The Effects of a Single Bout of Aerobic Exercise on Spider Fear Treatment Outcomes

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Abstract

Specific phobia involves severe fear or anxiety of a particular object or situation (American Psychiatric Association, 2013). The disorder is associated with disruptions in functioning and often occurs in combination with other mental disorders. Aerobic exercise has not yet been explored as a potential adjunct to therapy for specific phobia, despite its success in facilitating the treatment of other psychological disorders. For example, researchers have recently demonstrated reductions in anxiety constructs through aerobic exercise treatments (Broman-Fulks, Berman, Rabian, & Webster, 2004). It is possible that exercise may have similar therapeutic effects in individuals with specific phobia. This study served to examine the impact of aerobic exercise on spider fear treatment outcomes. Forty-two individuals from the Regina community and University of Regina participant pool were screened for the study and 11 were invited to participate based on eligibility requirements. Seven individuals came into the lab and were randomly assigned to complete an aerobic exercise session (n = 4) or a placebo stretching session (n = 3). Following their exercise treatment, all participants engaged in a one-hour exposure intervention that included viewing images of spiders and watching a spider documentary. Their improvements in fear severity were assessed across the treatment. Subsequent analyses revealed that the groups did not experience significantly different outcomes following the study such that aerobic exercise was not able to enhance the effects of the brief exposure treatment. Recruitment proved to be more challenging than originally anticipated, leading to a small sample size. Implications and future directions are discussed.

Keywords: specific phobia, spider fear, exposure therapy, aerobic exercise

The Effects of a Single Bout of Exercise on Spider Fear Treatment Outcomes

The *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013) characterizes specific phobia by intense fear or anxiety that is caused by a particular stimulus (e.g., spiders). Phobic responses occur with nearly every encounter with the stimulus and at the exact moment of confrontation (i.e., not a delayed reaction). The fear or anxiety response to the feared stimulus also elicits physiological arousal. Individuals with animal-related, natural environment, or situational specific phobia tend to demonstrate sympathetic nervous system activation, such as increased heart rate (LeBeau et al., 2010). Although these individuals experience severe fear, their responses are extreme in relation to the actual threat posed by the object or situation (American Psychiatric Association, 2013). Individuals often engage in active avoidance of the feared stimulus to prevent negative encounters, but this can significantly impair daily life functioning (American Psychiatric Association, 2013).

Specific phobia is associated with significant functional impairments (American Psychiatric Association, 2013). Researchers have found that individuals with the disorder tend to score lower on measures of psychosocial functioning (Stinson et al., 2007). Affected individuals display greater disability compared to those without the disorder (Stinson et al., 2007). Additionally, the level of impairment is similar to that of substance use disorders and other anxiety disorders (Stinson et al., 2007).

Specific phobia is prevalent in the general population. The disorder has a 12-month prevalence of 12.1% for individuals over the age of 13 (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). These rates have led to estimates that the disorder is the most common of all lifetime anxiety disorders and also suggest that it often persists throughout life

(Kessler, Ruscio, Shear, & Wittchen, 2010). Most cases of specific phobia appear before the age of 18 years, which is significant because evidence indicates early-onset anxiety anticipates future diagnoses with other mental disorders (Kessler et al., 2010). In fact, lifetime comorbidity has been established between anxiety disorders, including specific phobia, and mood disorders and in many cases, anxiety precedes diagnoses with depression (Merikangas & Swanson, 2010).

Treatment

Different treatments have been developed to help individuals resolve their specific phobia. Exposure therapy (ET) has been shown to be the most effective form of treatment for the disorder (Wolitzky-Taylor, Horowitz, Powers, & Telch, 2008). This method is characterized by the repeated presentation of the specific object or situation without any harmful consequences, thereby promoting habituation to feared stimuli (Fitzgerald, Seeman, & Maren, 2014). A number of different forms of ET have been developed to treat specific phobia. *In vivo* ET involves a live encounter with the feared stimulus (e.g., a live spider) in a controlled setting across a series of treatments (Choy, Fyer, & Lipsitz, 2007). One-session treatment is a modified version of *in vivo* ET, wherein clients are exposed to their feared stimulus in a single treatment session that lasts approximately three hours (Öst, 1989). Another variation of *in vivo* ET involves individuals viewing images of their feared stimulus (e.g., Matthews, Wong, Scanlan, & Kirkby, 2011). Virtual reality ET is an extension of this, wherein clients are exposed to a virtual situation generated by a computer that involves confronting their feared stimulus (Rothbaum & Hodges, 1999). Clients wear a headset display, complete with visual screens for each eye, earphones, and a monitor to detect movement in the client's head, hand, or foot (Rothbaum & Hodges, 1999).

Interoceptive exposure is an alternative therapeutic method that elicits physiological arousal comparable to anxious sensations (Smits et al., 2008). One theory suggests that

interoceptive exposure is able to elicit reductions in anxiety by generating physiological sensations in the absence of threatening consequences (Stewart & Watt, 2008). Individuals are then able to extinguish their learned fear response. Alternatively, interoceptive exposure may also effectively lessen fears by providing evidence contradictory to the beliefs individuals hold about their bodily sensations. When they are able to experience these cues without any negative results, individuals come to understand that the physiological responses themselves are not harmful.

Researchers have recently focused their attention on exercise as a form of interoceptive exposure for anxiety and related constructs (for a complete review, see Asmundson et al., 2013). Exercise serves to produce physiological responses (e.g., elevated heart rate, breathing rate, & perspiration) that are similar to those experienced in anxiety reactions (Asmundson et al., 2013). This may help individuals learn that these bodily cues are not threatening and may, therefore, reduce catastrophic interpretations (Asmundson et al., 2013). Much of the current research focuses on exercise as a mechanism for reducing anxiety sensitivity (AS), which involves feelings of fear due to an underlying belief that anxiety and its associated physiological responses may cause harm (Reiss & McNally, 1985). Broman-Fulks and colleagues (2004) demonstrated reductions in AS following six sessions of low- or high-intensity aerobic exercise that were 20-minutes long. A related study found that six sessions of aerobic exercise improved AS, regardless of whether a cognitive component was added to the therapy (Smits et al., 2008). Similarly, research by LeBouthillier and Asmundson (2015) suggested that a single bout of aerobic exercise is also capable of eliciting such improvements in AS.

An alternative explanation to the exercise-induced anxiety reductions that have been observed points to changes in brain chemistry. Brain-derived neurotrophic factor (BDNF) has

been thought to play a role in this relationship. BDNF is classified as a neurotrophin, a protein that promotes the differentiation and survival of neurons in development (Vaynman, Ying, & Gomez-Pinilla, 2004). BDNF has been implicated in the process of eliminating learned fear (Powers et al., 2015). A review of research findings revealed that BDNF levels can be increased through short bouts of aerobic exercise in humans, including individuals affected by neurological or psychological disorders (DeBoer, Powers, Utschig, Otto, & Smits, 2012). A study conducted on individuals with panic disorder revealed that these participants had lower levels of BDNF at baseline compared to healthy controls (Ströhle et al., 2010). Furthermore, only those affected by the disorder displayed increases in their BDNF concentrations following 30-minutes of aerobic exercise (Ströhle et al., 2010). Individuals with posttraumatic stress disorder (PTSD) were also shown to experience increases in BDNF levels after 30-minutes of moderate-intensity exercise when paired with prolonged ET (Powers et al., 2015). These participants also reported greater reductions in PTSD symptoms, while those who just received exposure did not display increases in BDNF or improvements in symptoms of PTSD (Powers et al., 2015).

Research has shown exercise to be an effective intervention for a number of different anxiety disorders and constructs, such as AS (Asmundson et al., 2013; Broman-Fulks et al., 2004; LeBouthillier & Asmundson, 2015; Smits et al., 2008). A systematic review of exercise as a treatment for anxiety disorders also revealed that it was capable of eliciting results comparable to those of established anxiety treatments (Stonerock, Hoffman, Smith, & Blumenthal, 2015). While the literature is extensive, it does not include information on exercise as a form of treatment or treatment adjunct for specific phobia. AS appears to play a role in the disorder (Paulus, Talkovsky, Heggeness, & Norton, 2015; Vanden Bogaerde & De Raedt, 2011), which

may mean that exercise could be a useful tool in helping those affected by specific phobia as well.

Purpose

To date, the effect of aerobic exercise in conjunction with ET for specific phobia has not been examined. The proposed study was designed to address whether a short bout of aerobic exercise can enhance ET outcomes in individuals with spider fear. A randomized controlled trial design was used to administer ET to all participants in combination with either a brief session of aerobic exercise or placebo stretching. I hypothesized that the ET session would be sufficient to reduce fear across all participants. Furthermore, I anticipated that outcomes with aerobic exercise would be enhanced, based on past literature examining the role of exercise in facilitating anxiety reductions (Asmundson et al., 2013; Broman-Fulks et al., 2004; LeBouthillier & Asmundson, 2015; Smits et al., 2008).

Method

Participants

Participants were recruited from the community using advertisements in the media and from the University of Regina participant pool. Students who completed the study received three course credits for their involvement. Individuals were eligible to participate if they were between the ages of 18 and 65, indicated a severe spider fear, and appeared to be able to safely engage in aerobic exercise. I intended to recruit 20 participants to achieve a sample size that was comparable to similar studies examining the treatment of spider phobia and anxiety (Broman-Fulks et al., 2004; Guastella, Dadds, Lovibond, Mitchell, & Richardson., 2007; LeBouthillier & Asmundson, 2015; Smits et al., 2008; Vansteenwegen et al., 2007) and that would be manageable given the time constraints associated with the Honours Program.

Measures

Physical Activity Readiness Questionnaire Plus (PAR-Q+; Warburton, Jamnik, Bredin, & Gledhill, 2011). The first section of the PAR-Q+ contains seven items designed to identify any potential risks associated with an individual's participation in aerobic exercise. Participants that responded "no" to all seven questions in this portion were deemed fit to participate. Participants that respond "yes" to any of these seven items were directed to a follow-up section composed of questions intended to help researchers gain a better understanding of the participant's health problem(s). If they responded "yes" to any of those follow up questions, they required a doctor's note clearing them for participation in the exercise portion of the study. Responses to the PAR-Q+ were only used to assess whether participants were qualified to engage in the study and were not included in later analyses.

Watts and Sharrock Spider Phobia Questionnaire (WS-SPQ; Watts & Sharrock, 1984). The WS-SPQ evaluates domains of vigilance, preoccupation, and avoidance-coping related to spider phobia. The 43-item questionnaire consists of questions to be answered in a yes/no format (e.g., "Are you always on the lookout for spiders?"). An answer of "yes" indicates a more phobic response on the majority of questions. For each phobic response, individuals earn one point. Total scores are then obtained from the sum of all responses. The measure displays good internal reliability, in that high scores on the measure correlated with high levels of subjective anxiety in response to participants seeing a spider (Watts & Sharrock, 1984).

The WS-SPQ has been chosen for the study to examine the cognitive and behavioural aspects of spider fear in participants and to screen participants for the study. I determined the minimum scores required on the subscales of the WS-SPQ based on the means and standard deviations reported for the control group used in the development of the measure (Watts &

Sharrock, 1984). Participants had to score one standard deviation higher than the mean for each subscale to be eligible to participate. Participants qualified for the trial if they obtained a score greater than or equal to five on the vigilance subscale, one on the preoccupation subscale, and four on the avoidance-coping subscale.

Fear of Spiders Questionnaire (FSQ; Szymanski & O'Donohue, 1995). The FSQ is an 18-item questionnaire designed to examine spider fear in a complementary fashion to the WS-SPQ (e.g., "If I saw a spider now, I would think it will harm me."). Each item is measured using a seven-point Likert scale. Scores are obtained by summing the values of the responses to each question. This assessment tool has been shown to have good internal consistency (Cronbach's $\alpha = .92$; Szymanski & O'Donohue, 1995). The questionnaire demonstrates convergent validity, construct validity, split-half reliability, and sufficient test-retest coefficients (Szymanski & O'Donohue, 1995). This measure was selected for the study because it assesses cognitive, behavioural, and physiological domains as well as negative attitudes and fear of harm by spiders; therefore, it will add to the information obtained from the WS-SPQ.

Depression Anxiety Stress Scales – 21 (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 is a 21-item report measure that examines symptoms of anxiety and depression (e.g., "I couldn't seem to experience any positive feeling at all."). Responses are listed on a scale from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*). Total scores are obtained by adding together all responses. The measure has high internal consistency for depression (Cronbach's $\alpha = .85$), anxiety (Cronbach's $\alpha = .81$), and stress (Cronbach's $\alpha = .88$) in addition to sufficient concurrent validity (Osman et al., 2012). Scores on the DASS-21 were collected to better understand the characteristics of the sample. These results were not used in later analyses.

Subjective Units of Distress Scale (SUDS; Wolpe, 1982). The SUDS is a rating scale used to measure the subjective distress experienced by an individual in their current situation. The scale contains scores ranging from 0 (*no distress*) to 100 (*most distress ever experienced*). This assessment was administered to participants throughout the course of the treatment condition to quantify the amount of distress associated with the exposure.

Procedure

A total of 42 individuals who expressed initial interest in the study were screened using the PAR-Q+, WS-SPQ, FSQ, and DASS-21. The advertisements used for the study contained a link to Qualtrics (https://www.qualtrics.com) that was accessible online and allowed them to complete these measures. Before they entered the questionnaire, they were presented with a consent form. The form outlined the purpose of the study, the role of participants, the methods used to ensure confidentiality, the possible benefits participants would experience for their engagement, their right to withdraw, and the manner in which assistance would be provided or questions answered. Participants were required to provide consent electronically before proceeding to the screening questionnaires.

If participants met the minimum required scores on each subscale of the WS-SPQ and there were no concerns regarding their responses to the PAR-Q+, they were notified that they qualified to participate by email. Eleven individuals were contacted to confirm they were eligible for the in-lab portion of the study and subsequently, seven of them came to participate. Their scores from the screening process served as their pre-treatment scores in data analysis.

On the day of the study, participants came into the lab and completed consent first. They were instructed to read the consent form once by themselves and then a research assistant reviewed particularly important sections (e.g., the right to withdraw) verbally with them. If there

were no concerns at that point and they were still willing to volunteer, they signed the consent form to indicate they agreed to participate.

Once consent had been provided, participants were randomized to their exercise condition. Sealed envelopes were prepared beforehand and contained either a "1" or a "2". There were an equal number of each kind of envelope and randomization was done in blocks of four (i.e., the first participant in a block would choose from four envelopes, the second participant would choose from three envelopes, and so on, until all envelopes had been selected). Individuals were randomized to aerobic exercise (AE) if they chose a "1". If they chose a "2", they were randomized to placebo stretching (PS).

Exercise session. Four individuals were randomized to the AE condition (age M = 30.50, SD = 17.97) and three were selected for the PS condition (age M = 20.00, SD = 2.00). Individuals in the AE + ET group then completed a 50-minute aerobic exercise session with a personal trainer. This involved briskly walking on a treadmill, first beginning with a slower and easier pace to allow the participants to warm up. The warm-up lasted approximately 10 minutes, during which individuals reached their target heart rate that was calculated as 60-80% of their age-adjusted maximum heart rate reserve. Participants continued exercising at this rate for approximately 30 minutes and concluded the final 10 minutes of exercise with a cool down. The cool down allowed participants to slowly return their heart rate to its resting pace.

Individuals in the PS + ET condition followed the same protocol; however, they engaged in a 30-minute session of passive stretching exercises with a personal trainer instead of aerobic exercise. Participants worked through a sequence of 36 different stretches used by LeBouthillier and Asmundson (2015). These exercises were designed to engage various muscles in the body. They were not intended to elicit physiological responses, such as increased heart rate, increased

breathing rate, and perspiration, in the way that the aerobic exercise was. Each stretch was held for 30-35 seconds and participants were permitted to rest briefly between each extension.

Treatment session. Following the exercise condition, all participants engaged in a one-hour ET session using images of spiders and National Geographic's *Incredible Spiders* documentary presented on YouTube (Keller, 2016). The entire ET session was presented on a 13" laptop screen for all participants. The images were presented in a PowerPoint. The slideshow began with less intimidating pictures, first of just a spider web and then realistic line drawings of spiders (see Appendix A). Eventually participants were exposed to photos of real spiders, first containing spiders pictured at a distance and then closer up. The PowerPoint contained a total of 10 pictures that were displayed for 30 seconds each. Immediately after, participants watched *Incredible Spiders* (Keller, 2016). The documentary presents information on various types of spiders found all over the world. It is approximately 45 minutes long. This represented the maximum level of exposure in the session. A researcher remained in the room with participants as they worked through the ET. Participants were assessed using the SUDS every five minutes in order to quantify the amount of distress they were experiencing throughout the exposure. Following the completion of the ET, participants electronically completed the same measures used at pre-treatment, with the exception of the PAR-Q+.

In the event that a participant ended the study with a high SUDS rating, at least one of the researchers was available to work with the participant to reduce their distress levels. Additional help was accessible to participants to ensure they did not leave the session feeling more afraid than they did before and to prevent reinforcement of their fear. Participants were also provided with the contact information of community resources that may have been helpful if they experienced significant distress following the study. These resources include the Regina Mobile

Crisis Hotline, the Regina Adult Mental Health Clinic, Regina Family Services, Regina Catholic Family Services, University of Regina Counselling Services, and University of Regina Psychology Training Clinic. Although these safeguards were put in place, none of the participants required help with distress management.

Data Analysis

The Statistical Package for the Social Sciences version 23 (SPSS; IBM Corp., 2015) was used to conduct all analyses. An independent samples *t*-test was utilized to examine SUDS ratings. This test was used to determine if there were differences between exercise groups in final SUDS ratings. Final SUDS scores served as the test variable. These were grouped according to whether participants were in the AE or PS condition. Peak SUDS ratings during the treatment were also examined using an independent samples *t*-test, with maximum scores as the test variable arranged according to exercise group.

A repeated measures ANOVA was conducted to determine the differences between exercise groups in changes in total WS-SPQ scores, using exercise condition (AE or PS) as the between-subject factor and change in score (baseline score, final score) as the within-subject factor. Another repeated measures ANOVA was used to examine differences in the total change in the vigilance subscale scores, again using exercise type (AE or PS) as the between-subject factor and vigilance score (initial vigilance, final vigilance) as the within-subject factor. Changes in preoccupation scores were analyzed using exercise (AE or PS) as the between-subject element and preoccupation score (initial preoccupation, final preoccupation) as the within-subject element. A final repeated measures ANOVA was used to examine the difference in changes in final avoidance-coping scores with type of exercise (AE or PS) as the between-subject element

and avoidance-coping score (initial avoidance-coping, final avoidance-coping) as the within-subject element.

A repeated measures ANOVA was also used to examine changes in FSQ scores across the treatment, based on the type of exercise completed. Changes in score (initial score, final score) served as the within-subject factor. Exercise condition (AE or PS) served as the between-subject factor.

Results

Despite considerable interest in the study, with 42 responses to the eligibility questionnaire, only a handful of individuals qualified to participate in the in-lab portion. Recruitment continued to be a challenge when trying to schedule participants to come into the lab. Although 11 individuals met eligibility criteria, four of them declined to participate any further. One individual stated they were too uncomfortable participate in the ET session, the second had scheduling conflicts with laboratory hours, and researchers were not able to contact the last two individuals. As a result, statistical analyses have been conducted with a limited sample size of seven individuals.

Pre-Treatment Characteristics

Individuals in the AE group obtained an average score of 11.50 (*SD* = 4.65) on the DASS-21 at pre-treatment. Those in the PS condition scored slightly higher on the measure (*M* = 13.67, *SD* = 13.43). Overall, the differences between groups did not appear to be substantial.

The average WS-SPQ total score at baseline for individuals in the AE group was 20.00 (*SD* = 6.05). Participants in the PS condition had a mean score of 17.33 (*SD* = 2.08) before treatment. Individuals in the AE condition reported an average score of 90.00 (*SD* = 21.77) on the FSQ while participants in the PS condition obtained an average score of 90.67 (*SD* = 21.96).

There did not appear to be sizeable differences between the groups in baseline scores. Table 1 summarizes the responses to the pre-treatment measures for spider fear.

Table 1

WS-SPQ and FSQ Scores at Baseline for Participants in the AE and PS Groups

	Aerobic exercise group (n = 4)		Stretching group (n = 3)	
	M	*SD*	*M*	*SD*
Total WS-SPQ Score	20.00	6.05	17.33	2.08
Total vigilance score	8.25	3.30	6.33	1.53
Total preoccupation score	5.75	3.77	4.33	1.53
Total avoidance-coping score	6.00	1.41	6.67	1.53
Total FSQ score	90.00	21.77	90.67	21.96

Post-Treatment Characteristics

At follow-up, participants in the AE group reported a total average score of 21.50 (*SD* = 4.79) on the WS-SPQ. Those in the PS condition had a mean final score of 18.00 (*SD* = 4.58) on the measure. Individuals in the AE condition obtained an average score of 84.25 (*SD* = 5.37) on the FSQ while the average score for those in the PS condition was 97.33 (*SD* = 21.39). Table 2 summarizes the post-treatment fear scores.

Table 2

WS-SPQ and FSQ Scores at Follow-Up for Participants in the AE and PS Groups

	Aerobic exercise group (n = 4)		Stretching group (n = 3)	
	M	*SD*	*M*	*SD*
Total WS-SPQ score	21.50	4.79	18.00	4.58
Total vigilance score	7.50	2.08	6.33	1.15
Total preoccupation score	8.00	4.08	5.00	3.46
Total avoidance-coping score	6.00	1.83	6.67	.58
Total FSQ score	84.25	5.37	97.33	21.39

Changes in SUDS Ratings

The AE group began the treatment with higher SUDS ratings (M = 15.00, SD = 10.00) than the PS group (M = 6.67, SD = 5.77). There did not appear to be substantial differences between participants in initial scores. The AE group demonstrated slightly lower peak ratings during the treatment (M = 55.00, SD = 5.77) than the PS group (M = 60.00, SD = .00), although this difference was not significant, $t(5) = -1.46$, $p = .20$. Participants in the AE group provided slightly higher SUDS ratings at the end of the ET session (M = 40.00, SD = 8.16) compared to the individuals in the PS group (M = 36.67, SD = 12.01). This difference was not found to be significant, $t(5) = .30$, $p = .78$

Changes in WS-SPQ Scores

Analyses revealed no main effect for change in WS-SPQ scores across the treatment, $F(1, 5) = 1.86$, $p = .23$, $\eta_p^2 = .27$. There was no main effect between exercise groups, $F(1, 5) = .75$, p

= .43, η_p^2 = .13. Finally, there was not a statistically significant interaction between score change and exercise group, $F(1, 5)$ =.28, p = .62, η_p^2 = .05.

There was not a significant main effect for change in scores on the vigilance subscale across the treatment, $F(1, 5)$ = .18, p = .75, η_p^2 = .02. There was also no main effect between exercise conditions, $F(1, 5)$ = 1.25, p = .31, η_p^2 = .20. There was no significant interaction between change in vigilance score and group, $F(1, 5)$ = .18, p = .75, η_p^2 = .02.

There was no main effect for changes in the preoccupation subscale between pre- and post-treatment, $F(1, 5)$ = 2.48, p = .18, η_p^2 = .33. Differences between the groups did not produce a significant main effect, $F(1, 5)$ = .78, p = .42, η_p^2 = .14. Results revealed that there was not a significant interaction between change in preoccupation scores and exercise condition, $F(1, 5)$ = .73, p = .43, η_p^2 = .13.

The findings indicate there was no main effect for changes in the avoidance-coping subscale across the treatment, $F(1, 5)$ = .00, p = 1.00, η_p^2 = .00. There was no main effect between conditions, $F(1, 5)$ = .44, p = .54, η_p^2 = .08. There was also no interaction between avoidance-coping change and type of exercise, $F(1, 5)$ = .00, p = 1.00, η_p^2 = .00.

Although the results did not demonstrate statistically significant differences between the AE and PS groups in fear reduction, some individuals did appear to experience improvements in their level of fear. Two participants lowered their total WS-SPQ scores by approximately one point each. Both belonged to the PS group.

Additionally, of the participants that did not experience score reductions or whose scores even increased, there were changes in scores on the individual subscales. Many individuals reduced their score on one subscale while scoring higher on another. One fairly stable trend

appeared in the preoccupation scores, in that there tended to be increases in the subscale from pre- to post-treatment. These ranged from one to six additional points across participants.

Changes in FSQ Scores

There was no main effect for changes in FSQ scores across the study, $F(1, 5) = .003$, $p = .96$, $\eta_p^2 = .001$. There was also no main effect between the AE and PS groups, $F(1, 5) = .40$, $p = .56$, $\eta_p^2 = .07$. There was no interaction between FSQ score changes and exercise condition, $F(1, 5) = .49$, $p = .52$, $\eta_p^2 = .09$.

Despite a lack of statistically significant results in changes on the FSQ, some individuals did demonstrate decreases in scores across the treatment, indicating decreases in fear. Three participants were able to reduce their scores by at least five points each. One participant belonged to the PS condition while the remaining two individuals were in the AE condition.

Discussion

This investigation used a randomized controlled trial design to examine the impact of aerobic exercise on a brief ET session for spider fear. The study design included an AE condition and a PS condition, both followed by one-hour of ET. Individuals in the AE group ($n = 4$) spent approximately one hour on a treadmill, with 30-minutes spent in the active component of the condition where participants were exercising at 60-80% of their age-adjusted maximum heart rate reserve. The remainder of the session was dedicated to warm-up and cool down. Conversely, those in the PS condition ($n = 3$) spent approximately 30 minutes working through a sequence of 36 stretches. All participants followed their exercise with an hour-long ET session watching images and videos of spiders.

A single bout of aerobic exercise was not found to be able to enhance reductions of spider fear accomplished through a brief ET session. The AE and PS groups used in this study did not

differ in changes in total score on the WS-SPQ and FSQ. Furthermore, individuals did not score differently across the treatment on the vigilance, preoccupation, and avoidance-coping subscales of the WS-SPQ. The participants did not display significantly different levels of fear at study completion.

Almost all participants followed the expected trend for SUDS ratings during the ET session. The majority of individuals began with lower distress ratings, which then increased with greater exposure to spiders, and subsequently dropped toward the end of the session. It seems as though participants became slightly more comfortable with spiders as they experienced greater levels of confrontation, based on reductions in SUDS ratings.

Despite a lack of changes in scores overall on the WS-SPQ, some participants did experience reductions. Additionally, almost all participants displayed changes in subscale scores, such that score on one subscale would decline while the score on another subscale would increase. Higher scores after treatment were seen most often on the preoccupation subscale. Increases may have been occurred because this dimension of spider fear was measured immediately after participants engaged in an ET session. Individuals may have been distracted by the images and video that they saw just prior to completing the follow-up questionnaire and this may have impacted their subsequent responses.

It may be the case that individuals who may have experienced the greatest benefit from the intervention were too apprehensive to participate. Individuals with severe spider phobia may engage in avoidance behaviours so that they do not have to confront their fear (American Psychiatric Association, 2013). It may be important that future recruitment efforts emphasize that the study does not involve any kind of contact with live spiders. Potential participants should also be reassured that the ET session is designed in a way that will allow them to become more

comfortable with spiders so that they are able to handle increasing levels of exposure. Researchers should reiterate to them that someone from the research team will be present throughout the course of the treatment and will ensure that they are experiencing manageable levels of distress.

Limitations/Future Directions

This study was only able to investigate the impact of exercise on spider fear. Other types of fear were not included in the current examination. Subsequently, the results are restricted in the degree to which they may generalize to apprehension of other animals. The study is also limited in that it did not incorporate diagnoses of animal-related specific phobia based on *DSM-5* criteria. This examination only included the assessment of significant spider fear. It is important to assess individuals who qualify for a diagnosis with spider phobia to determine how they respond to the intervention. Lastly, a lack of follow-up with participants presents a limitation. It is impossible to know if the results were maintained after the study's completion.

Based on the results obtained from the current study, I have four main suggestions for future research:

1. Although recruitment for this study will be ongoing, researchers should replicate the current design using a larger sample size. Use recruitment methods that help individuals feel more comfortable with coming in to complete the study. It may also be even more important when dealing with this kind of clinical sample to reinforce that participants will not be required to confront live spiders.
2. Investigate a different type of animal fear using aerobic exercise as a treatment adjunct. It is possible that individuals with other kinds of fears may respond to interventions involving aerobic exercise in the same way as those with significant spider fear. It would

be ideal to begin with another animal-related fear (e.g., snakes) and then explore other types of apprehension (e.g., injection fear).

3. Examine the impact of multiple sessions of aerobic exercise and treatment on spider fear. Individuals may need to experience exercise and exposure multiple times before they observe any changes in their level of fear. Work should be done to investigate the impact of three or four sessions distributed across numerous weeks.

Implications

This research demonstrated the challenges of working with samples of fearful individuals. I received a large number of responses to the eligibility questionnaire, but very few individuals qualified to participate. Those who experience significant fear may avoid all situations in which they may come into contact with their feared stimulus, which may explain the limited number of eligible individuals. Future recruitment efforts must take this into consideration.

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Appendix A: Images of Spiders Presented to Participants

Image #1

Image #2

Image #3

Image #4

Image #5

Image #6

Image #7

Image #8

Image #9

Image #10