIVITY AND STRESS VULNERABILITY IN  
UNIVERSITY STUDENTS<sup>1</sup>

FURONG XU

*University of Rhode Island*

WENHAO LIU

*Slippery Rock University*

JEPKORIR ROSE CHEPYATOR-THOMSON

*University of Georgia*

ROBERT SCHMIDLEIN

*San José State University*

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*Summary.*—The purpose of this study was to examine association between leisure-time physical activity and stress vulnerability among college students. A modified survey including physical activity and stress vulnerability questions were administered to 120 college students. Forty percent of the sample fell in physically inactive category, with less than 150 minutes of physical activity each week. Twenty-one percent of sample showed symptoms of depression or anxiety. A standard linear regression analysis revealed a significant association between leisure-time physical activity and depression ( $r = -0.55, p < .01$ ). In addition, social network was found to have a significant correlation with leisure-time physical activity ( $r = 0.58, p < .001$ ). It also found that walking, jogging, and running were physical activities in which college students engaged most.

1           Depression and anxiety due to unfavorable stress are negative emotional states associated  
2 with feelings of worry and negative thinking; interfering with people's daily life (Seligman,  
3 Walker, & Rosenhan, 2001). Health professionals have demonstrated serious concern over  
4 depression and anxiety because they may have a negative impact on people's physical and  
5 mental health (American College Health Association, 2006; Andrew & Wilding, 2004;  
6 Weitzman, 2004). College has been considered a period in which depression and anxiety can  
7 easily occur, as this is a transition period from childhood to young adult, and college students  
8 during this period may encounter myriad problems (McNamara, 2000).

9           According to American College Health Association (ACHA, 2006), college students  
10 were more susceptible to stress as a consequence of maturational changes and entering the new  
11 social community or new life to which they had to accommodate and adjust themselves. For  
12 many college students, going to college might be the first time away from home, handling  
13 difficult tasks including, time management and courses selections. Additionally, a large portion  
14 of college students have to work in order to subsidize tuition while struggling to maintain  
15 academic success, while advanced college students might face difficulty with career choices and  
16 job search, especially when economic conditions are down. Andrew & Wilding (2004) reported  
17 that college students frequently experienced problems such as financial difficulties, poor  
18 academic performance, and stressful interpersonal relationships, which made them particularly  
19 vulnerable to anxiety and depression. Further, it was found that college students with a high level  
20 of depression or anxiety were more likely to continuously have these problems later in life; and  
21 that students who suffered from depression or anxiety may be at a higher risk for further health  
22 complications later in life (Zivin, Eisenberg, Gollust, & Golberstein, 2009).

1           According to data collected by Behavioral Risk Factor Surveillance System in 2006, the  
2 prevalence of depression and anxiety was the highest (12.5%) among youth, aged 18-24,  
3 compared with other age groups. This phenomenon has raised an increasing concern of college  
4 students' mental health (O'Neal, Dunn, & Martinsen, 2000). While a certain level of stress may  
5 result in improved performance, too much stress can adversely affect people's physical and  
6 mental health (Schneiderman, Ironson, & Siegel, 2005). Individuals with depression or anxiety  
7 are also at a higher risk of developing cardiovascular disease than those without it (Rowan, Haas,  
8 Campbell, Maclean, & Davidson, 2005). In addition, depression and anxiety could lead to  
9 alcohol abuse and other risky behaviors (Weitzman, 2004), and could possibly make people  
10 more vulnerable to suicidal ideation (American College Health Association, 2006).

11           Meanwhile, a substantial body of research has showed beneficial effects of physical  
12 activity on depression and anxiety. A large-sample study reported a significantly inverse  
13 relationship between leisure time physical activity and depression symptoms among adolescents  
14 who participated in a school-based, group-randomized trial study to alter cancer-related dietary  
15 risk behaviors in young adolescents (Motl, Birnbaum, Kubik, & Dishman, 2004). In another  
16 study, Goodwin (2003) discovered the effect of physical activity on reducing people's depression  
17 level. Similar findings were reported in other studies as well (Motl, Birnbaum, Kubik, &  
18 Dishman, 2004; Paluska & Schwenk, 2000). In addition, after a thorough literature review,  
19 Martinsen (2008) recently reported the promising results of the effect exercise has on decreasing  
20 depression and anxiety levels.

21           While physical activity has potential effects on reducing stress, literature suggests that  
22 half of university students exercise well below the recommended level (150 minutes weekly) of  
23 physical activity (Burke, Carron, & Eys, 2006; Irwin, 2004), and that relatively few studies have

1 related exercise to decreasing depression among the college population in the United States.  
2 Skirka (2000) investigated the effects of sports participation on psychological health among a  
3 group of 270 college athletes and non-athletes. An inverse correlation between perceived stress  
4 and sport participation was noted. Another study examined the effects of leisure time physical  
5 activity on stress management in a sample of 135 undergraduate psychology and kinesiology  
6 students; it was found that participants' level of stress was significantly reduced with  
7 participation in physical activity (Carmack, Boudreaux, Amaral-Melendez, Brantley, & de Moor,  
8 1999). However, a study ( $n = 814$ ) conducted in Southern California reported no significant  
9 association between perceived stress and level of physical activity among college students  
10 (Nguyen-Michel, Unger, Hamilton, & Spruijt-Metz, 2006), and the authors claimed that their  
11 findings might be affected by some limitations such as the selected survey instrument.

12 To better understand the relationship between physical activity and unfavorable stress  
13 among college students, it is desirable to conduct additional research. Therefore, the purpose of  
14 this study was to further examine the correlation between physical activity participation and  
15 stress level among college students.

## 16 Method

### 17 *Participants*

18 Potential participants were a convenience sample of 135 students from five classes in  
19 three universities. 120 of the students sampled (age 18-30; 55 female, 65 male) completed the  
20 survey, yielding an 89% response rate. Of the 120 participants, 26% were freshmen ( $n = 31$ ),  
21 25% were sophomores ( $n = 30$ ), 26% were juniors ( $n = 31$ ), 19% were seniors ( $n = 23$ ), and 4%  
22 were graduate students ( $n = 5$ ). As for race distribution, 76% were Caucasian ( $n = 93$ ), 7% were

1 African American ( $n = 8$ ), 8% were Asian American ( $n = 10$ ), 2% were Hispanic ( $n = 2$ ), 0.8%  
2 were American Indian, and the remaining 5% identified as other.

### 3 *Measures*

4 A three-part questionnaire was used in this study. The first section contained  
5 demographic information including age, gender, grade levels, ethnical background, and academic  
6 performance (GPA). The second asked the participants to recall exercise frequency, duration,  
7 and type of physical activity they engaged in during a typical week in the past three months. All  
8 questions had a multiple choice format, except the type of physical activity each participant  
9 engaged in. For example, the item for exercise duration asked: “When you exercised, on average,  
10 how many minutes did you engage in the specific activity?” the participants chose one of the  
11 following choices, 30 minutes or less, 31-60 minutes, 61-90 minutes, or more than 90 minutes.  
12 Total weekly physical activity time in minutes was calculated by having frequency of weekly  
13 physical activity multiplied by the average duration of exercise time. As for type of physical  
14 activity, participants were required to write down the specific activities they engaged in during a  
15 typical week in the past three months. In addition, physical activity was categorized into three  
16 levels based on professional recommendations (Burke, Carron, & Eys, 2006; Irwin, 2004); that  
17 is, low (less than 150 minutes weekly), medium (150-300 minutes), and high (more than 300  
18 minutes).

19 The third part was based on a stress vulnerability scale, which was modified from Hoeger  
20 and Hoeger’s Depression Anxiety Stress Scale (2005). This scale contained 25 four-point items  
21 with 1 indicating strongly disagree and 4 indicating strongly agree, summing to 100 points. The  
22 25 items covered four subcategories of the stress vulnerability scale, health (40 points), social  
23 network (16 points), time management (20 points), and nurturance (24 points). A composite



1 score of 60 or higher out of the 100 points indicated a high level of stress vulnerability. In the  
2 present study, coefficient alphas for the four subcategories were all greater than .70, and a split-  
3 half coefficient of .85 was obtained, indicating acceptable internal consistency of the stress  
4 vulnerability scale.

#### 5 *Procedure*

6 After obtaining the approval to conduct the study from the institutional review board of  
7 human subjects, the modified questionnaire was administered to 30 university students at a  
8 university located in the Northeast region of the United States as a pilot survey in fall 2007. The  
9 questionnaire was revised based on the feedback of the pilot version. These changes included  
10 removing difficult sentences and revising or removing items lacking internal consistency. After  
11 revising, the final version of the questionnaire was administered to 120 students from three  
12 universities in fall 2008.

#### 13 *Data Analyses*

14 All statistical analysis was done through the SPSS Version 13.0 for Windows software  
15 package. Descriptive statistics analysis was conducted to describe the characteristics of  
16 participants (gender, age, grade levels, and ethnical background), physical activity levels,  
17 composite stress vulnerability scores, and scores of the four subcategories of stress vulnerability  
18 (health, social network, time management, and nurturance). The composite stress vulnerability  
19 scores were converted into five levels based on Hoeger and Hoeger' scoring protocol for stress  
20 vulnerability: excellent (0-30), good (31-40), average (41-50), vulnerable to stress (51-60), and  
21 high vulnerability to stress ( $\geq 61$ ). Standard linear regression analyses were used to test the  
22 strength of association between physical activity level and stress vulnerability, each of the four  
23 subcategories of stress vulnerability, and academic performance. The independent samples t-test

1 was used to examine differences in physical activity levels, perceived stress vulnerability, and  
2 each of the four subcategories of the stress vulnerability between male and female college  
3 students. Alpha level was set at  $p < 0.05$  for all the inferential tests.

#### 4 Results

5 One hundred and twenty university students (55 female and 65 males) completed the  
6 questionnaire. Table 1 presents selected demographic characteristics of the sample (insert Table  
7 1 here). A standard linear regression analysis (Figure 1) revealed a significantly inverse  
8 correlation between leisure time physical activity and stress vulnerability ( $r = - 0.55, p < 0.01$ ).  
9 In addition, of the four subcategories (health, social network, time management, and nurturance)  
10 of the stress vulnerability, only social network was found to have a significant correlation with  
11 leisure-time physical activity ( $r = 0.58, p < .001$ ) (Figure 2). The mean stress vulnerability score  
12 was 51 with the range from 30 to 71. Twenty-one percent of samples ( $n = 25$ ) showed significant  
13 symptoms of depression or anxiety, with stress vulnerability scores that were more than 60 (out  
14 of 100). Out of 27 minority respondents, 5 (18.5%) had stress vulnerability score higher than 60,  
15 while only 12 out of 93 Caucasian respondents or 12.9% of them scored above that level. This  
16 difference, however, is not statistically significant at the 0.05 level. In addition, no significant  
17 relationship between leisure-time physical activity and academic performance was identified ( $p >$   
18 0.05).

19 In terms of physical activity level, forty percent of the sample ( $n = 48$ ) fell into the  
20 physically inactive category, with less than 150-minutes of physical activity each week, although  
21 most of them indicated trying to incorporate physical activity into their daily schedule. Sixty  
22 percent of the samples ( $n = 72$ ) exercised three times or more during a typical week during the  
23 past three months, and 59% respondents ( $n = 71$ ) were using exercise to cope stress. With

1 regards to type of physical activity engaged, most participants ( $n = 79$ , 65.3%) reported jogging  
2 and running, followed by walking ( $n = 22$ , 18.2%). Other physical activities engaged with  
3 relatively more participants were ball games (baseball, softball, basketball, or soccer;  $n = 9$ ;  
4 7.3%), bicycling ( $n = 6$ , 4.95%), badminton ( $n = 3$ , 2.48%), and swimming ( $n = 2$ , 1.65%).

5 With respect to gender differences (Table 2), male college students reported significantly  
6 higher weekly physical activity minutes ( $M = 265.8$ ,  $SD = 165.4$ ) than female college students  
7 did ( $M = 174.7$ ,  $SD = 130.1$ ), with  $t_{(118)} = -3.38$  and  $p < 0.01$ . However, no significant gender  
8 differences were found in stress vulnerability or any of the four subcategories of stress  
9 vulnerability (health, social network, time management, and nurturance).

## 10 Discussion

11 The main purpose of this study was to examine how physical activity was associated with  
12 stress vulnerability in college students. We also examined how physical activity was associated  
13 with each of the four subcategories of the stress vulnerability and academic performance. In  
14 addition, participants' physical activity level and gender differences in physical activity, stress  
15 vulnerability, and each of the four subcategories of stress vulnerability were examined.

16 It was found in the study that college students' physical activity level was inversely  
17 related to their perceived stress vulnerability, and the result is consistent with the finding in  
18 previous studies (Skirka, 2000; Carmack, Boudreaux, Amaral-Melendez, Brantley, & de Moor,  
19 1999). This demonstrates again that physical activity participation may be an effect strategy in  
20 reducing college students' stress level, hence alleviating their depression and anxiety level as  
21 well. Also, it was found that male college students were more physically active than their female  
22 counterpart, but there was no significant difference in term of stress vulnerability between  
23 genders, and this result is somewhat inconsistent with previous research. Two previous studies

1 (Angst et al., 2004; Matud, 2004) reported higher level of physical activity and lower level of  
2 stress and depression on the part of male college students compared with female students, which  
3 seems logical, given that physical activity is frequently found to be inversely related to stress  
4 vulnerability. The reason for the discrepancy could be complicated and multiple factors that  
5 impact stress vulnerability. While physical activity is generally suggested as a strategy to deal  
6 with stress and depression, it is not an absolute solution; many other factors also play a role in  
7 stress and depression. For example, One's financial situation and self-efficiency can be related to  
8 stress vulnerability (Cohen, Gottlieb, & Underwood, 2000). Both are important predictors of  
9 depression and anxiety (Krieger, 2001). These two factors, however, were not measured in this  
10 study but may contribute to the stress vulnerability level of the sample in this study.

11 The present study revealed that walking, jogging, and running were physical activities  
12 engaged most by college students. All those activities were aerobic activities with moderate to  
13 vigorous intensity. This result regarding physical activity type is consistent with conclusions of  
14 Megan, Ball and Salmon's (2008) review that all physical activity improves global mental  
15 health, whereas aerobic activity is more dominant in alleviating symptoms of depression in the  
16 adult population. Walking, jogging, and running are also lifetime activities that can be carried  
17 over into old age, and highly suggested in physical activity recommendations (Gallahue &  
18 Ozmun, 2006).

19 However, forty percent of the sample ( $n = 48$ ) fell into the physically inactive category,  
20 with less than 150-minutes of physical activity each week. There was also a high percentage of  
21 stress vulnerability (21%) among college students, and this finding is in accordance with that of a  
22 web-based survey (Eisenberg, Gollust, Golberstein, & Hefner, 2007) indicating that 15.6%  
23 undergraduate student and 13% graduate students had positive sign for anxiety and depression.

1 Thus, increasing physical activity levels and reducing stress vulnerability on the part of college  
2 students will be a continuous focus in the future. Given that physical activity levels in general are  
3 considered as factors to alleviate stress levels, more strategies facilitating college students'  
4 physical activity participation needs to be identified and implemented. Based on the results of  
5 this study, one's social network is significantly correlated with their physical activity level,  
6 which is consistent with Cohen et al. (2000) statement that social support could directly  
7 contribute to health behaviors such as physical activity. Thus, strategies, including organizing  
8 walking clubs or jogging/running clubs in universities and colleges may contribute to physical  
9 activity levels of college students. These clubs provide social support/network and physical  
10 activity opportunities as well.

11 In summary, the results of the present study indicate that physical activity is inversely  
12 correlated to perceived stress and depression, and one's social network is positively related to  
13 physical activity involvement. The results also indicate that low physical activity level and a high  
14 prevalence of stress is a continuing issue among college students. Given the considerable  
15 evidence that physical activity may alleviate stress, it is suggested to increase college students'  
16 physical activity level as a means of reducing their stress level.

17 Some limitations associated with the study need to be mentioned as well. The sample in  
18 this study consisted of college students from only three universities, majoring in kinesiology, or  
19 registered in physical education classes, which might not be representative of the typical college  
20 student population in the US. Also, the physical activity survey involved a three-month physical  
21 activity recall, which was very challenging and might result in inaccurate data. Further, the study  
22 was with a cross-sectional design, and data collection at several time points may provide a more

- 1 comprehensive picture of the issue. Hence, more research with better design is needed in the
- 2 future.
- 3

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- 21

1 Table 1.

2 *Distribution of College Students' Demographic Characteristics*

|                       | Percentage              |                       |                         |
|-----------------------|-------------------------|-----------------------|-------------------------|
|                       | Female ( <i>n</i> = 55) | Male ( <i>n</i> = 65) | Total ( <i>N</i> = 120) |
| <b>Grade</b>          |                         |                       |                         |
| Freshman              | 32.7                    | 20.0                  | 25.8                    |
| Sophomore             | 23.6                    | 26.2                  | 25.0                    |
| Junior                | 23.6                    | 27.7                  | 25.8                    |
| Senior                | 16.4                    | 21.5                  | 19.2                    |
| Graduate student      | 3.6                     | 4.6                   | 4.2                     |
| <b>Age</b>            |                         |                       |                         |
| 18-20                 | 45.5                    | 33.8                  | 39.2                    |
| 20-25                 | 54.5                    | 64.6                  | 60.0                    |
| 26-30                 | 0.0                     | 1.5                   | 0.8                     |
| <b>Race/ethnicity</b> |                         |                       |                         |
| African American      | 9.1                     | 4.6                   | 6.7                     |
| Caucasian             | 72.7                    | 81.5                  | 77.5                    |
| Asian                 | 9.1                     | 7.7                   | 8.3                     |
| Spanish/Latino        | 1.8                     | 1.5                   | 1.7                     |
| American Indian       | 1.8                     | 0.0                   | 0.8                     |
| Other                 | 5.5                     | 4.6                   | 5.0                     |

3

4

1 Table 2.

2 *Gender Differences in Weekly Physical Activity Minutes, Stress Vulnerability, and Each of the*

3 *Four Subcategories of Stress Vulnerability*

---

|                                  | Female ( <i>n</i> = 55) |           | Male ( <i>n</i> = 65) |           | Independent t-test |          |
|----------------------------------|-------------------------|-----------|-----------------------|-----------|--------------------|----------|
|                                  | Mean                    | <i>SD</i> | Mean                  | <i>SD</i> | <i>t</i>           | <i>p</i> |
| Weekly physical activity minutes | 174.7                   | 130.1     | 265.8                 | 165.4     | -3.38              | .001*    |
| Stress vulnerability             | 52.3                    | 9.8       | 50.5                  | 9.7       | 1.03               | .308     |
| Health                           | 36.9                    | 5.0       | 36.7                  | 4.5       | 0.21               | .836     |
| Social network                   | 11.2                    | 3.4       | 12.7                  | 2.8       | -1.67              | .068     |
| Time management                  | 13.0                    | 2.0       | 12.8                  | 2.2       | 0.52               | .602     |
| Nurturance                       | 18.0                    | 2.3       | 17.7                  | 2.2       | 0.98               | .331     |

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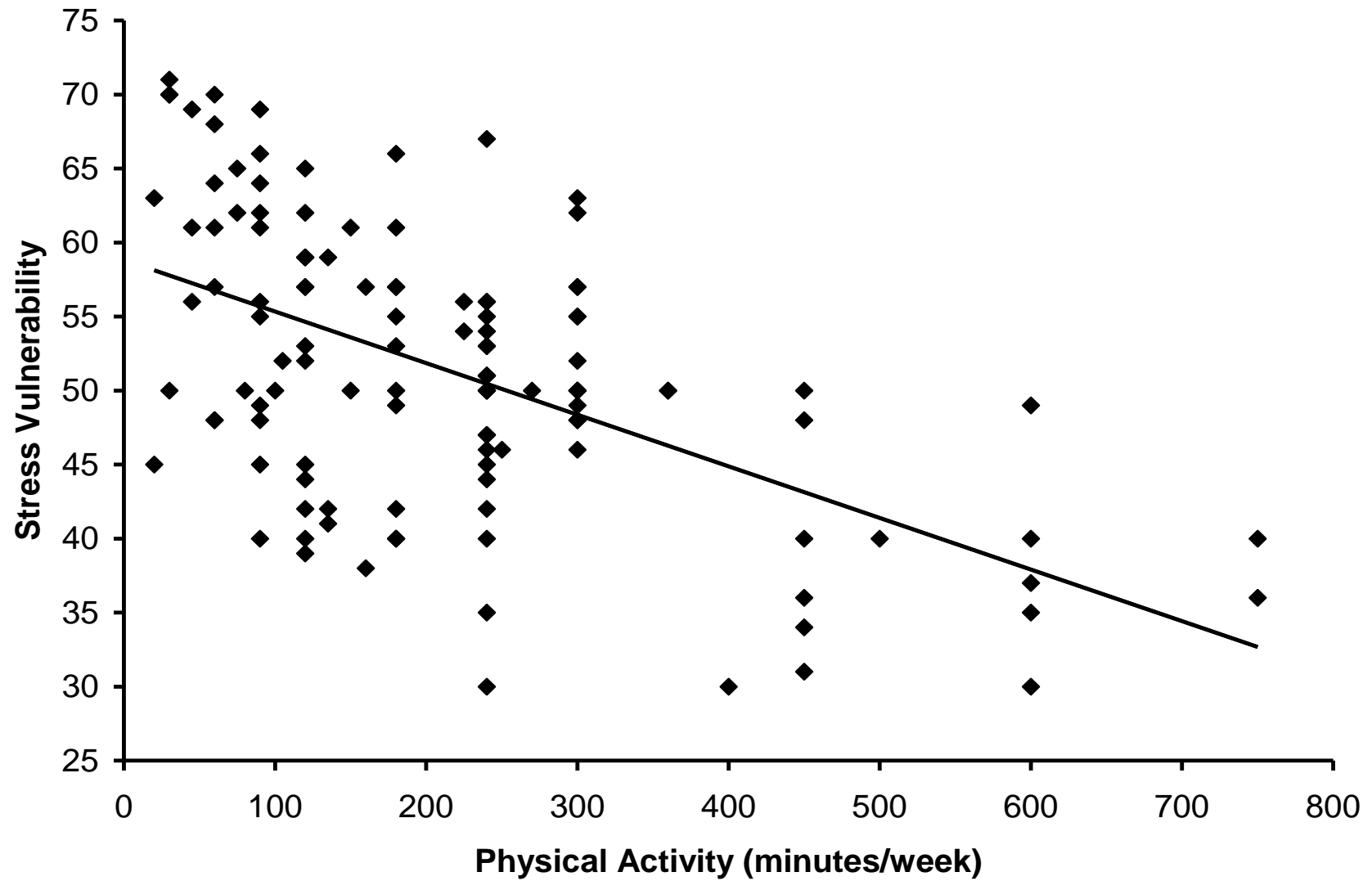
4

5 *Note.* The composite score for stress vulnerability is 100 points. The total score is 40 points for

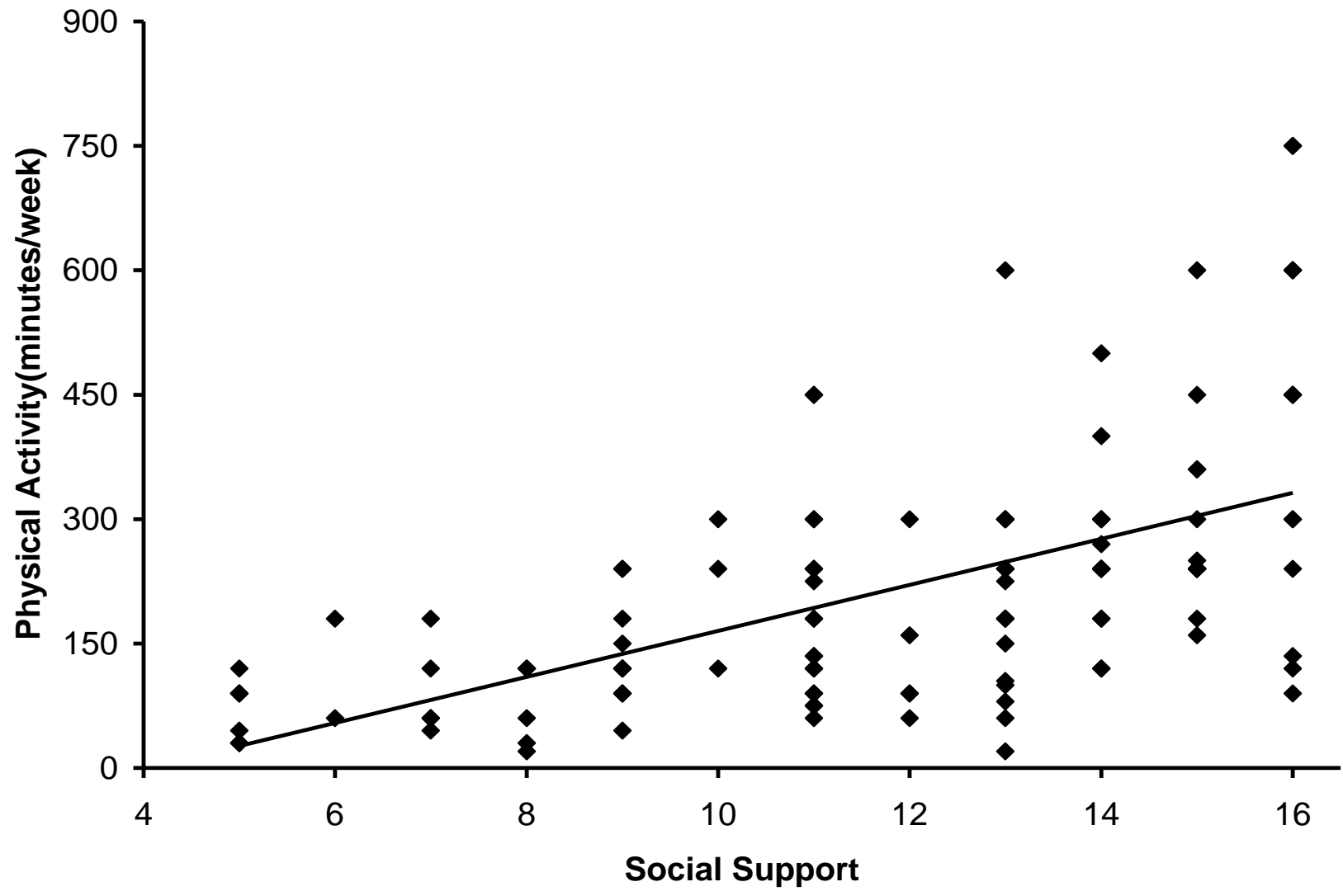
6 health, 16 points for social network, 20 points for time management, and 24 points for

7 nurturance.

8 \* Gender difference is significant at the 0.01 level (2-tailed).



- 1
- 2 *Figure 1.* Linear correlation between physical activity and stress vulnerability



1

2 *Figure 2.* Linear correlation between social support and physical activity