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An Exposure-Based Intervention Dismantles College-Aged Females' Barriers for Resistance Training: Project WONDER Training

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Abstract: This study aimed to examine the effects of an exposure-based resistance training (RT) intervention on perceived barriers, benefits, and motives for RT in college-aged females and to assess moderating effects of a trainer-trainee relationship on any intervention outcomes. A sample of 13 (M_{age} = 20.7 ± 1.3y) physically active, non-resistance training female students completed an 8-week intervention (1hr 45min, twice per week). The intervention was effective in reducing perceived time/effort ($t[12] = 5.02$, $p < 0.001$, $d = 1.81$), physical effect ($t[12] = 2.48$, $p = 0.029$, $d = 0.86$) and social ($t[12] = 4.86$, $p < .001$, $d = 1.97$) RT barriers. A positive change pattern was established in stress management ($t[12] = 2.21$, $p = 0.048$, $d = 0.62$), revitalization ($t[12] = 2.71$, $p = .019$, $d = 0.95$), and enjoyment ($t[12] = 3.53$, $p = .004$, $d = 1.18$). Finally, the analyses showed that goal ($\beta = 0.23[0.02]$, $p < 0001$, $R2 = 0.979$) and bond ($\beta = 0.21[.01]$, $p < 0001$, $R2 = 0.995$) alliances were positive moderators with large-sized effects on changes in physical barriers. For stress management, bond alliance was the only statistically significant, small-sized moderator, with a greater bond increasing the effect on the intervention ($\beta = 0.21[.01]$, $p < 0001$, $R2 = 0.997$). This data suggests that an exposure-based RT intervention is beneficial for reducing perceived RT barriers in physically active, non-resistance training college-aged women and that bond-oriented support from the trainer is especially impactful in reducing some of those perceived barriers.

Keywords: Exercise, Benefits, Motives, Self-determination theory, Health belief model, Therapeutic alliance

Samantha Thompson obtained both a Psychology degree in 2017 and a MS in Kinesiology in 2020 from the University of Georgia. Her primary research interests regard behavioral health, perceptions and motivation, and her goal is to observe and intervene within various populations in order to promote positive lifestyle changes and improve overall wellbeing. Furthermore, she hopes to continue to contribute to the behavioral sciences in a way that is both applicable and impactful for the general population.

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the overarching goal of her research program is to create and disseminate knowledge regarding the importance of exercise/physical activity and a healthy diet for well-being, broadly defined, with a special interest in middle-older adults, college students, and women's health.

1. Introduction

Resistance training (RT) is exercise known for its variety of benefits, and it plays an important role in population health [1]. RT (i.e., weight training or strength training) is a modality of exercise in which the muscles of the body perform or attempt to perform work through eccentric, concentric, and/or isometric contractions against an opposing force [2]. RT typically involves the manipulation of variables, such as volume and/or intensity, to achieve specific strength, power, endurance, and/or hypertrophy goals, and it includes body weight exercises, elastic band movements, weight training machinery, and free weights [2,3]. Current guidelines for healthy adults recommend that, at a minimum, individuals should accumulate 2-3 non-consecutive days per week of RT focusing on multiple muscle groups and incorporating 3-5 sets of 8-12 repetitions for each movement performed [3].

While regular participation in RT plays a vital role in the promotion of healthy aging and prevents many chronic conditions (e.g., type 2 diabetes and metabolic syndrome), RT is especially beneficial for female populations [1]. RT has been shown to reduce and prevent fat gain [4-6] and plays a vital role in the prevention, improvement, and reversal of bone mineral density losses in pre- and postmenopausal women [1,7]. Despite these well-established benefits and national recommendations to adopt healthy RT habits early in life, more than 75% of college-aged females do not meet the current recommendations [8,9]. Furthermore, research has shown that young women have specific barriers [10-12] and maladaptive exercise motives [13-16] for RT limiting their participation in healthy RT behaviors. Thus, specific RT intervention efforts are warranted to lower these RT barriers in college-aged females.

Although numerous theories and models have been presented to examine health behaviors, including exercise participation, the Health Belief Model [17] has remained relevant across time and could be used to best explain the lack in healthy RT activity among college-aged females. The Health Belief Model theorizes that behavior exists on a continuum of four domains, namely perceived benefits and barriers, motivation/motives, perceived susceptibility and severity, and cue to action. While perceived benefits/barriers can be numerous and individual, previous research has identified four benefits and four barriers to be the most central for RT participation [18]. Perceived benefits can be categorized as 1) psychological (i.e., builds confidence, helps one feel better in general), 2) social (i.e., provides a way to meet people, is competitive), 3) body image (i.e., improves appearance, improves self-image, helps maintain weight), and 4) health (i.e., improves strength, increases metabolism) benefits. In addition, research has identified the following perceived barriers, as 1) time/effort (i.e., too much work, too inconvenient), 2) social (i.e., no familial encouragement), 3) physical (i.e., too uncoordinated, causes sore muscles), and 4) specific obstacles (i.e., prior obligations, medical problems), to hinder RT engagement [18].

Motivation research, on the other hand, has shown that individuals have several motives for exercise, including psychological (i.e., stress management, revitalization, enjoyment, and challenge), interpersonal (i.e., social recognition, affiliation, competition), health (i.e., health pressures, ill-health avoidance, positive health), body-related (i.e., weight management, appearance), and fitness (i.e., strength/endurance, nimbleness) motives [19]. These operationalizations have been centered on the concepts of intrinsic (i.e., engaging in behaviors due to reasons that are intrinsically stimulating and pleasurable) and extrinsic (i.e., engaging in behaviors for the purpose of extraneous outcomes) motivation, terminology conceptualized by the Self-Determination Theory [20]. Intrinsic motives are theorized to be more adaptive, whereas extrinsic motives tend to overlap with the maladaptive [21]. Although not fully aligned with the theory, it has been argued that psychological, health, and fitness motives are mostly intrinsic, whereas interpersonal and body-related motives are better understood as extrinsic [19-22].

Recent studies have indicated that perceived benefits and barriers as well as motives seem to be important factors facilitating and hindering college-aged females' exercise habits [10-16, 23, 24]. It has been shown that college-aged females are aware of the multitude of beneficial effects of RT whether or not they participate in RT itself, but perceptions of barriers are viewed very differently between females that regularly participate in RT and those that do not [10,11]. Specifically, non-training females have reported higher RT barriers, particularly in time/effort, social, physical effects, and specific obstacles, compared to females currently training [10,11]. Researchers, such as Dworkin (2001) and Salvatore and Marecek (2010), have worked to further define the explicit impediments that hinder RT engagement within female populations. They found that a "gender coding" (i.e., the assignment of traits, behaviors, and/or actions exclusively to one gender) of exercise modalities and fitness equipment existed in fitness facilities and centers, posing as a threat for female RT participation and maintenance. Furthermore, it was discovered that many females were limited by the societal standards of femininity and its perceived loss through the strength and musculature that accompanies RT [23,24], and many lacked further engagement due to proficiency, evaluation, competence, and appearance concerns [24].

Similar to the aforementioned perceived barriers for RT engagement, studies have shown that motives for exercise itself follow a multidimensional pattern. With respect to college-aged females, these exercise motives tend to be gender specific [13,16] and relate to participants' experience levels [14,15]. Researchers have found that females are primarily motivated for exercise by extrinsic, body-centered motives (e.g., weight management and appearance), whereas their male counterparts are typically motivated by intrinsic, fitness-related motives [13,16]. Females also appear to have greater motive for exercise when the modality is aerobic-related [16] compared to their male counterparts whose motives for exercise are independent of modality [23,24]. Research has shown that with exercise experience, these maladaptive extrinsic motives tend to shift toward more adaptive extrinsic and intrinsic motives [13-15] – motives that have been shown to have a higher impact on exercise adherence [13-16] as well as exercise frequency and volume [25].

Despite the evidence indicating that perceived RT barriers and motives are important predictors of exercise adoption and participation, to date, very few interventions have been conducted to examine how RT benefits/barriers and motives change across time [26-29]. Previous research in this age group has focused primarily on the effectiveness of RT in (a) physical functioning [26], and (b) physical self-concept [27-30], with positive intervention effects found in college-aged females' muscle strength/endurance and self-esteem and self-worth. In addition, research has shown physical activity interventions to be relatively successful in reducing adult females' physical activity barriers, although these barriers have not been shown to change among teenage girls [31]. A recent meta-analysis summarized that RT interventions can be efficacious in improving participants' self-efficacy, physical strength, physical self-worth, and global self-worth [30]. However, this meta-analysis was focused on both genders and limited to an age group of up to 18 years in age.

Due to the nature of some of the barriers/benefits and motives for RT, researchers have suggested that interventions specifically led by well-informed, female instructors and structured for the purpose of overcoming RT barriers may be beneficial for altering the negative RT perceptions [23,24,32]. It has been demonstrated that cognitive and behavioral approaches utilizing exposure techniques that elicit fear extinction have been successful in helping individuals overcome a variety of fear-related barriers [33] and avoidance behaviors [34,35] with respect to mental health. Methods of exposure therapy involve repeated exposure to a negatively perceived stimulus until that stimulus is no longer viewed as a threat (i.e., fear extinction) [33]. Furthermore, previous and recent evidence has indicated that therapist-assisted (i.e., therapist is present) exposure within real-world settings helps counteract avoidance behaviors [36] and fosters positive results regarding accountability, graded exposure, and reinforcement [37].

Exposure-based therapies have typically been used to treat anxiety disorders and addiction [38]; however, there is some evidence that supports exposure techniques in exercise settings, specifically regarding pain reduction. Researchers, such as Crombez *et al.* (1996) and Goubert *et al.* (2002), have discovered that exposure through repetition of specific movements associated with participants' perceptions of pain significantly decreased the fear regarding those exercises and the expectation of high levels of pain with performance. Further research has suggested that graded exposure *in vivo* (i.e., exposure in which a participant's fears are categorized from least to most fear-provoking and are activated gradually, challenged, and disconfirmed in order to reduce perceptions of threats) may be the best technique for reducing pain-related fear regarding exercise [41]. While the aforementioned graded exposure and therapist-assisted techniques have been found translational in science [42-44], the impact of a gradual, hierarchal exposure approach supported by experienced trainers with respect to treating RT-related fears/barriers in college-aged women is unknown.

Recent advances have also suggested that the trainer – trainee relationship may be an important factor moderating the intervention efficacy [45]. The impact of the trainer – trainee relationship (or therapeutic/working alliance), as operationalized by Bordin (1979), can be divided to three main components: (1) the trainer – trainee agreement of goals, (2) the trainer – trainee agreement on intervention tasks, and (3) the affective bond between the trainer and trainee. Although research in medicine and psychology has focused on the impact of therapeutic alliance on treatment outcome [47-49], with regard to research in exercise, much of this research has focused on success in and adherence to weight loss interventions [45]. Though previous literature has encouraged an established alliance between trainees and trainers for successful exercise interventions amongst the college-aged population, very little research to date has focused on the utility of therapeutic alliance with RT behaviors. Furthermore, researchers have noted that gender may play a vital role in determining these bonds, especially with respect to college-aged females and RT [24,32]. Lockwood (2006) suggested that future RT interventions amongst college-aged females be led by qualified female resistance trainers both capable and passionate about helping novices learn applicable skills and positive RT behaviors.

Considering all the aforementioned evidence, the following gaps in the RT literature warrants this inquiry. First, while research has shown that college-aged females have barriers that limit them from healthy RT habits, less is known concerning how an intervention incorporating best-practice RT models [2,3] and exposure-based techniques [36,50] can help physically active, college-aged females to overcome their perceived barriers for RT [12]. Second, though it has been shown that females' motives for RT are more extrinsic and body-related (e.g., weight management and appearance) than intrinsic (e.g., fitness), there is a lack of understanding in how these exercise motives can be modified with a behavioral RT intervention. Finally, although previous studies have shown a therapeutic alliance to impact the effectiveness of weight loss interventions [45], the role of the trainer-trainee relationship moderating the effectiveness of a behavioral RT intervention is largely unknown. However, it has been proposed that experienced, female trainers could assist in further dismantling the current "gender-coding" by instructing, encouraging, and thus undoing females' barriers to RT [24,32].

Thus, in this context, the primary aim of this study was to examine the effect of an 8-week (1hr 45min, twice per week) RT intervention following best-practiced RT models [2,3] and graded exposure-based techniques [36] on physically active, but non-RT trained, female college students' perceived barriers/benefits and exercise motives for RT. It was hypothesized that participants who completed the RT intervention would experience a decrease in their perceived barriers for RT but no changes in perceived benefits for RT (Hypothesis 1a). In addition, it was assumed that RT intervention participants motives would change from more extrinsic motives toward intrinsic motives (Hypothesis 1b). The secondary aim of the study was to examine the moderating effect of trainer-trainee alliance on the changes in perceived barriers/benefits and exercise motives among college-aged females. Due to the exploratory nature of aim 2, no hypotheses were set.

2. Methods

2.1 Study Design and Participants

This study was a pre-post intervention without a comparator arm. Upon clearance from the university's Institutional Review Board (IRB), a convenience sample of 13 female students (M_{age} = 20.69 ± 1.32) from the [name omitted for peer review] were recruited and allocated to one condition. The primary trainer of the intervention was a 24-year-old female with a Bachelor's in Science degree in Psychology and five years of experience in exercise training, including a variety of both aerobic and RT. Secondary trainers were female, undergraduate research assistants enrolled in Psychology or Kinesiology degree programs with two to four years of experience in exercise training. Eligibility was analyzed in two parts using Qualtrics questionnaires. Age, demographics, and self-reported exercise habits were assessed during the screening. Quantitative measures of physical activity habits (measured via the International Physical Activity Questionnaire [IPAQ]) and stages of change (measured via the Stages of Change-Continuous Measure [URICA-e2]) were analyzed at baseline. Eligible participants were defined as undergraduate, full-time, female students between the ages of 18 and 24 who met guidelines for aerobic activity (i.e., either 150-300 minutes of moderate intensity, 75-150 minutes of vigorous intensity, or an equivalent combination of moderate-to-vigorous intensity of weekly aerobic training) but did not meet the recommended guidelines for resistance training (i.e., 2 or more non-consecutive days of weekly resistance training) [3,9]. In addition, to be eligible, females had an agreement level ranging from 3-5 on six or more of the barriers listed in Peter *et al*. (2019) Level of Agreement with Resistance Training Barriers questionnaire.

2.2 Intervention

During the intervention, participants attended biweekly training sessions for eight consecutive weeks. Each session ranged from 1.5 – 2 hours (1hr 45 min in average; ~28 hours of total training), and participants were shown proper breathing techniques, bodily placement, and equipment utilization prior to each session. In order to support best-practiced methods of training [3], the sessions began with a 10-minute warm-up (i.e., dynamic stretching) and ended with a 10-minute cool-down (i.e., static stretching). The exercise portion of each session consisted of a variety of multi- and single-joint RT movements that incorporated small and large muscle groups. Each movement was completed in anywhere from 2-4 sets for 8-15 repetitions with short breaks in between each set, and participants recorded repetitions completed after each set for every movement. When applicable, weight/resistance was self-selected by participants and also recorded during the sessions. RT equipment used during the intervention included body weight, resistance bands, free weights (i.e., dumbbells, kettlebells, body bars, barbells, plates), and resistance machines.

The group-based exposure training was adapted from the suggestions of previous researchers, following a three-step, nonlinear protocol for treatment (i.e. cognitive-behavioral assessment, education, graded exposure *in vivo*) [41,51,52] that aimed to foster both a graded treatment response and a strong trainer-trainee relationship (i.e., therapeutic alliance). The cognitive-behavioral assessment [41] to determine participants' barriers concerning RT consisted of the aforementioned screening and baseline assessments for eligibility. Education [41] regarding RT was provided in the form of verbal cues, nonverbal demonstrations, and trainer feedback and was delivered throughout seven weeks of the intervention. It included education of various movements, equipment variability and usage, effective set and repetition schemes, progressive overload, and designing a workout without the assistance of a trainer. This in-depth protocol for educating the participants throughout the majority of the intervention was also utilized with the intent of strengthening the trainer-trainee bond [45]. Lastly, graded exposure *in vivo* was provided in four phases in order to gradually overcome participants' perceived barriers in a hierarchal manner (Table 1).

2.3 Measures

2.3.1 Dependent Variables

The Benefits and Barriers to Strength Training Questionnaire was used to assess participants' perceived benefits and barriers to RT [10,18] prior to and following the intervention. The questionnaire included 55 5-point Likert scale items that comprised of 24 benefit and 31 barrier items ranging from 1 (not important) to 5 (extremely important). The benefits and barriers sections both measure four different subscales, with benefits including psychological (9 items), social (4 items), body image (6 items), and health (5 items) and barriers comprising of time/effort (10 items), physical effects (8 items), social (6 items), and specific obstacles (7 items). The scale has been found to be a valid and reliable instrument to analyze exercise benefits and barriers [18]. In this study, Cronbach analysis showed an acceptable internal consistency.

The Exercise Motivation Inventory-2 was used during pre- and posttest to measure exercise motives for RT [19]. The inventory included 51 5-point Likert scale items ranging from 0 (not at all true for me) to 5 (very true for me) and consists of five sub-model groupings and 14 total factors. The sub-models include stress management, revitalization, enjoyment, challenge, social recognition, affiliation, competition, health pressures, ill-health avoidance, positive health, weight management, appearance, and fitness motives. For the purpose of this study, the scale was modified by replacing the term "exercise" with "resistance train/training". This scale has been found to be valid and reliable for use in college-aged populations [19]. Internal consistency of this assessment was acceptable for both pre-and posttests.

2.3.2 Moderator Variables

The Working Alliance Inventory-Short Form Revised was administered at mid-point and posttest [45] in order to assess and analyze the trainer-trainee relationship and its impact on the intervention outcomes. This inventory is a shortened version of

Horvath and Greenberg's (1989) Working Alliance Inventory found to be more appropriate and applicable in clinical settings and research [54].

Table 1 Graded exposure *in vivo*

Phase 1 *(2 Weeks)*	**Phase 2** *(2 Weeks)*	**Phase 3** *(3 Weeks)*	**Phase 4** *(1 Week)*
Trainees met in a small, private, gym reserved for their personal usage In-depth education and one-on-one feedback was provided RT movements, sets to complete per movement, and equipment to use per movement were provided by the trainer Repetitions and weights used were recorded each session by the trainee	Trainees met in small, private, gym reserved for their personal usage Trainees worked in groups of 2-3 New and more challenging movements were introduced by the primary trainer Trainees were encouraged to increase weight and/or repetitions Less one-on-one feedback was provided RT movements, sets to complete per movement, and equipment to use per movement were provided by the trainer Repetitions and weights used were recorded each session by the trainee	Trainees were integrated into their university's fitness center Trainees worked in groups of 2-3 Each group was buffered by one trainer for feedback New and more challenging movements were introduced by the primary trainer RT movements, sets to complete per movement, and equipment to use per movement were provided by the trainer Repetitions and weights used were recorded each session by the trainee	Trainees trained in their university's fitness center independently Trainers remained close by to provide any necessary feedback/instruction Trainees were encouraged to design and complete their own RT regimen (movements, equipment, sets, repetitions, weight) without trainer assistance

It includes 12 5-point Likert scale items ranging from 1 (rarely or never) to 5 (always) and measures three domains of alliance (i.e., goal, task, and bond). For the purpose of investigating RT, this form was modified by replacing words such as "therapy" with "resistance training" and "therapist" with "trainer". Previous literature has shown that the scale has high validity and reliability [55]. The internal consistency analyses showed the scale to be consistent in both tests (i.e., mid- and post-test).

2.3.3 Treatment Adherence

Participant attendance was recorded each week to measure participant's treatment adherence. Sessions ranged from 85% to 100% attendance throughout the 8-week intervention, with a total average of 93% rate of attendance.

2.4 Procedures

Participants were recruited over a period of two and a half weeks via email, flyers, and word of mouth, and individuals interested in participating in the intervention completed a Qualtrics screening questionnaire. The screening questionnaire assessed demographics, health history, and compliance with inclusion criteria. After the screening questionnaire was completed, participants were contacted via phone by researchers to verify correctness of information provided. Once a follow-up phone call was completed, participants were notified of eligibility within 24 hours and scheduled for a baseline visit. Two approximately 45-minute visits were held prior to and following the intervention. All questionnaires used during these visits were completed through Qualtrics, and anthropometric measures were collected during both visits by a trained researcher. In order to reassure that each participant was in good health for the intervention, an exercise readiness questionnaire was delivered at baseline.

2.5 Sample Size

Sample size calculations were based on estimated Cohen's d effect size of RT barriers (ranging from specific obstacles .93 to time/effort barrier 1.00) by Harne and Bixby (2005). The calculation was performed with GPower 3.1 with the conservative effect size of .80, significance level of .05 and a desired power of 80% resulting in the sample size recommendation of 12.

corrected effect sizes (Cohen's *d*) were tabulated to test the effectiveness of the program on participant outcomes. Cohen's effect size standards (> 0.80 = large; < 0.80 to > 0.20 = medium; < 0.20 = small) were utilized to determine the practical meaningfulness of the *p* values [58].

To respond to the second research questions, the role of trainer-trainee relationship on the intervention effects were examined using the following procedure. First, change scores, i.e. a residual change of the independent-dependent variable relationship, using the linear regression analyses were calculated. Second, if a statically significant relationship between baseline value (X) and change score (Y) were established in a simple, unconditional regression model, the role of moderator (W) and interaction effect (WX) were estimated (Figure 1). Due to a number of estimated parameters/degrees of freedom (df), all simple regression models were saturated. Finally, the moderating effects for each statically significant moderator were tested using the established guidelines for Mplus (version 8), with the maximum likelihood model estimator and 10,000 bootstrapped estimates [59].

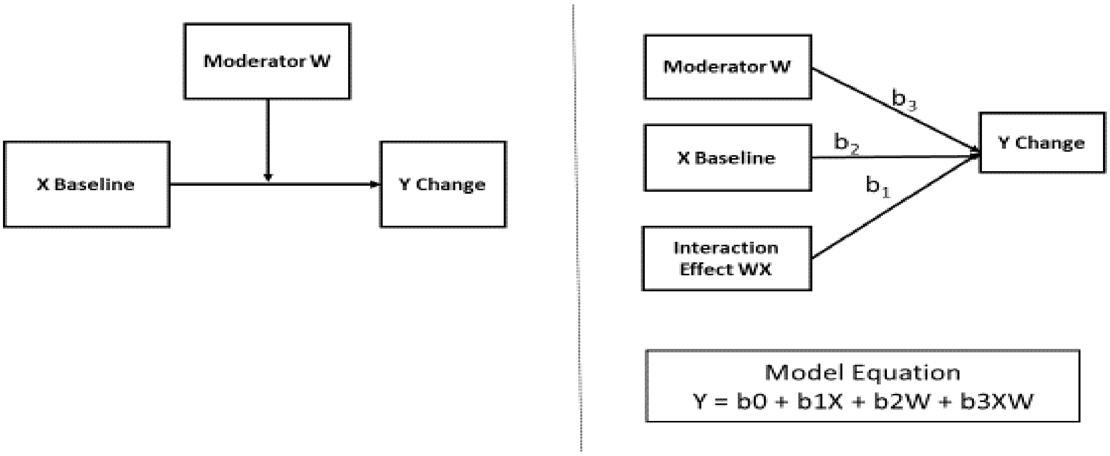

Figure 1 Model, statistical diagram, and model equation of the moderator analyses

2.6 Statistical Analyses

Preliminary and descriptive analyses, including statistics for normality, outliers, and internal consistency, were conducted.

No statistically significant outliers were detected through the covariance matrix based on the Mahalanobis distance test ($p < 0.001$) of standardized values (± 3.00) [56]. Second, paired *t*-tests with Morris and DeShon [57] equation for mean-dependence

Models for small (meanW − 1 standard deviation [SD]), medium (meanW), and high (meanW + 1 SD) moderator values were established. The model was evaluated based on the X-Y relationship (b_2 needed to be statistically significant), change in R^2s between null and mediator model (improved explanatory strength required), and Newman Johnson graph (95% CI could not cross the x-vector).

3. Results

Preliminary results are presented in Table 2. The sample was relatively homogenous as the mean age of the participants was 20.7 (1.3) years, and per inclusion criteria, all engaged in recommended MVPA (MPA 69.2% and VPA 30.8%) and were in the contemplation stage of change at the beginning of the study. Most participants completed all 16 training sessions; however, those that could not complete all sessions missed no more than 2 sessions.

The correlations between the study variables are presented in Appendix 1. There were no significant correlations found between the perceived barriers and benefits with the exception of time/effort and social (benefits) being negatively correlated (r = -0.62, p = 0.025). A few associations were observed between perceived barriers and motives for RT: positive correlations between physical effects and ill-health avoidance motives (r = 0.58, p = 0.040), specific obstacles and social recognition (r = 0.68, p = 0.010), and specific obstacles and competition (r = 0.63, p = 0.022) and a negative correlation between physical effects and enjoyment (r = -0.60, p = 0.032). Several strong, positive correlations were established between perceived benefits and motive for RT including: psychological benefits and stress management (r = 0.73, p = 0.005), social benefits and affiliation (r = 0.82, p = 0.001), body image benefits and both weight management (r = 0.88, p < 0.001) as well as appearance (r = 0.86, p < 0.001), and health benefits and positive health (r = 0.81, p = 0.001), appearance (r = .75, p = 0.003), and strength and endurance (r = 0.74, p = 0.004). No negative correlations were found between perceived benefits and motives for RT aside from social benefits and challenge (r = -0.61, p = 0.028). The findings relating to the first aim showed that there were statistically significant and large-sized reductions across three of the barriers subscales (Table 2): time/effort t(12) = 5.02, p < .001, d = 1.81, Mbase = 2.71 · .62, Mpost = 1.71 · .49; physical effects t(12) = 2.48, p = 0.029, d = 0.86, Mbase = 1.96 · .63, Mpost = 1.51 · 0.42; social (barriers) t(12) = 4.86, p < .001, d = 1.97, Mbase = 2.85 · 0.82, Mpost = 1.50 · 0.54. Although positive mean level changes occurred in benefits, there were no significant changes (p > 0.05). Statistically significant improvements were found in three psychological motives for RT– stress management t(12) = 2.21, p = 0.048, d = 0.62, Mbase = 3.17 · 1.09, Mpost = 3.75 · 0.78; revitalization t(12) = 2.71, p = 0.019, d = 0.95, Mbase = 3.62 · .82, Mpost = 4.35 · 0.72; and enjoyment t(12) = 3.53, p = 0.004, d = 1.18, Mbase = 2.90 · 0.92, Mpost = 13.96 · 0.87.

A simple, unconditional regression model for each statically significant intervention effect was established. Our analyses showed that only physical barriers (β = 0.334[0.189], p = 0.048, R2 = 0.64) and stress management (β = 0.332[0.11], p = 0.003, R2 = 0.73) as a motive had a statically significant predictive relationship from the baseline to the change score (Table 3 and Figure 2). For the physical barriers moderator, the analyses estimated that goal (β = 0.23[0.02], p < 0001, R2 = 0.979) and bond (β = 0.21[.01], p < 0001, R2 = 0.995) alliances were positive moderators with large-sized effects on changes in physical barriers. Specifically, the higher the goal or bond alliance established the larger declines in physical barriers were demonstrated. No task alliance for physical barriers were detected. For stress management, only bond alliance, not task or goal, was a statistically significant, small-sized moderator, with higher bond increasing the effect of the intervention in stress management (β = 0.21[.01], p < 0001, R2 = 0.997).

4. Discussion

The purpose of this study was to examine the effects of an exposure-based intervention on perceived barriers/benefits and motives regarding RT in physically active, college-aged females. The findings of this study revealed that an 8-week, best-practice RT intervention utilizing graded exposure techniques can reduce young women's barriers to RT. In addition, the study showed that goal and affective bonds between a trainer and trainee contributes to both reductions in physical barriers and improvements in stress management. This study demonstrated that physically active females who did not engage in RT perceived RT very beneficial for their psychological, body image, and health benefits and moderately useful for their social benefits. This finding corroborates the previous findings that have shown females to perceive RT beneficial regardless of their training status [10,11,60].

In addition, the results showed perceived social and time/effort barriers to be the most prominent barriers for RT. These findings coincided with previous studies that have shown time/effort [10,11] and social barriers [12] to be the most frequent barriers among college-aged females.

Table 2 Descriptive results

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	Baseline	Post-test	Baseline	Post-test	Baseline	Post-test	Baseline	Post-test
Variables	**Mean(*SD*)**		**Reliability**		**Skewness**		**Kurtosis**	
Age (years)	20.69(1.32)	na	na	na	na	na	na	na
Body Mass Index	24.22(4.00)	24.37(4.06)	na	na	-0.05	0.31	-1.09	-0.76
Benefits to Resistance Training								
Psychological	4.28(0.65)	4.56(0.38)	0.88	0.79	-0.77	-0.87	-0.11	-0.08
Social	3.28(0.93)	3.62(0.85)	0.84	0.82	0.19	-0.37	-0.81	0.04
Body Image	4.29(0.67)	4.32(0.63)	0.87	0.82	-0.66	-1.04	-0.98	1.23
Health	4.64(0.38)	4.44(0.60)	0.80	0.79	-0.72	-0.95	-0.95	-0.24
Barriers to Resistance Training								
Time/Effort	2.71(0.62)	1.71(0.49)	0.75	0.81	0.07	0.29	-0.07	-1.10
Physical Effects	1.96(0.63)	1.51(0.42)	0.73	0.81	-0.58	0.44	-1.36	-1.35
Social	2.85(0.82)	1.50(0.54)	0.75	0.51	1.49	0.94	2.17	-0.08
Specific Obstacles	1.92(0.76)	1.92(0.76)	0.70	0.70	0.94	0.94	0.87	0.87
Exercise Motives								
Stress management	3.17(1.09)	3.75(0.78)	0.75	0.91	-0.37	-0.65	-0.33	0.97
Revitalization	3.62(.82)	4.35(0.72)	0.51	0.80	-0.44	-0.56	0.04	-1.12
Enjoyment	2.90(0.92)	3.96(0.87)	0.70	0.84	0.68	-0.09	1.72	-1.46
Challenge	3.25(1.15)	3.98(0.76)	0.78	0.76	-0.86	-0.88	1.86	1.12
Social Recognition	1.42(1.15)	1.92(1.52)	0.89	0.89	0.98	0.10	0.43	-1.76
Affiliation	2.58(1.25)	3.08(1.35)	0.90	0.95	-0.09	0.11	-0.54	-1.18
Competition	2.08(1.56)	2.31(1.67)	0.95	0.91	0.30	0.21	-1.40	-1.68
Health Pressures	1.12(1.12)	2.04(1.44)	0.67	0.63	0.93	0.93	0.58	0.58
Ill-Health Avoidance	3.69(1.11)	3.92(1.04)	0.88	0.87	-2.04	-.039	2.08	-1.03
Positive Health	4.69(0.56)	4.54(0.54)	0.74	0.94	-1.28	-0.39	0.48	-1.87
Weight Management	3.63(1.26)	3.37(1.25)	0.86	0.86	-.076	-0.22	-0.47	-0.51
Appearance	3.77(1.26)	3.37(1.27)	0.94	0.94	-0.55	-0.77	-1.08	-0.07
Strength & Endurance	4.54(0.66)	4.62(0.42)	0.75	0.80	-1.45	-0.63	1.27	-1.36
Nimbleness	3.64(1.22)	3.59(1.23)	0.95	0.91	-0.66	-0.75	-0.44	0.05

Table 3 Results of the moderator analysis on the statistically significant effects

Model	β(SE)	*p*	$R^2(SE)$	*p*	$R^2\Delta$
Physical Barriers[a]	-0.33(0.19)	< 0.047	0.640(0.16)	<0.001	
ΔPhysical Barriers (X)					
Goal (W_1)	-0.03(0.03)	0.321	0.979	0.010	0.339
Interaction (XW_1)	0.23(0.02)	<0.001			
Bond (W_2)	-0.12(0.02)	0.545	0.995	<0.001	0.335
Interaction (XW_2)	0.21(.01)	<0.001			
Task (W_3)	0.53(.13)	<0.001	0.612	<0.001	-0.028
Interaction (XW_3)	0.03(0.06)	0.596			
Stress Management[a]	0.55(0.21)	0.009	0.732(0.13)		
ΔStress Management (X)					
Goal (W_1)	0.23(0.02)	<0.001			-0.041
Interaction (XW_1)	0.07(0.05)	0.155	0.691	<0.001	
Bond (W_2)	0.02(0.02)	0.358	0.997	<0.001	0.265
Interaction (XW_2)	0.21(.01)	<0.001			
Task (W_3)	0.22(0.01)	<0.001	0.710	<0.001	-0.022
Interaction (XW_3)	0.03(0.02)	0.216			

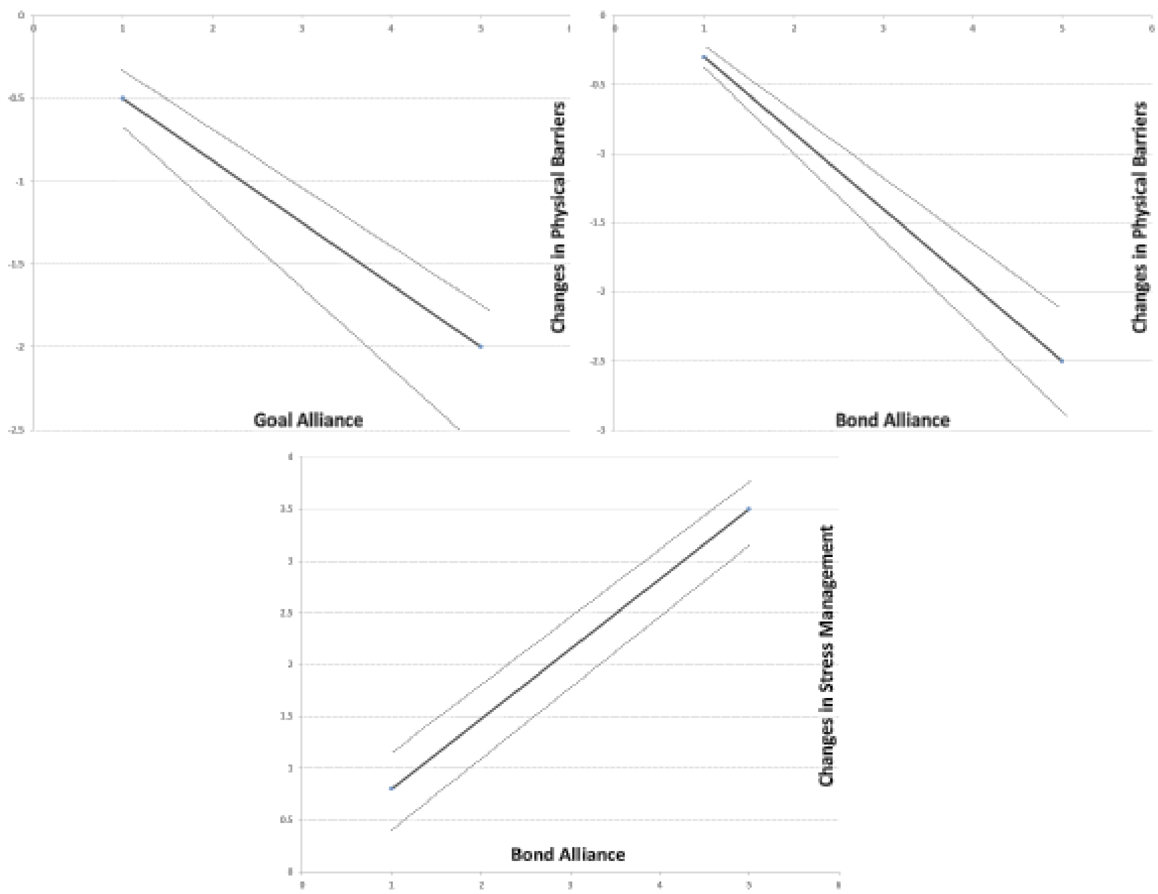

Figure 2 Newman Johnson graph for the statistically significant moderator effects
Note. Lower and upper 95% confidence intervals presented with the dashed lines

Previously, Peters *et al.* (2019) demonstrated that evaluation concerns (i.e., how individuals perceive what others think of them), feelings of incompetency, and low self-efficacy are the most frequent sources of social barriers. Although our study did not examine underlying reasons for the social RT barriers, it is possible that gender-associated (e.g., RT is for men only) concerns made up a portion of the social barriers experienced by the young women in our study. Moreover, the results of our study underscore that barriers for RT exist among college females regardless of physical activity levels.

Although there was no observable impact regarding perceived benefits, the RT intervention had an expected, positive effect in reducing most of the perceived RT barriers, namely time/effort (e.g., do not have enough time), physical effects (e.g., makes one hot and sweaty), and social barriers (e.g., do not like to RT alone). These findings support the findings of Ransdell *et al.* (2004) which showed that an exercise intervention can reduce perceptions of exercise barriers for mothers; however, these findings indicate potential differences with respect to age as there were no significant changes in perceived exercise barriers observed among their daughters. Although some models of behavior change, such as the Heath Belief Model have theorized that an inverse relationship exists between perceived benefits and barriers (i.e., higher perceived benefits means lower perceived barriers), similar to the findings in our study, previous literature has shown that the beneficial effects of RT are universally understood and RT barriers tend to be dependent on training status [10,11,60].

In regard to the exercise motives, this study showed that these young, physically active females did not view social recognition or health pressures as strong motives for RT, whereas positive health and strength/endurance were found to be prominent motives among this population. Most of these findings uphold the observations of Sas-Nowosielski *et al.* (2017) who showed positive health to be a high motive for exercise and social recognition to be a low motive for exercise in women across all ages. Moreover, though health pressures were high motives in older age groups, they were not as high of motives for women in early or middle adulthood [61] or for male and female college students [62]. In contrast to our findings demonstrating the importance of strength/endurance as a motive for RT, other studies have shown that females are typically not as motivated by the intrinsic, physical enhancements/adaptations as their male counterparts [60,63]. It may be that a strength/endurance motive is important for physically active females but not for a general female population.

This current study found that the intervention was effective in improving stress management, revitalization, and enjoyment. These findings supported our hypothesis on the positive effect of the intervention on intrinsic, adaptive motives. These findings are encouraging considering that the previous studies have shown females to have high levels of extrinsic, body-related motivation for exercise [63-65], and adaptive motives and motivation have shown to relate to the sustained exercise engagement [66]. Opposite to our hypothesis, this intervention did not elicit any changes in body-related motives (i.e., extrinsic) for RT. Interestingly, previous research has shown that experience in female exercisers tends to shift exercise motives toward more intrinsic rather than extrinsic motives [14,15]. This extrinsic to intrinsic shift was observed in this current study; however, the participants were already established as physically active females prior to the 8-week RT period. Therefore, it may be important to determine whether motives were modulated given the introduction of a new exercise mode (i.e., RT). Alternatively, while most research indicates that experience dictates the difference between levels of extrinsic or intrinsic motive for exercise, some research does support the idea that women have high levels of body-related motivation regardless of experience [60]. Our study contributes to current literature showing that higher levels of extrinsic or intrinsic motive for exercise may be dependent on not just gender and experience, but on modality as well.

Due to the rarity of significant established findings in therapeutic alliance with respect to exercise intervention research, specifically, trainer-trainee observations were exploratory within this current study. Our results suggest that strong bond and goal alliances had moderate to high effects on physical effects barriers and bond alliance had a small effect on stress management motive for RT. The finding in the physical effect barriers indicated that the instructors' efforts to establish a bond (i.e., the quality of the relationship between the trainer and trainee) and goal (i.e., predetermined agreement between the trainer and trainee on specific objectives that the trainee wishes to accomplish) alliance contributed to the demonstrated reductions of those barriers. Similarly, a trainer-trainee bond contributed to the demonstrated changes in participants' stress management. It has been established that the quality of the working alliance (i.e., bond, task, and goal alliance) is predictive of participant (i.e., trainee) satisfaction in treatment outcomes in other related clinical/health fields [53,67,68]. As separate variables, the bond alliance focuses on the connection between the trainer and trainee while task and goal alliances conceptualize different undertakings and targets established by both the trainer and trainee together prior to training [46]. While our study did not show that the task alliance had any significant moderating effects on intervention outcomes, this may best be explained by the nature of the intervention itself (i.e., the need for a trainee to establish mutually agreed upon tasks with the trainer was not applicable), Thus, unlike results of previous studies in other fields [53,67,68], it would stand to reason that strong bond and goal alliances alone would be more beneficial to the outcome of an exercise-based intervention.

Although our novel findings are of interest, there are several limitations to be acknowledged. First, this study utilized a convenience sample and lacked a control group. Thus, the changes observed could have been partially due to other exercise-based activities participants engaged in during the intervention; however, this is rather unlikely. Regardless, it is noteworthy that we included physically active but non-RT females in this study. Unfortunately, due to a lack of random sampling, the conclusions drawn from this study are not representative of the entire population of non-RT females. Furthermore, although the sample was powered to detect moderate sized changes between pre- and post-measurements, it was underpowered for moderator analyses. Therefore, it is possible that we were not able to detect some of the moderator effects. Nevertheless, our study contributes to the current literature, and more research is needed to determine whether trainer-trainee relationship is a dependable measurement for assessing the moderating effects of a trainer-trainee alliance with respect to exercise intervention outcomes.

5. Conclusions

Overall the results of the study indicate that exposure-based RT is beneficial for reducing the perceived barriers for RT among physically active college-aged females that are unengaged in healthy RT behaviors. In addition, our study indicates that goal and bond alliance between the trainer and trainee is especially impactful in reducing the physical effect barriers for RT, such as appearing "hot and sweaty or "bulky" or feeling "uncomfortable", "fatigued", or "sore", and that bond alliance is moderately important for utilizing stress management as motivation for RT.

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Authors Contribution

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Conflict of interest

The authors declare that they have no actual or potential conflict of interest, including financial, personal or other relationships with people or organizations that could have inappropriately influenced this work.

Informed consent

All participants gave written informed consent to participate in this study.

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