Abstract: A study utilizing a college sample compared psychological responses to yoga, water aerobics, and walking. Measurement variables included anxiety, exertion, pain, arousal, and mood. Anxiety was reduced for all modalities, with greatest reduction for water aerobics. Exertion was similar for all modalities suggesting all trials were of similar intensity. Pain was greatest for yoga when compared to the other modalities. Arousal was lowest after yoga and mood was more positive after walking and water aerobics. Results indicate that all modalities provide psychological benefit and institutions of higher education are encouraged to promote these types of wellness activities.

Stress affects college students' physical, mental, social and intellectual health. Stressors most frequently cited by students are lack of ability to manage academic demands, job obligations and family commitments. Other stressors identified included financial responsibilities, changes in living arrangements, social pressures and preparation for life after graduation (National Institutes of Health [NIH], 1997). Over a 13-year period at a large mid-western university, a study examined reasons why 13,257 students were seeking help from the counseling center on campus. From 1988 to 1994, it was found that students most frequently reported relationship problems. Following that period of time, reporting of stress and anxiety problems dramatically increased and superseded the reporting of relationship issues (American Psychological Association, 2003). The National College Health Assessment (NCHA) conducted by the American College Health Association (ACHA) elicited information about barriers to academic performance. For fall 2005, college students ranked stress as the top impediment to academic performance (ACHA, 2005). This finding reinforces a previous statement indicating that stress is associated with impairments to cognitive functioning including the ability to learn, remember and concentrate (NIH, 1997).

College students will not always possess the necessary stress management skills and coping strategies. Physical activity is one coping strategy that is perhaps underutilized by many college students. Exercise not only increases physical fitness but also provides the opportunity for improved mental health. In addition, exercise, especially aerobic, can help to decrease the effects of depression (Strawbridge, Deleger, Roberst, & Kaplan, 2002). Physical activity also releases endorphins thereby decreasing pain and increasing feelings of well being (Viru & Tendzegolski, 1995). An added benefit to promoting increased physical activity among college students is the reduction in the burden of chronic disease in the United States. Estimates are that 400,000 preventable deaths each year are attributed to poor diet and lack of physical activity (Mokdad, Marks, Stroup, & Gerderding, 2004). Research in recent years has led to an overwhelming consensus that physical activity is a key element in health promotion. This consensus has led to the publication of numerous documents extolling the importance of physical activity including the Surgeon General's Report on Physical

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Activity (United States Department of Health and Human Services, 1996) and Healthy Campus 2010 (ACHA, 2002). These documents have helped to set the agenda for conducting research on the benefits of physical activity on physical and mental health in a variety of populations.

One review of literature indicates that single bouts of exercise may offer positive mood effects, release of built-up tension, and general refreshment of the mind regardless of participants’ physical fitness levels (Hansen, Stevens, & Coast, 2001). In a study of a single bout of Tae Kwon Do, a total of 20 novice male and female college students participated in Tae Kwon Do for 75 minutes to determine changes in mood. The Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971) was utilized and contains the following dimensions of mood: vigor, anxiety, depression, anger, fatigue, and confusion. The POMS was administered prior to and after the single bout of Tae Kwon Do. Students in a regular lecture class served as a control group. Findings indicated a significant decrease in scores on tension, depression, anger, fatigue and confusion, and a significant increase in scores on vigor relative to the control group. Global mood was also significantly improved. A related study investigated the impact of various physical activity classes on mood (McGowan & Pierce, 1991). The study included 77 college students enrolled in a running, karate, or weight lifting classes that each lasted 75 minutes. Participants completed the POMS prior to and immediately after their class. Results indicated a significant reduction in total mood disturbance, tension, depression, anger, and confusion for all exercise conditions.

Research to date in college students has also addressed the impact of exercise intensity on mood responses. One study involved 32 female students who completed two eight-minute trials of low-intensity and two eight-minute trials of high-intensity exercise (Steptoe & Cox, 1988). The design allowed for the testing of how physical fitness and music played during exercise might impact mood responses. The POMS was administered prior to and after each exercise bout. High-intensity exercise resulted in increases in tension, anxiety and fatigue. Additionally, vigor and exhilaration were observed to be higher after the low-intensity trial compared to the high-intensity trial. Group differences were not observed for fitness or presence of music with exercise. A similar study investigated the impact of low and moderate intensity exercise on mood as measured by the POMS (Berger & Owen, 1998). Each of the 91 college students completed the POMS before and after 20 minutes of jogging on the treadmill at low and moderate intensities based on heart rate. Results indicated mood was improved from pre to post similarly for each of the prescribed intensities.

Mode of exercise and its relationship to mood and perceptions of stress have also been addressed in the research literature. One of these studies utilized 73 older adults who were randomly assigned to either water or land exercise that included a warm-up, exercise, and cool-down phase (Watanabe, Takeshima, Okada & Inomata, 2000). The primary variable of interest for this study was anxiety as measured by the State Anxiety Inventory (SAI; Spielberger, Gorsuch, Luschene, Vagg, & Jacobs, 1983). This measure was administered before and after exercise and assesses current perceived feelings of tension and apprehension. Both exercise groups scored significantly lower on post-exercise anxiety. However, there were no significant differences in scores between the land and water exercise groups. A similar study utilized both the POMS and SAI to assess how mode of exercise might benefit stress and mood in a college population (Berger & Owen, 1988). Each participant completed bouts of swimming, body conditioning, hatha yoga, and fencing on separate days. After exercising, the participants in hatha yoga were less anxious, tense, depressed, angry, fatigued and confused. Swimming resulted in less tension and confusion, while fencing resulted in improvements in vigor only. Additionally, body conditioning participants reported significant increases in fatigue but no other mood changes. This research collectively suggests that exercise mode and familiarization with exercise may influence reduction in perceived stress.

The review of literature generally suggests that most exercise at low and moderate intensities is beneficial and that some bouts of exercise may be more beneficial than others. However, the existing literature needs to be replicated and extended. Therefore, the purposes of this study were to: (1) examine the relationship between walking, water aerobics and yoga on college students’ levels of stress, anxiety and mood status, (2) identify any changes in students’ levels of stress, anxiety and mood status after the completion of each exercise modality, and (3) identify how perceived exertion and pain might differ between exercise modalities. The selection of the exercise modalities was based on ease of implementation, availability of the facilities and personnel expertise.

**METHOD**

**STUDY POPULATION**

Sixty-one undergraduate students enrolled in two sections of general stress management classes at a regional university in the southeastern United States served as the population for this study. Each eligible student was provided with the following after approval from the institutional review board: (1) description of the research project with informed consent, (2) demographics questionnaire, and (3)
health status questionnaire. Only participants classified as "low-risk" or "moderate-risk" according to the American College of Sports Medicine (ACSM) guidelines were invited to participate in the study (ACSM, 2000). Individuals are deemed to be at low risk if they have no more than one coronary artery disease risk factor, have no overt symptoms of disease, and are young (men < 45 years; women < 55 years). Thirty-seven students completed screening and all exercise data forms (11 males, 26 females, mean age ± SD = 22.6 ± 4.07 years). Participants reported exercising an average of almost four days per week (3.7 ± 1.0), with a range of one to seven days per week. The study population included 73% Caucasians (n=27), 22% African-Americans (n=8), and 5% Hispanics (n=2). Self-report of height and weight indicated that our sample was at the high end of normal weight status according to body mass index (24.5 ± 4.02 kg/m²).

EXPERIMENTAL EXERCISE TRIAL

The modes of exercise utilized in this study were: walking, water aerobics, and yoga. All exercise bouts took place within indoor facilities with climate control that allowed for comfortable exercise environments. Each bout of exercise consisted of five minutes of warm-up, 40 minutes of exercise, and five minutes of cool-down. All participants received supervision and instruction from a skilled professional who facilitated each session of exercise and gave instruction to exercise at a low to moderate intensity. The walking bout was conducted around an indoor track and the yoga bout was conducted in an aerobics studio. The water aerobics bout was conducted in a heated pool. The exercise sessions assumed low fitness level to accommodate the diverse physical fitness level and experience levels of the participants. For all exercise sessions, students were encouraged to wear appropriate and comfortable clothes. One researcher (the instructor for the course) was present during each of the trials to ensure that performance cues were similar. Each participant completed all trials on separate days as part of the laboratory component of their academic course.

INSTRUMENTATION AND PARTICIPATION

Each participant was given detailed written instructions on the use of each scale prior to responding. Stress level was measured using the SAI, which is a reliable, valid, and widely used measure of current perceptions of anxiety (Spielberger et al., 1983). The SAI is a twenty-item questionnaire composed of statements related to level of perceived stress and anxiety. Each item includes the stem "I feel" and sample items include: calm, tense, nervous, relaxed, and worried. Items are scored on a four-point Likert-type scale ranging from not at all (1) to very much so (4). Several items are reverse scored and all items are summed to give an overall anxiety score. This measure was administered before and immediately after each exercise session.

Rating of perceived exertion (RPE) and pain were measured with Borg's CR-10 scale (Borg, 1998). Scores ranged from nothing at all (0) to absolute maximum (10). Arousal was measured with the Felt Arousal Scale (FAS; Svebak & Murgatroyd, 1985). This single item measure is scored on a six-point scale from low arousal (1) to high arousal (6). Example states of low arousal include relaxation and calmness, while high arousal would be indicated by perceptions of feeling tense and "worked-up." Mood was measured with the Feeling Scale (FS; Hardy & Rejeski, 1989) and was based on how pleasant the activity was perceived to be. This single item measure is scored on an eleven-point scale from very bad (-5) to very good (+5). All of the above measures are single-item indicators not subjected to traditional reliability and validity assessments, but are considered to have good face validity and are commonly used in the literature. These data were collected immediately after completion of each exercise trial.

STATISTICAL ANALYSIS

A 3 (Trial: Walking, Yoga, Water Aerobics) x 2 (Time: Pre-Exercise, Post-Exercise) factorial ANOVA with repeated measures on both factors was used to examine anxiety. A one way repeated measures ANOVA was utilized to compare RPE, pain, arousal, and mood immediately at the end of each trial. Follow-up comparisons were conducted when appropriate to determine significant differences. Results for all analyses are reported as statistically significant when p ≤ .05.

RESULTS

Table 1 summarizes means and standard deviations for measured variables. Other statistical findings are reported in distinct sections that follow. The first section below details the results of the repeated measures ANOVA for anxiety measured both immediately before and after exercise. The second and third sections provide findings specific to post exercise measures of exertion, pain, arousal, and mood. Follow-up comparisons were also conducted when as required based on the ANOVA. Effect size (ES) was also calculated from the follow-up comparisons to determine the magnitude of specific comparisons by dividing the mean difference by the pooled standard deviation (Cohen, 1988). Effect size values provide an indication of the magnitude of observed differences and in practical sense show the size of differences between means (small effect: 0.00 to 0.29; medium effect: 0.30 to 0.69; large effect: 0.70 or greater). Small effects are generally conceived as not
Table 1. Mean ± SD Values of Psychological Variables for Each Trial of Exercise

<table>
<thead>
<tr>
<th>Trial</th>
<th>Walking</th>
<th>Yoga</th>
<th>Water Aerobics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Anxiety</td>
<td>31.8 ± 9.9^A</td>
<td>33.1 ± 11.8^A</td>
<td>33.7 ± 11.3^A</td>
</tr>
<tr>
<td>Post-Anxiety</td>
<td>28.7 ± 8.3^A</td>
<td>27.7 ± 11.3^AB</td>
<td>25.1 ± 4.8^B</td>
</tr>
<tr>
<td>Post-Mood</td>
<td>4.19 ± 1.13^A</td>
<td>3.49 ± 1.52^B</td>
<td>4.22 ± 1.16^A</td>
</tr>
<tr>
<td>Post-Arousal</td>
<td>3.94 ± 1.51^A</td>
<td>3.49 ± 1.22^B</td>
<td>4.08 ± 1.26^A</td>
</tr>
<tr>
<td>Post-Exertion</td>
<td>3.11 ± 2.16^A</td>
<td>3.46 ± 2.19^A</td>
<td>3.27 ± 1.97^A</td>
</tr>
<tr>
<td>Post-Pain</td>
<td>1.08 ± 1.50^A</td>
<td>2.08 ± 2.11^B</td>
<td>1.46 ± 2.36^AB</td>
</tr>
</tbody>
</table>

Note:
Mean not sharing superscripts are significantly different (p < .05)
Means sharing superscripts are not significantly different (p > .05)

being practically important whereas medium and large effects are.

ANXIETY
Analysis of anxiety revealed a significant Time effect, F (1, 33) = 20.93, p < .01, a significant Trial x Time interaction effect, F (2, 32) = 4.80, p < .05, but no significant Trial effect, F (2, 32) = .48, p > .05. Follow-up comparisons revealed no significant differences in anxiety prior to exercise (ES < .20 for all comparisons), but did indicate that anxiety was significantly lower post-exercise when compared to pre-exercise (walking: ES = .30; yoga: ES = .42; water aerobics: ES = 1.21). Additionally, anxiety measured post-exercise was significantly lower for water aerobics when compared to walking (ES = .55). The interaction effect indicates that the reduction in anxiety for water aerobics was greater than the reductions exhibited in the other exercise modes.

EXERTION AND PAIN
Analysis of perceived exertion revealed no significant differences between the modes of exercise, F (2, 72) = .35, p > .05. This finding was expected and suggests that the amount of effort required to participate in each trial of exercise was similar. Analysis of perceived pain revealed a significant difference between modes of exercise, F (2, 72) = 3.12, p = .05. Perceived pain was greatest for yoga and follow-up comparisons revealed that pain during yoga was significantly greater than pain experienced in walking (ES = .56).

AROUSAL AND MOOD
Analysis of arousal revealed a significant difference between modes of exercise, F (2, 72) = 4.61, p < .05. Arousal level was lowest in yoga, and follow-up comparison revealed that arousal during yoga was significantly lower than walking (ES = .33) and water aerobics (ES = .48). Similarly, analysis of mood revealed a significant difference between modes of exercise, F (2, 72) = 6.05, p < .01. Mood levels were more positive for walking and water aerobics, and follow-up comparisons revealed that mood was significantly lower for yoga than walking (ES = .53) and water aerobics (ES = .54).

DISCUSSION
All modes of exercise (walking, water aerobics and yoga) studied in this research reduced anxiety. For water aerobics, pre-anxiety scores were high. Some students may have been more anxious because of fear related to water. Despite this baseline elevation in anxiety, water aerobics reduced anxiety more than the other exercise modes. This finding is similar to the reductions in anxiety for water exercise discussed previously (Watanabe et al., 2000). Participants in the current study may have had a calming effect from the water and appreciated its anti-gravity properties.

Pre-anxiety scores for yoga were also high and may have been because this mode of exercise was novel. The reports of higher pain for this mode of exercise may be attributed to some students' low fitness and flexibility levels and higher body fat percentages, making it more challenging to perform the yoga postures. Some of these students may not have used yoga movements thus finding them difficult. However, yoga was most effective in reducing arousal levels thus producing a state of calmness or relaxation. This reduction in tension is similar to the results from a study using yoga in a workplace setting.
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(Gura, 2002). Although participants in our study reported high levels of anxiety and pain initially, this mode of physical activity can provide a state of calmness while increasing vital components of fitness. Mood scores, indicating how pleasant the activity was perceived to be, were more positive for walking and water aerobics, suggesting that students found these types of exercise more enjoyable. Over time and with practice, the students may perceive yoga as being positive and pleasant. As noted by Berger and Owen (1988), mode of exercise and familiarity with the exercise may reduce perceived stress and thus increase pleasure.

There are noted limitations of this study. The convenience sample of 61 undergraduate students enrolled in two sections of general stress management classes may lack generalizability. However, this sample of students represented a variety of individuals from different ages, race and physical activity levels. Additionally, the data was entirely self-report, which may create problems with respect to accuracy even though students were reminded about how confidentiality of their responses would be maintained throughout the study. An objective measure of exercise intensity such as heart rate would have also been beneficial, but was not deemed necessary for this initial exploratory study.

Other researchers have studied the impact of various modalities of exercise on stress anxiety, and mood levels (Hansen, Stevens, & Coast, 2001; McGown & Pierce, 1991; Steptoe & Cox, 1988). However, this study is novel because previous research has not compared these three types of exercise along with measurements of exertion and pain using college students with a wide range of fitness levels. Furthermore, no research reviewed used water aerobics as a means to reduce anxiety and improve mood among college students. Thus, the researchers believe that this study provides new data to add to the growing body of literature regarding the psychological responses to various bouts of physical activity.

RECOMMENDATIONS

The general conclusions of the study support using a variety of exercise modalities in the promotion of health and wellness. One particular recommendation that is derived from this study is that modes of exercise that might be considered “alternative” or “non-traditional” are in fact effective in modulating mood and perceptions of stress. These modalities should be considered as equally important in comparison to other more traditional exercise modalities. Future studies are needed to verify the effects of walking, water aerobics and yoga on college students’ psychological perceptions when engaged in a single bout of physical activity, but this and related studies do suggest that single bouts of exercise can provide a meaningful benefit. Additional research studies should be conducted to examine other exercise modalities and environments to determine their impact on anxiety and mood levels. It also would be advantageous to follow a cohort of college students to investigate psychological changes resulting from regular exercise.

The call to action that emanates from the study centers on health and physical activity programs on college campuses. Attention should be given to the academic programs on campus and those programs that are affiliated with campus recreation. Colleges and universities are encouraged to evaluate their existing resources and priorities with regards to creating a campus that supports healthy behaviors and lifestyles. Part of this process might include performing a needs assessment with respect to campus health. Specific action steps might include the development of new classes, both academic and extracurricular, that promote healthy lifestyles that emphasize physical fitness and stress management. All of these recommendations are part of an attempt to improve the physical activity status of students, which is linked to improved health and academic performance (NIH, 1997). Additionally, university planning teams should consider these kinds of issues when making decisions and recommendations for the building and renovation of campus facilities that have the opportunity to contribute to campus life and health.
REFERENCES


HEALTH EDUCATION RESPONSIBILITIES AND COMPETENCIES

Responsibility IV- Conduct Evaluation and Research Related to Health Education

Competency A: Develop plans for evaluation and research

Competency B: Review research and evaluation procedures

Competency D: Carry out evaluation and research plans

Competency E: Interpret results from evaluation and research

Competency F: Infer implications from findings for future health-related activities

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