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Can Active Seniors Gain Stress-Reducing Results From Acute Exercise?

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ABSTRACT

Not all senior citizens stop being active after society considers them past their prime. Though mental strategies are frequently construed as the treatment of choice for reducing anxiety, a body of literature has shown that somatic interventions such as acute exercises have relaxing effects on young adults and could be effective particularly for seniors as well. This study examined the effects of a brisk walk on somatic state anxiety with older physically fit women. Forty volunteers (age M = 68, SD = 5.3) were randomly assigned to two groups. The experimental group walked for 20 minutes while a control group sat near an indoor running track. Peripheral digital temperature, heart rate, state cognitive and somatic anxiety were measured. A significant somatic change occurred in peripheral digital temperature between groups and between times. The experimental group was less somatically anxious after the walk than after a restful sitting period. Twenty minutes after the walk, the experimental group showed higher levels of peripheral digital temperature. No significant differences were noticed in state anxiety. As healthy elderly women, state anxiety was not manifested prior to the walk likely because the brisk walk was not perceived as a competitive event. This study suggests that a brisk walk will have positive lasting effects on somatic anxiety. Future research should examine the effects of a brisk walk on senior athletes in a competitive environment as it relates to a somatic stress-reducing strategy.

Introduction

Over 14,000 qualifying seniors and took part in the Senior Olympics at Hampton Roads, Virginia, USA in 2003. The Roslyn News reported that the oldest competitor, a male swimmer was 101 years old and there was a 95+-age category for the 100-meter race (Scotchie, 2003). With a 56% increase in the number of Senior Olympics participants from 1999 to 2003, the trend shows that older adults are being active at a higher performance level. More senior citizens are encouraged to continue their sporting involvement at national and international events (e.g., the World FINA Masters championship, Senior Olympics, the Senior National Games and the Golden Age Games).

Like elite competitors, older fit adults must maintain healthy and active lifestyles to remain physically well. Similarly, when taking part in organised activities, the psychological hurdles of physical tension and mental pressures do arise before competing. Athletes regularly use mental training before and during warm-ups. Often, cognitive interventions are seen as the panacea to many sport performance solutions for addressing irrational fears or imaging performance rehearsals to reduce cognitive distracters (c.f. Bakker &Whiting, 1989; Orlick, 2002; Ungerleider, 1996).

Unlike most competitive athletes, senior participants face extra detrimental aging effects; progressively impaired static balance (Gustafson, Noaksson, Kronhed, Moller & Moller, 2000), greater number of chronic diseases (Wild, Peeters, Hoefnagels, Oeseburg, & Binkhorst, 1997), decreasing levels of maximal oxygen uptake, drops in cognitive performance (Pirani, Neri, Belloi, Dinelli & Vecchi, 1984), increased memory loss (Fabre, Masse-Biron, Chamari, 1999).

Older adults cannot rely on mental strategies alone for controlling somatic and cognitive anxiety. One direction to explore has been to examine the effects of exercise for reducing state anxiety and for improving physical attributes. While impaired static balance and chronic diseases are realities, the speed at which maximal oxygen uptake, cognitive performance and memory loss deteriorate can be lessened.

Effects of Aerobic Training on Older Adults

Aerobic training is known to be physiologically helpful for older adults (Cupelli et al., 1984; Hawkins & Wiswell, 2003). Though maximal oxygen uptake of older athletes decreases even with continued vigorous endurance exercise at about 8 to15% per decade, a much greater drop is noticed in sedentary people (Pollock et al., 1997). Some researchers have shown that the master athletes who continue to engage in regular vigorous endurance exercise will reduce the gradual loss in maximal oxygen uptake by about one-half the rate in age-matched sedentary subjects (Rogers, Hagberg, Martin 3rd, Ehsani & Holloszy, 1990).

One study supporting the practical effects of aerobic exercise on older adults, evaluated the outcome of a four-month aerobic exercise program of 51-70 yr old volunteers on several levels including neuropsychological test performance, depression indices, sensory thresholds, and visual acuity (Dustman et al., 1984). Their results showed that aerobically trained participants had significantly improved scores on the neuropsychological test battery compared to the control group. Dustman et al. (1984) suggest that the promotion of better cerebral metabolic activity leads to improved results in lessening memory loss. Further, since aerobic exercise increases maximal oxygen uptake, more oxygen is thought to go to the brain and thereby improving memory (Fabre, Masse-Biron, Chamari, 1999). Though this hypothesis has been contested and may be oversimplified, many studies have examined the effects of aerobic exercise and maximal oxygen uptake on performance (c.f. Hawkins & Wiswell, 2003).

Some researchers have examined the importance of age versus maximal oxygen uptake on performance and have found that active older adults (over 70 years) could carry on a relatively high exercise intensity during long aerobic exercises, i.e., walk 120 kms in four continuous days (Wild, Peeters, Hoefnagels, Oeseburg, & Binkhorst, 1997). Their study demonstrated that maximal oxygen uptake was more influential on performance than age or chronic diseases in active elderly people. Unfortunately, age is a contributing factor to decreasing maximal oxygen uptake (Fabre, Masse-Biron, Chamari, 1999).

Studies by Wild et al. (1997) and by Dustman et al. (1984) were done using exercises of long duration; 120 kms in four days and a four-month aerobic exercise program, respectively. Similarly, Hawkins & Wiswell, (2003) reviewed 17 cross-sectional studies and 17 longitudinal studies with people of different ages. Their motive was to examine long-distance or long-term effects of aerobic exercises on active elderly people. Though these three studies have found positive effects of aerobic training on older adults, the applications for general training are too rigorous and demanding in time for the typically fit older adult who may want to compete.

In pre-competitive situations, a shorter physical intervention could be more convenient for the participant. Active elderly populations have different needs that may not be fully met by mental training (Fabre, Masse-Biron, Chamari, 1999; Pirani, Neri, Belloi, Dinelli & Vecchi, 1984). Encouraging results have come from the use of acute somatic strategies for reducing arousal, stress and physical anxiety. Positive results in cognitive and somatic control have been noted by using physical exercises of short duration. Such results have included lower state cognitive and somatic anxiety, lower resting heart rate and blood pressure levels (Petruzzello & Landers, 1994; Rejeski, Thompson, Brubaker, and Miller, 1992). Slower breathing tempo, lower catecholamines and increases in skin temperature have also been found (Senkfor & Williams, 1995). Similarly, these physiological changes promote a state of relaxation (Lohaus & Klein-Hessling, 2003).

Few studies have examined the effects of short duration exercises on stress and anxiety in elderly populations, particularly with older women (Schneider, 1997). Given the sparse amount of research with this population, further research is warranted for several reasons. First, the ratio in the number of older women to men is increasingly apparent. In 2000, for every 100 American women over the age of 65, there were only 83 American men in the same age category and the ratios become much more drastic as age progresses (U.S. Census Bureau, 2000). Second, Astrand bicycle ergometers (Raglin & Wilson, 1996; Rejeski et al., 1992; Steptoe, & Cox, 1988); treadmill jogging (Bahrke & Morgan, 1978; Petruzzello, & Landers, 1994; Petruzzello, Landers & Salazar, 1993) or a combination of both (Morgan, Roberts, & Feinerman, 1971) have been commonly used as short exercise sessions when dealing with state anxiety. Though controlled exercise bikes and indoor jogging are good leisure and fitness activities for younger adults, older adults do appear to prefer walking (LaCroix, Leveille, Hecht, Grothaus and Wagner, 1996; Morris & Hardman, 1997). Third, confined laboratory settings with treadmills and bicycle ergometers can provoke the "white coat" syndrome where the testing site, an artificial environment, is the source of increased anxiety. The purpose of this exploratory study was to examine the effects of a brisk 20-minute walk on somatic anxiety in older women immediately after the exercise and 20 minutes later.

Method

Participants and Site

Seventy healthy elderly women from various parts of Alberta, Canada, enrolled in a week-long physical activity program (i.e., walking, callisthenics and aqua-aerobics). During a scheduled meeting, a detailed description of the study was given. Those participants wanting to take part, read and signed an informed consent. They also completed a Physical Activity Readiness Questionnaire to confirm that they were physically and medically capable of doing a brisk walk. Participants were randomly assigned to a control or an experimental group. In total, forty volunteers (age range 60 - 78 years, $M = 68 + 5.3$ years) participated in this study. This experiment took place inside a large heated (ambient temperature of $20^{o}C$) pavilion on an indoor 200-meter Tartan track, commonly used by the public for walking/jogging. The indoor track was chosen was because the outdoor weather was too unpredictable in April. This may range from a warm + $15^{o}C$ to a cold windy and slushy $-10^{o}C$ day. The track was reserved for one day during the study to reduce external distractions.

Materials and Instrumentation

The PE 3000 Sport Tester. The Sport Tester is a cardiac self-monitoring telemetry device consisting of a chest belt with two electrodes and a transmitter with a wrist band acting as the receiver. The portable heart rate monitoring system is a valid and reliable tool for measuring ambulatory heart rate (Bar-Or, Bar-Or, Waters, Hirji, & Russell, 1996). The Sport Tester was set to record subjects' heart rate every 15 seconds. While walking, the experimental group subjects maintained a target zone; (60% to 80% of the subject's maximal heart rate) based on each subject's age. This target zone was calculated by using the following equation; 220 - age x 80% or 60% = upper or lower limit (McArdle, Katch and Katch, 1981). Walkers could monitor their pace by listening for their own personal alarm coming from their wrist band. A beep, audible only to them could be heard if they deviated from their personal target zone. All participants were introduced to the sound of the alarm before their walk to ensure that they were capable of hearing it. Researchers checked if the participants remained within their target zone by walking next to them with a receiver. Without a transmitter, experimenters were able to check participants' heart rates without causing any transmission disturbances. Data was then downloaded from each personal heart rate receiver through a PE 3000 interface onto a computer for statistical analysis.

Biotic Bands II & III. Biotic Bands, accurate to 0.5^{o}F, were used for measuring peripheral digital temperature. It has been shown that a positive correlation existed between warm peripheral temperature and low manifestations of stress levels (c.f. Green & Green, 1989). A warmer peripheral digital temperature, after the walk would suggest reduced stress levels.

The Biotic Bands are small black strips containing thermo chromic liquid crystal temperature indicators and have a range of 20^{o}F; Biotic Bands II ranged from 78^{o}F to 98^{o}F while Biotic Bands III ranged from 64^{o}F to 84^{o}F. Liquid crystal squares light up next to the scale of degrees shown on the sides. As they light up, they change from red-tan, orange, yellow-green to blue. Each color represents a difference of 0.5^{o}F.

State Anxiety. Subjects were expected to have some elements of anxiety prior to the walk, similar to a competition for a few reasons. First, all subjects generally came from different parts of the province and as a result, did not know each other. This lack of familiarity amongst peers was expected to be an anxiety-provoking factor. Second, although the experiment was fully explained and researchers were available to answer questions, nervousness was expected because of the upcoming scientific experiment. Nervousness was noted in a few instances. Frequent requests were made about their heart rate and whether or not the equipment was working properly. In addition, a number of participants were having difficulty with attaching the telemetry belt; a simple task requiring fine motor dexterity.

The Competitive State Anxiety Inventory-Form 2 (CSAI-2) was used for two reasons. It was expected that the participants would perceive the scientific experiment like a competition because of its unknown psychological (questionnaires) and physiological results (heart rate and peripheral temperature). Second, this questionnaire evaluates three sub-scales, self-confidence, cognitive and somatic anxiety, with nine items in each of (Martens, Burton, Vealey, Bump, & Smith, 1990). The somatic subscale of anxiety was deemed most important to this study. Participants rate the intensity of their anxiety levels before a competition on a 4-point scale (1 = *not at all*, 4 = *very much so*). In this study, state cognitive and somatic anxiety were the major focus and the self-confidence sub-scale was not used. The CSAI-2 has shown good internal consistency and has been found to have good reliability and validity as a measure of multi-dimensional state anxiety (Martens et al., 1990; Woodman, Albinson, and Hardy, 1997).

Non-Relevant Questionnaire. This questionnaire contained 20 items related to common distractions found in their environment or in their current lifestyle. Items include statements like "I watch television while I eat" and "When I get stressed, I forget things". Responses to each item were scored based on a Likert-type scale ranging from 1 (not at all) to 4 (very much so). This questionnaire was solely used as a time-filler to minimize the chances of having the control and experimental groups interact socially and accordingly the questionnaire was not considered quantitatively.

Design and Procedure

Participants answered a Physical Activity Readiness Questionnaire (PAR-Q) prior to the study (Health Canada, 2002). This questionnaire asks seven questions related to being suitably healthy before undertaking physical activities like brisk walking exercises. Such questions include "Do you feel any pain in your chest when you do physical activity? Do you know of any other reason why you should not do physical activity?" All participants answered favourably.

An hourly schedule was created where 10 subjects, (five experimental and five control group members) were tested. This restricted number of participants lessened the chances for potential confounding variables (i.e., socializing, competitiveness, motivation, confusion, distractions). After a detailed explanation of the study and the equipment, heart rate, peripheral digital temperature, and state anxiety were measured twenty minutes before a walk, immediately post-exercise and twenty minutes after. For the sake of safety, heart rate was also examined after 40 minutes of walking. Personnel were CPR certified and qualified to use the Cardiac Defibrillator on site.

Participants wore the cardiac telemetry system and a lightly wrapped Biotic Band around their index finger. The participants who had digital temperatures lower than 78^{o}F were fitted with the Biotic Bands II and III. All subjects began their Sport tester, sat in comfortable chairs and answered the CSAI-2 while their baseline pulse and peripheral temperatures were taken. The control group then sat 15 meters apart and about 5 meters away from the track watching the experimental group walk. Twenty minutes later, the experimental group began walking, 40 meters apart from each other. A research assistant began the walk with participants to lessen any confusion. An assistant ensured that the target zone was respected while using a second heart rate receiver.

After the walk, the experimental group returned to their chairs and answered the following questionnaires: CSAI-2 and the non relevant questionnaire. Pulse and digital temperature were measured. Twenty minutes later, all subjects were reassessed. Forty minutes after the walk, heart rate was checked again.

Results

As expected, changes in heart rate were quite noticeable because of the walk yet a Group x Time ANOVA with repeated measures showed no differences. In summary, the experimental group's heart rate had dropped by 11.1% after 20 minutes while the control group's heart rate dropped by 3.8%. The drop in heart rate continued even after 40 minutes. Comparatively, the experimental group’s heart rate dropped by 18.2% whereas the control group had seen a 5.0% change.

Peripheral digital temperature changed significantly. Though the experimental group's mean temperature was initially lower 20 minutes before the walk (83.6^{o}F) than the control group's (85.2^{o}F), a substantial temperature increase was noticed at 20 minutes after the exercise (91.8^{o}F and 88.8^{o}F respectively). A Group x Time ANOVA with repeated measures identified a between-groups Interaction Effect, F (2,74) = 6.86; p < .0018 and a Time Effect, F (2,74) = 26.32; p <.01.

In examining state cognitive and somatic anxiety, subjects in both groups displayed scores below 50%, suggesting that anxiety was not a concern for most participants. The experimental group scores were 43.1% for cognitive anxiety and 46.4% for somatic anxiety whereas the control group scored 41% for cognitive and 47.6% somatic anxiety. Twenty minutes after the walk, the scores remained relatively low (38.8% and 45.8%; 26.5% and 31.4%). No significant changes were found.

Discussion

The results of this study showed that a brisk walk had the relaxation-type effects of warming peripheral digital temperature (Basmajian, 1989). Such physiological results are conducive to establishing a solid base for concentration. Older active adults, like other people have preferences in pre-event stress management techniques, active and quick versus passive and long duration (Couture, 1990), cognitive versus affective versus kinaesthetic (Kivisto & Couture, 1997) or cognitive associative versus dissociative training strategies (Couture, Jerome & Tehanyi, 1999).

Preparation for a brisk walk did not provoke strong feelings of anxiety in older women. A number of studies have found acute physical activity to have anxiolytic effects for the average population (Breus & O'Connor, 1998; Morgan, Roberts & Feinerman, 1971; Petruzzello, Jones, & Tate, 1997; Petruzello, Landers, & Salazar, 1994; Raglin & Wilson, 1996). The non-significant results may be attributed to three reasons.

First, the large majority of studies done in this field have examined younger adults and men in laboratory settings doing tasks such as riding bicycle ergometers and jogging on treadmills. As was found by Aldwin, Sutton, Chiara and Spiro III, (1996), it is possible that older women are generally less stressed particularly when exercising in a natural setting. Interestingly, Watanabe, Takeshima, and Okada (2000) found similar low state anxiety results when they examined healthy elderly persons who took part in land and water-based acute exercises.

Second, Netz, Tenenbaum and Sagiv (1988) suggest that changes in psychological responses may not be exercise-induced but rather a result from feeling more comfortable with the experimental process and the immediate surroundings especially near the end of a completed exercise. This group of participants had been together for about three days, staying in the same residence and eating at the same cafeteria. Friendships and familiarization may have contributed to the downfall of high anxiety scores. Future studies should examine the effects of social familiarization and camaraderie on anxiety particularly when preparing for individual sports and competitions.

Third and likely the biggest limitation to this study was the choice of using the CSAI-2 anxiety questionnaire. The participants were not as anxious prior to the event as we had expected. Second, because of the controlled pace between participants, the competitive nature of a brisk walk was diminished. Third, unlike a competition, there were no extrinsic rewards for performance.

Other anxiety instruments may have been better suited for this study. Such instruments as the State Trait Anxiety Inventory (STAI), the Profile of Mood States (POMS), the Adjective Check List, (ACL) and the State Anxiety Inventory (Morgan, Roberts & Feinerman, 1971; Petruzello & Landers, 1994; Steptoe & Cox, 1988) may have provided different results. The CSAI-2 is a valid and reliable instrument for a competitive environment yet this study did not create a suitably competitive environment for the instrument. It is possible that this instrument does not provide an appropriate measurement for studies dealing with acute exercise. For example, in using another inventory, Ekkekakis, Hall and Petruzello (1999) raised questions that are more serious. They looked at the internal consistency and validity of Spielberger's State-Trait Anxiety Inventory's state anxiety subscale when dealing with acute exercise. They concluded that there were conceptual and psychometric problems with the instrument and the concept of activation in C.D. Spielberger's theory of anxiety. Their suggestion was to consider creating a new instrument specifically designed for acute exercise. In future studies, a different anxiety-measuring instrument should be used in place of the CSAI-2. Though a replication of this study would be in order, it appears that gender and age differences do exist and should be further examined.

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