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Sarah L. Garnaat
Northern Arizona University

Jessica E. Gwinn
Northern Arizona University

Sara L. Riley
Northern Arizona University

Lisa A. Winslow
Northern Arizona University

Michael C. Hansbourgh
Northern Arizona University

See next page for additional authors

Sarah L. Garnaat, Jessica E. Gwinn, Sara L. Riley, Lisa A. Winslow, Michael C. Hansbourgh, Amanda L. Zielinski, Erin L. Gorter, Jennifer Blevins, Ph.D., and Sumner J. Sydeman, Ph.D.

Northern Arizona University

Relationship between Trait Anxiety and Health-related Factors

Growing evidence indicates that anxious individuals are more likely to engage in unhealthy lifestyle behaviors associated with coronary heart disease. We examined the relationship of Trait Anxiety (T-Anx) with lifestyle behaviors and physiological variables in a sample of 34 college undergraduates scoring in the upper/lower quartiles on T-Anx (50% women). Participants were assessed for physiological variables (BP, BMI) and behaviors including cigarette smoking, activity/exercise level, alcohol intake, and sleep. High T-Anx participants smoked significantly more cigarettes, slept significantly fewer hours, and engaged in significantly less vigorous-intensity physical activity than low T-Anx participants. No significant differences between groups were noted on BP, BMI, overall activity level, or alcohol use. These findings provide evidence that high T-Anx college-age individuals engage in unhealthy behaviors.

Coronary heart disease (CHD) is the leading cause of mortality in the United States, according to the American Heart Association (AHA, 2002; Arias, Anderson, Kung, Murphy, & Kochanek, 2003). Modifiable risk factors include: high blood pressure (BP), high cholesterol, cigarette smoking, diabetes mellitus, obesity, and physical inactivity (AHA, 2002; Ayas et al., 2003). Non-modifiable risk factors such as age, male gender, and heredity also increase the likelihood of CHD (AHA, 2002; Arias et al., 2003). Recently, Ayas et al. (2003) found that self-report of short sleep duration was an independent predictor of coronary events.

Emotional factors, including elevated levels of anxiety, have been implicated as prognostic factors for the presence and course of CHD (Kawachi, Colditz, et al., 1994; Kawachi, Sparrow, Vokonas, & Weiss, 1994; Kubzansky, Kawachi, Weiss, & Sparrow, 1998). Anxiety is postulated to increase the likelihood of CHD through direct physiological mechanisms such as increased risk for high BP or abnormal cardiac rhythm (Paterniti et al., 1999; Räikkönen, Matthews, Flory, Owens, & Gump, 1999) and lifestyle factors such as cigarette smoking (Pereira et al., 1997), sleep duration (Ayas et al., 2003), and activity level (Kubzansky et al., 1998). Kubzansky et al. (1997) further state that highly worried individuals are more likely to engage in these high risk behaviors.

Kubzansky et al. (1997), in the Normative Aging Study, found that men with higher levels of worry regarding social conditions were more likely to smoke cigarettes and consume alcoholic beverages. Breslau, Kilbey, and Andreski (1991) found that patients with anxiety disorders were significantly more likely to have nicotine dependency. Individuals with higher anxiety have been found to have a higher incidence of hypertension (Kawachi, Sparrow, et al., 1994; Kubzansky et al., 1997).

Patients with panic disorder have been found to be comparatively less physically fit (Gaffney, Fenton, Lane, & Lake, 1988; Hayward, 1995; Kawachi, Sparrow, et al., 1994; Taylor et al., 1987). This may be due to a relationship between the presence of anxiety disorders and unhealthy lifestyle factors (Hayward, 1995). Thus the relationship between general anxiety and physical fitness and its effect on cardiovascular health merits further study.

State anxiety is generally defined as an emotional state or reaction that can be distinguished from other emotions such as anger or sadness by its observable behavior. An anxiety state consists of unpleasant feelings of tension, apprehension, nervousness, worry, and activation of the autonomic nervous system (Appels, Golombeck, Gorgels, de Vreede, & van Breukelen, 2000; Kawachi, Sparrow, et al., 1994; Kubzansky et al., 1998).

Trait anxiety, on the other hand, refers to relatively stable individual differences in anxiety level as a personality characteristic. People who have high trait anxiety are more likely to perceive stressful situations as being personally dangerous or threatening and to respond to such situations with elevations in state anxiety. The stronger the anxiety trait, the more likely the individual is to have experienced state anxiety in the past and to experience intense elevations in state anxiety in future threatening situations (Kawachi, Sparrow, et al., 1994; Kubzansky et al., 1998; Spielberger, 1983).

The purpose of this study was to test the hypothesis that high T-Anx participants, compared to their low T-Anx counterparts, would engage more in unhealthy lifestyle behaviors including cigarette smoking, sedentary behaviors, alcohol intake, and fewer hours of sleep. We also hypothesized that high T-Anx individuals would exhibit poorer health in terms of body mass index (BMI) and resting BP.

Methods

Participants

Participants screened for inclusion in this study consisted of 130 Introduction to Psychology undergraduate students at a midsize state university in the Southwest. Participants were prescreened for anxiety level using Spielberger's Trait Anxiety (T-Anx) scale (Speilberger, 1983) and a Demographic Questionnaire at the beginning of the semester. Using the normative data for college students from the State-Trait Anxiety Inventory (STAI) manual, these participants were categorized into quartiles based on the scores received on the T-Anx scale. Entry criteria for the study required students to fall in the lower or upper quartiles of T-Anx. Sixty-six participants met this inclusion criterion. Of these participants, 56 percent ($n = 37$) were successfully reached and scheduled for follow-up appointments. Of those scheduled for follow up appointments, 34 completed the remaining testing sessions for an overall completion rate of 54 percent. The final sample consisted primarily of Caucasian, unmarried, freshmen men ($n = 17$) and women ($n = 17$). The study was approved by the university's institutional review board, and all participants provided informed consent prior to data collection procedures. Participants were given extra credit for their involvement in each phase of the study.

Measures

Participants were assessed on physiological variables and behavioral measurements. The physiological variables included resting BP and BMI. A trained exercise science undergraduate research assistant measured BP according to published measurement standards. Behavioral measurements included the Self Report Physical Activity Recall Questionnaire (SPARQ). The SPARQ (Nowicki, Ketterson, Anton, Sydeman, & Perri, 2001) is a self-report adaptation of the Stanford 7-Day Physical Activity Recall (PAR) Interview, a widely utilized interview used to determine physical activity level in the past week (Blair et al., 1985). On the

SPARQ, participants rate their physical activity in two categories, vigorous or moderate, for the past seven days. The SPARQ instructs participants to include activities that lasted at least 10 minutes in duration and to exclude light activities such as leisurely walking. Scoring is similar to the PAR, though a new category called "vigorous" physical activity was created for the SPARQ that encompasses both the "hard" and "very hard" intensity categories of the PAR. Vigorous intensity physical activity is defined as activities that cause an individual's heart to beat fast and/or cause an individual to work up a sweat. Examples of vigorous activities include jogging and construction work. This vigorous category, which collapses the hard and very hard categories of the PAR, was created because most sedentary individuals engage in little or no very hard intensity activities. Moderate intensity activity is defined as activity that is generally *not* exhausting; this definition is similar to the definition of moderate intensity used in the PAR. Examples of moderate activity include brisk walking and housework, such as sweeping or mopping.

To calculate energy expenditure, hours of both vigorous and moderate intensity physical activity are multiplied by 6 metabolic equivalents (METs) and 4 METs, respectively (consistent with the PAR, which uses 6 METs for hard activity and 4 METs for moderate activity). In addition to rating their SPARQ, participants are also asked, "During the last 7 days, how many hours did you sleep on average each night?" Total sleeping hours are included and multiplied by 1 MET. Similar to the PAR, all hours not spent in moderate or vigorous activities or sleeping are categorized as "light" activities, and are multiplied by 1.5 METS. Thus, total kcal/hour can be calculated in a scoring procedure similar to that of the PAR. Average caloric expenditure per day was calculated for the current study using the Stanford 7-Day PAR formula.

To further assess activity level, participants were instructed in how to use a daily training log for self-monitoring of their activity level as measured by a Yamax pedometer. Participants were instructed to reset their pedometer at the start of each day, to wear their pedometer for the course of each day, and to record their total steps taken at the end of each day during the 7-day period. Participants also completed a Health Habits Questionnaire that provided self-report information regarding cigarette smoking (packs per day, or PPD), and alcohol intake (number of drinks per week).

Procedure

After screening and categorization into Low T-Anx and High T-Anx groups was completed, participants were instructed to go on a 12-hour fast prior to their first morning follow-up appointment. At this appointment, participants were told to sit quietly for 10 minutes alone in the lab before BP was measured. Blood pressure was measured from the brachial artery of the right arm via auscultation using a standard BP cuff while participants were in the seated position. Two BP measurements were recorded and averaged for analysis, with a five-minute wait between measurements. Height was measured without shoes. Weight was measured using a standard medical office scale. Height and weight were used to calculate BMI (weight in kilograms/height in meters^2). Participants then completed the SPARQ (Week 1) and the Health Habits Questionnaire. Following completion of the questionnaire, participants were trained in the use of the pedometer and were instructed to record their daily number of steps in a pedometer log for the subsequent seven days. Participants were scheduled for a final appointment during which they returned equipment and logs as well as completed the SPARQ for a second time (Week 2), which was collected to provide two weeks of activity-level data, in order to provide a more stable estimate of activity level.

Data was entered into SPSS for Windows Version 10.0. Between-group differences were examined for high T-Anx and low T-Anx participants on demographic, physiological, and behavioral variables. Independent samples t tests were used for continuous data and chi-square analyses were used for dichotomous/categorical data. Data was averaged within group over the two week period for relevant variables. All statistical tests were two-tailed and tests of group differences were considered significant if $p < 0.05$.

Results

Tests of group differences can be found in Table 1. In our comparison of high T-Anx and low T-Anx groups, there were no significant differences found in regards to gender, age, race, class standing, or marital status. On our physiological variables (BP, BMI) no significant differences were found between high T-Anx and low T-Anx participants.

High T-Anx participants smoked significantly more with an average of 1.25 PPD of cigarettes, while low T-Anx participants smoked an average of .39 PPD of cigarettes ($p = .04$). High T-Anx participants also reported sleeping significantly fewer hours over two consecutive weeks of reporting ($M = 5.93$ hours/night) than low T-Anx participants ($M = 7.19$ hours/night, $p = .003$). There were no significant differences in overall activity level as indicated in the SPARQ (average kcals/day) or the 7-day pedometer log (average number of steps/day). However on the SPARQ, high T-Anx participants reported engaging in significantly fewer hours per week of vigorous intensity physical activity ($M = 1.00$ hours/week) compared to low T-Anx participants ($M = 3.62$ hours/week, $p = .02$) over two consecutive weeks of reporting. Finally, no significant differences were noted on alcohol intake.

Discussion

In investigating the relationship between T-Anx and important physiological factors and lifestyle behaviors associated with CHD, we hit upon several significant findings. First, high T-Anx participants smoked significantly more cigarettes than low T-Anx participants. Evidence indicates that cigarette smoking is the single most important risk factor for the development and advancement of CHD (Sebgrets, Falger, & Bär, 2000). Additionally, we found that high T-Anx participants slept significantly fewer hours than did the low T-Anx participants. Short sleep durations have recently been identified as a risk factor for the development of CHD (Ayas et al., 2003). The high T-Anx participants averaged approximately six hours of sleep a night, an amount that Ayas et al. found to put individuals at significantly greater risk for developing CHD. In terms of overall activity level, no differences between groups were noted on the pedometer log or average kcals/day expended on the SPARQ. However, one interesting difference in pattern of activity level was noted on the SPARQ with high T-Anx individuals engaging in significantly fewer hours of vigorous intensity physical activity per week. Contrary to expectations, no significant differences were found in regard to alcohol intake or our physiological indicators (BP, BMI).

Our findings of higher usage of cigarettes and decreased amount of sleep in high T-Anx participants support previous research on these topics. Penny and Robinson (1986), when comparing smokers and nonsmokers, found that smokers were significantly higher in their levels of T-Anx. These results are consistent with Perkins, Grobe, and Fronte (1992) who found that many individuals may use smoking as a means to reduce anxiety level. Anxious individuals high in worry frequently have problems with sleep (American Psychiatric Association, 2000), a finding replicated in our study.

Strengths of the current study include the prospective design of data collection and the use of varied outcome measures. Specifically, participants were initially screened on T-Anx, and then returned for follow-up visits over the remaining course of the semester. The use of physiological variables (fasting BP, BMI), self-report measures of health behaviors, and real-time behavioral measures (e.g., pedometer) provided multi-modal assessment. Another strength was the inclusion of equal numbers of male and female participants.

The small sample size ($N = 37$) and disproportionate sizes of the groups ($n = 26$ for low T-Anx; $n = 11$ for high T-Anx) were the primary limitations of the current study. Also, the study was limited by the lack of diversity within the sample regarding race and age. The sample was comprised primarily of Caucasian individuals between 18 and 21 years of age, due in large part to the demographic makeup of Introduction to Psychology courses at the university where this study was conducted.

In order to clarify the mechanisms linking anxiety and CHD, further prospective studies utilizing larger sample sizes and multiple outcome measures, including physiological indices and lifestyle behaviors, are suggested. Studies examining CHD behavioral factors in individuals diagnosed with actual anxiety disorders are also recommended. Future studies should also further examine the relationship between anxiety and activity level, taking into account intensity of physical activities. Finally, similar future studies including female participants with sufficiently large sample sizes to permit independent examination of gender effects in relation to the factors examined here are warranted. Inclusion of female participants is important because women tend to score higher than men on both implicit and explicit anxiety measures (Egloff & Schmukle, 2004). Also, as Kubzansky et al. (1998) point out, epidemiological studies linking anxiety and CHD have historically focused almost exclusively on males despite the higher prevalence of anxiety disorders in females. Future research in this area should attempt to address these issues.

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Table 1

Comparison of Low T-Anx and High T-Anx Participants on Physiological and Behavioral Variables

	Low T-Anx (n = 26)	High T-Anx (n = 11)	
Physiological Variables	M (SD)	M (SD)	t
Systolic BP	109.80 (8.32)	108.81 (7.99)	.33
Diastolic BP	71.44 (6.28)	70.36 (5.05)	.50
BMI	24.24 (4.73)	25.12 (3.72)	-.55
Behavioral Variables			
SPARQ total Kcal/day	2616.10 (605.81)	2632.69 (478.86)	-.08
SPARQ hours of vigorous PA	3.62 (3.38)	1.00 (1.30)	2.48*
SPARQ hours of moderate PA	3.89 (3.12)	3.71 (2.82)	.16
Pedometer (avg. steps/day)	9938.82 (3890.38)	12013.59 (3168.04)	-1.48
Cigarettes (PPD)	0.39 (0.31)	1.25 (0.35)	-3.13*
Alcohol (drinks/week)	6.93 (6.80)	7.10 (4.95)	-.05
Sleep: avg. hours/night	7.19 (1.27)	5.93 (0.95)	2.95**

*$p < .05$; **$p < .01$