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Psychological well-being and exercise addiction: The treatment effects of an REBT intervention for females



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ARTICLE INFO	A B S T R A C T
Keywords: Rational beliefs Exercise Intervention Case-study	Whilst there is growing research on the benefits of Rational Emotive Behaviour Therapy (REBT) for athletic performance and wellbeing, there has been little attention on the effectiveness of REBT for the exercising population. Recent evidence suggests that REBT may be helpful for males who show signs of exercise addiction, but the effects for females are currently unknown. The current study aims to build on the extant research by adopting a single-case research design to examine the effects of REBT on irrational beliefs, exercise addiction symptomology, psychological distress, and unconditional self-acceptance (USA) of three female exercisers. Self-report data were collected at pre-, during, and post-REBT timepoints. Visual analyses revealed reductions in irrational beliefs and psychological distress, and increases in USA, maintained two-weeks post-REBT. Exercise addiction symptomology also reduced during the intervention, and this was maintained for two out of the three

REBT in improving exercise addiction and its comorbidities.

1. Introduction

The benefits of physical activity for improved health and well-being are well documented (De Mello et al., 2013; Landolfi, 2013). Individuals are therefore encouraged to increase activity levels to attain these benefits (Warburton et al., 2006). However, when participation in exercise becomes all-consuming and disrupts other aspects of life, the exercise becomes synonymous with addictive behaviour (Hausenblas & Mann, 2018). Definitions and explanations of exercise addiction have been drawn from research around other addictive behaviours such as substance dependence and gambling (Hausenblas & Symons Downs, 2002a; Nogueira et al., 2018).

Exercise addiction has been defined as excessive exercise behaviour resulting in physical (e.g., injury), psychological (e.g., mood modification) and social harm (e.g., interpersonal relationships; Hausenblas & Symons Downs, 2002a; Landolfi, 2013; Lichtenstein et al., 2017). Additional features include lack of control over the excessive behaviour and maintenance of the behaviour despite presence of negative consequences (Berczik et al., 2012; Weinstein et al., 2015). Whilst there are little empirical studies to substantiate claims (Bamber et al., 2000), it has been reported that 3% of the general population hold exercise

addiction symptomatology (Sussman et al., 2011), and is more so prevalent amongst ultrarunners and sport science students (Freimuth et al., 2011). Many different terms have been used to describe the addictive nature of exercise behaviour including abusive, compulsive, excessive exercise, and exercise dependence (Nogueira et al., 2018). Exercise addiction is a term used here to describe this behaviour as it contains elements of both dependence and compulsion (Berczik et al., 2012; Hausenblas & Mann, 2018).

exercisers post-REBT. Social validation data supported these findings. The study adds weight to the efficacy of

Exercise addiction can be of either a primary or secondary nature, depending on the individual's motivation to exercise (Cunningham et al., 2016; Veale, 1987). Primary exercise addiction encompasses exercise as a means to escape from psychological problems or unpleasant feelings (e.g., stress). Secondary exercise addiction encompasses exercise as a means to lose weight or change body shape (Hausenblas & Mann, 2018; Lichtenstein et al., 2017; Nogueira et al., 2018; Szabo & Rendi, 2008) and is often compounded with an eating disorder (Landolfi, 2013). There is a strong link between exercise addiction and eating disorders (Sussman et al., 2011). The literature pertaining to secondary exercise addiction suggests that a co-occurring eating disorder, such as anorexia nervosa or bulimia nervosa, usually exists (Freimuth et al., 2011). To establish exercise addiction in its primary form, it is important

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to identify those who use exercise as a means to cope with internal distress in the absence of an eating disorder (Bamber et al., 2003; Freimuth et al., 2011). In the present paper, the concept of exercise addiction will be primary in nature, as this will allow the intervention to focus solely on the core features of exercise addiction. In the current climate, exercise and physical activity are being promoted more than ever to improve the health and wellbeing of inactive individuals (Outar, 2018). This promotion can result in more cases of exercise addiction (Lichtenstein et al., 2017), especially if individuals are unaware of the adverse consequences that over exercising brings (Johnston et al., 2011; Lim, 2020).

Individuals with exercise addiction may present a range of psychological symptoms such as anxiety, low self-esteem and psychological distress (Grandi et al., 2011; Szabo & Rendi, 2008). Although if this is the case, the mechanisms through which exercise addiction influence psychological distress are under researched. Of the dearth of research into this phenomenon, Bamber et al. (2000) and Landolfi (2013) suggest that it is perceptions of guilt that could manifest symptoms of psychological distress. Whilst these findings are not causal, it is evident that those who present with high levels of exercise addiction report suffering negative consequences to their psychological health (Berczik et al., 2012). It is therefore relevant to further examine the mechanisms through which primary exercise addiction influences psychological distress.

Cognitive behavioural approaches (CBT; Cognitive Behavioural Therapy) have been recommended for treating exercise addiction (Lichtenstein et al., 2017). Rational Emotive Behaviour Therapy (REBT; Ellis, 1957) is a cognitive behavioural approach asserting that the beliefs people hold about themselves, others, and the world influence their emotional and behavioural response to life adversity (Ellis & Dryden, 1997). At the core of emotional disturbance are four types of irrational beliefs; demandingness (PIB), awfulizing (AWF), frustration intolerance (FI), and self-depreciation (DEP). Irrational beliefs are dogmatic, rigid, inconsistent with social reality (illogical) and hinder long-term goal attainment (MacInnes, 2004; Wood et al., 2018). . The four opposing rational beliefs that facilitate psychological health are: preferences, anti-awfulizing, frustration tolerance (FT) and unconditional self-acceptance (USA; e.g., Turner & Bennett, 2018). A fundamental aim of REBT is to reduce irrational beliefs and strengthen rational beliefs to aid psychological health (Davis & Turner, 2020).

REBT is a short-term, structured, collaborative therapy, which is suitable for the immediate and fast pace of sport and exercise contexts (Bowman & Turner, 2022; Turner & Bennett, 2018). A systematic review identified 39 studies that applied an REBT intervention with athletes (Jordana et al., 2020). However, the support for the effectiveness of REBT in exercise settings is lacking. To date, there are only two studies that have applied REBT to an exercise population successfully (Outar, 2018; Outar et al., 2018, 2021). Alongside the minimal appreciation for REBT in exercise settings, there is also an underrepresentation of exercising females in research (Forsyth & Roberts, 2019). Evidence from REBT research shows that females hold greater irrational beliefs and symptoms of anxiety and depression than males (Turner et al., 2019; Walen & Grieger, 1988). Furthermore, females with exercise addiction report greater depression symptoms than males (Modolo et al., 2011). Due to such gender differences, and the increasing levels of female participation in sport and exercise (Forsyth & Roberts, 2019), the investigation of REBT with female exercisers would prove to be a fruitful avenue of research. To date, there is no study to the researchers' knowledge that has explored REBT amongst female exercisers at risk of exercise addiction.

REBT is not only an approach to weaken irrational beliefs, it also aims to strengthen rational beliefs. The use of REBT, much like findings presented in previous research (e.g., Outar et al., 2018), may increase an individual's rational beliefs, namely, USA. USA is defined as the belief that "the individual fully and unconditionally accepts himself whether or not he behaves, intelligently, correctly, or competently and whether or not other people approve, respect, or love him" (Ellis, 1977, p. 101). Low levels of USA have been found to precede high levels of exercise addiction, with significant findings reported only for female participants (Hall et al., 2009). REBT has been shown to be effective for reducing self-depreciation beliefs (Cunningham & Turner, 2016). Research suggests that USA may be key in reducing exercise addiction (Ellis, 1994). Furthermore, USA is negatively associated with depression and anxiety, intimating that USA may improve individuals' psychological distress (Chamberlain & Haaga, 2001). In Outar et al.'s (2018) study, as a result of REBT, all participants showed an increase in USA, highlighting the potential role of this rational belief in exercise addiction.

In the first and only study that has examined the effectiveness of a psychological intervention (i.e., REBT) for treating individuals with symptoms of exercise addiction, Outar et al. (2018) found that sessions of REBT led to reduced exercise addiction symptomology and irrational beliefs and increased USA in three male exercisers. These effects were maintained 2 weeks later. Though efficacious, the participants' mental health was not measured, and the study provided little understanding into the application of REBT among females. There is growing evidence that irrational beliefs are deleterious for mental health (Turner et al., 2019; Turner et al., 2022; Vîslă et al., 2016). Very little research applying REBT within sport and exercise has focused on participants' well-being (see Davis & Turner, 2020 for an exception); the ability to use one's own resources to cope with challenges faced (Dodge et al., 2012). Thus, to advance the research, it would be beneficial to explore the effect of REBT on psychological distress in a female exercising population.

The present study seeks to extend the work of Outar et al. (2018) by testing the efficacy of an REBT intervention for exercise addiction with female exercisers and capturing psychological distress using a single-case research design. To the authors' knowledge no research has examined the role of irrational beliefs upon exercise addiction amongst females. In line with Outar et al.'s findings it is hypothesized that an REBT intervention will reduce irrational beliefs and exercise addiction symptomology and increase USA, from pre-to during intervention, with the effects remaining stable at post-intervention. It is also hypothesized that psychological distress will reduce as a result of REBT, building on the extant REBT literature in improving individuals' psychological well-being.

2. Method

2.1. Participants

As part of a screening process, participants were recruited via an advertisement placed on social media. The advertisement invited adult, female exercisers to complete four measures and provide their email address if they were interested in being selected for the intervention. Three out of six respondents who met the inclusion criteria; scoring highly for irrational beliefs (>18; Turner et al., 2016) and scoring either in the 'at risk' (n = 1) of exercise dependence range or the 'nondependent-symptomatic'(n = 2) range (Hausenblas & Symons Downs, 2002b) were randomly selected to participate. Two participants reported their main exercise activity as running and both ran six times a week. The third participant engaged in HIIT (High Intensity Impact Training) and weight training sessions at the gym, five times a week. The age range of participants was 26–38 (M = 30.7 SD = 6.4). In one bout, participants reported to engage in exercise on average for 60-90 minutes. Informed consent was obtained from all participants, a risk assessment checklist was completed, and ethical approval was granted from the university before data collection began.

2.2. Design

The study employed a single-case A-B, staggered, multiple baseline, across-participants design (Barker et al., 2011). Single-case designs allow the researcher to examine changes in the data as the intervention

is introduced. Participants established a stable baseline in all four measures before the start of the intervention. A single-case design was chosen as an appropriate method for distinguishing individual effects across time, in response to a behavioural intervention (Barker et al., 2013; Barker et al., 2020). REBT was applied across participants at staggered time points as per Outar et al.'s (2018) research. It was important to use a staggered baseline, to eradicate alternative explanations for behaviour change (Barker et al., 2011). Participant 1 commenced the intervention phase in week 4, Participant 2 in week 5, and Participant 3 in week 6.

2.2.1. Measures

Irrational Beliefs. The irrational performance beliefs inventory (iPBI; Turner et al., 2016) consists of 28 items that measure the four core irrational beliefs (demandingness, awfulizing, frustration intolerance and self-depreciation). Two items were omitted (one measuring self-depreciation and one measuring awfulizing) as they were not appropriate for the context of this study. Items are based on a Likert scale between 0 (*strongly disagree*) and 5 (*strongly agree*). Three of the items on this scale were re-worded to fit the context of this study. The iPBI has been psychometrically tested to show test-retest reliability (Cronbach's $\alpha = 0.90$ to 0.96; Turner et al., 2018) and validity (Turner et al., 2016) and has been used in an exercise context (Outar et al., 2018; Turner et al., 2022).

Exercise Addiction. The Exercise Dependence Scale-21 (EDS; Hausenblas & Symons Downs, 2002b) is a measure used to establish individuals' risk of exercise dependence. It is based on presence of exercise dependence symptoms derived from the DSM-IV criteria for substance dependence (American Psychiatric Association, 1994). The scale has 21 items that are on a six-point Likert scale ranging from 1 (*never*) to 6 (*always*). There are seven subscales relating to different aspects of exercise dependence (tolerance, withdrawal, intention effect, lack of control, time, reduction in other activities and continuance). Participants' scores are categorised as 'at risk', 'nondependent-symptomatic' or 'nondependent-asymptomatic.' This scale has been demonstrated to show content and concurrent validity (Hausenblas & Symons Downs, 2002b) as well as excellent test-retest reliability (Cronbach's $\alpha = 0.86-0.97$; Symons Downs et al., 2004).

Unconditional Self-acceptance. The Unconditional Self-Acceptance Questionnaire (USA-Q; Chamberlain & Haaga, 2001) is a 20-item scale asking participants to rate items on a Likert scale from 1 (*almost always true*) to 7 (*almost always untrue*). The USA-Q has been used previously in sport (Cunningham & Turner, 2016), and measures the belief that an individual fully and unconditionally accepts themself regardless of behaviour, achievement, approval, respect, or love from others (Ellis, 1977). This scale has been used with the same design over time in previous studies demonstrating test-retest reliability (Cunningham & Turner, 2016; Outar et al., 2018). The original validation study showed moderate internal consistency (Cronbach's $\alpha = 0.72$; Chamberlain & Haaga, 2001).

Psychological Distress. The Depression Anxiety and Stress scale (DASS-21; Lovibond & Lovibond, 1995) is a measure whereby participants rate the frequency and severity of experiencing negative emotions over the previous week. It consists of three sub-scales; depression, anxiety and stress, with seven items in each. To calculate comparable scores with the full DASS questionnaire, each 7-item scale was multiplied by two. Participants rate on a 4-point Likert scale how many of the items applied to them in the past week, from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*). The DASS-21 has been validated in a number of populations and excellent internal consistency has been demonstrated for each of the subscales (Crawford et al., 2009).

Social validation. Social validation data were collected postintervention to ascertain the participants' perceptions and feelings of the intervention. Participants attended an online focus group, facilitated by a practitioner unknown to the participants to minimise social desirability bias (e.g., Outar et al., 2018). Social validation provides qualitative data to enhance researchers' understanding of results and intervention efficacy (Page & Thelwell, 2013). Participants were asked open-ended questions, accumulating insights into the usefulness, importance, and impact of the REBT intervention on the participants' thoughts and behaviours.

2.3. Data collection

Participants completed all four outcome measures twice per week pre-intervention (3 weeks). Participants completed the iPBI and USA-Q twice per week at pre-, during and post-REBT. Participants completed the EDS and DASS-21 at weeks 1, 3 and 6 during the intervention, and once a week post-intervention.

2.4. Intervention

Participants attended six 45-min REBT sessions, being in line with the majority of REBT studies using between two and eleven sessions (see Jordana et al., 2020). The sessions were delivered using Zoom video conferencing by the primary researcher. The primary researcher had received training in counselling skills prior to data collection and was supervised by a British Psychological Society (BPS) Chartered, Health Care Professions Council Registered, and REBT-trained (Advanced Practicum) sport and exercise psychologist (fourth author). Planning with the supervisors took place prior to each session. This enabled the primary researcher to follow a pre-determined structure to ensure intervention procedural reliability across participants. Sessions were delivered, adhering to guidelines around the application of REBT (DiGiuseppe et al., 2014; Turner & Barker, 2014).

The delivery of sessions aligned with the three phases of REBT; education, cognitive restructuring and reinforcement phase. In the first phase (2 sessions), participants were provided with an understanding of the principles of REBT and goals for therapy were established. They were guided through the GABCDE framework to demonstrate that when faced with adversity (A) to one's goals (G), it is our beliefs (B) about the adversity that determines our emotional and behavioural response (C consequences), not the adversity alone. Recently in REBT literature, Turner (2022) has brought G into clearer focus recalling Ellis's (1994) work and tying REBT theory to Lazarus' (1999) cognitive appraisal theory. In brief, goals are an important part of the GABCDE framework because A is only 'adverse' to the extent that it represents a barrier or impediment to G. When A impedes G, the conditions are set for the occurrence of negative emotion. We often face barriers to achieving our goals due to our own human fallibility and the uncertainty and uncontrollability of the world we inhabit (Turner, 2022). So, pursuing Gs calls forth As, which brings about negative emotions at C. But important in REBT, it is when we apply irrational beliefs (B) to this G-A incongruence that the negative emotion is expressed as unhealthy. In contrast, it is when we apply rational beliefs (B) to this G-A incongruence that the negative emotion is expressed as *healthy*. Educating participants about the GABC framework allowed them to recognise their own GABC's and helped them to understand that they could learn to regulate their emotions by changing the way that they think to help them to move closer to their goals.

In the cognitive restructuring phase (4 sessions), participants' irrational beliefs were disputed (D) using three types of questioning: Evidence (what evidence is there that the belief is true?), logic (does this belief make sense?) and pragmatics (is this belief helpful for goal attainment?). The process of disputing irrational beliefs helped participants to generate their own alternative, rational beliefs, (E - effective). Participants were educated in USA and were taught how to foster this to develop rational beliefs.

The reinforcement phase (throughout all sessions) involves rehearsal of new strategies learnt through the setting of homework assignments between sessions. Participants were set cognitive assignments (e.g., GABCDE worksheets and rational self-statements), emotive assignments (rational emotive imagery, REI; Ellis & Dryden, 1997) and behavioural assignments (testing new rational beliefs). For the final session, the practitioner used the method "rational reverse role-play" (Maultsby, 1971), where the participants helped the primary researcher, who played the role of an exerciser with irrational beliefs to identify, reconstruct and reinforce new effective rational beliefs.

3. Results

3.1. Visual and statistical analysis

Visual analysis of the data (see Fig. 1 and Table 1) was carried out to determine whether REBT brought about any meaningful changes upon

measured variables (Bloom et al., 1999; Ottenbacher, 1986). Any meaningful changes that have occurred following an intervention can be seen graphically based on a) the number of overlapping data points between phases, b) the immediacy of effects following the intervention, and c) the size of effects following the intervention (Hrycaiko & Martin, 1996). Autocorrelation analyses were conducted to determine the serial dependency of the visual data. This is important as interpretation of visual data is more accurate when the data has low serial dependency. The analyses revealed significant autocorrelation in composite iPBI scores (P1, r = -0.80; P2, r = -0.95; P3, r = -0.90), psychological distress (P1, r = -0.83; P2, r = -0.79; P3, r = 0.82), and for participants 2 and 3, USA (P2 r = 0.93 P3 r = 0.85), and EDS scores (P2 r = -0.88; P3 r = -0.95). The autocorrelated data were transformed using first





Table 1

Mean scores and standard deviations (M \pm SD) of outcome measures for pre post, a

ost, and follow-up.				r ,	Outco
Outcome Measure		Participant 1	Participant 2	Participant 3	
Composite Irrational Beliefs	Pre	$\begin{array}{c} \textbf{30.88} \pm \\ \textbf{0.78} \end{array}$	$\begin{array}{c} 21.42 \pm \\ 0.56 \end{array}$	$\begin{array}{c} \textbf{22.35} \pm \\ \textbf{1.13} \end{array}$	
	During	$\begin{array}{c} \textbf{28.35} \pm \\ \textbf{2.64} \end{array}$	16.44 ± 1.89	$\begin{array}{c} \textbf{16.40} \pm \\ \textbf{3.71} \end{array}$	Unco
	Post	24.88 ±	12.90 ±	11.56 ±	Acc
	RCI pre-	-1.43	0.78 -2.06	-2.46	
	during				
	RCI	83	85	-1.16	
	during-				
	RCI pre-	-1.83	-2.59	-3.28	
	post				
Demandingness	Pre	32.25 ±	$23.83 \pm$	28.20 ±	
	During	1.20	17.42.+	0.84 18.10 +	
	During	2.87	2.15	4.07	Depre
	Post	$\textbf{27.00}~\pm$	14.40 \pm	13.50 \pm	
		2.87	0.55	2.89	
	RCI pre-	56	-2.31	-3.65	
	during	00	67	1.00	
	during-	82	07	-1.02	
	post				
	RCI pre-	-1.89	-3.40	-5.30	
	post				Anvie
Frustration	Pre	34.50 ±	$26.17 \pm$	24.00 ±	Anxie
Intolerance	During	0.58	2.23	2.45	
	During	$30.20 \pm$	17.00 ±	17.40 ±	
	Post	26.25 +	$12.80 \pm$	12.25 +	
	1 000	3.30	0.84	1.26	
	RCI pre-	-1.24	24 -2.65 -1.90		
	during			2.00	
	RCI	87	92	-1.13	
	during-				
	POSt BCI pre-	_2 37	-3.84	_3.38	Stress
	post	-2.37	-5.64	-3.30	
Awfulizing	Pre	$\textbf{27.75} \pm$	19.50 \pm	$\textbf{23.80} \pm$	
		1.89	1.22	0.84	
	During	$26.10~\pm$	13.42 \pm	12.70 \pm	
		2.69	2.94	3.20	
	Post	$23.00 \pm$	$10.20 \pm$	8.50 ± 0.58	
	RCI pre-	2.00	-2.23	-4.06	
	during	.00	2.20	1.00	
	RCI	68	71	92	
	during-				
	post				1.00
	RCI pre-	-1.73	-3.38	-5.57	differe
Solf doprosistion	post	20.00	16 17	12 40	levels
Sen-depreciation	Ple	29.00 ±	10.17 ± 3.92	13.40 ± 2.07	sumpt
	During	26.40 ±	$17.92 \pm$	17.40 ±	were r
	. 0	2.01	2.15	3.84	For
	Post	$23.25~\pm$	14.20 \pm	$12.00~\pm$	formed
		0.96	1.48	1.41	tween
	RCI pre-	52	.36	.81	was se
	during	1.00	1 1 9	1 71	detern
	during-	-1.00	-1.18	-1./1	partici
	post				Turner
	RCI pre-	-1.16	40	28	nocite
	post				and et
Exercise Addiction	Pre	5.42 ± 0.23	3.90 ± 0.15	$\textbf{3.42} \pm \textbf{0.33}$	hotwo
	During	4.90 ± 0.96	3.48 ± 0.59	2.74 ± 3.03	DELWE

Post

RCI pre-

during

 $\textbf{4.95} \pm \textbf{0.00}$

-.66

06

 $\textbf{3.07} \pm \textbf{0.17}$

-.53

- 47

Outcome Measure		Participant 1	Participant 2	Participant 3
	RCI			
	nduring-			
	post			
	RCI pre-	- 55	- 97	-1.83
	post	100		1100
Unconditional Self	Pre	70.00 +	89.17 +	82.60 +
Acceptance		10.13	2.71	3.13
	During	74.40 ±	96.75 ±	97.40 ±
	. 0	3.34	5.22	5.52
	Post	77.50 +	109.20 +	102.00 +
		1.91	1.10	2.94
	RCI pre-	.75	1.29	2.51
	during			
	RCI	40	1 59	59
	during-	.10	1.09	.05
	post			
	BCI pre-	1.26	3 36	3 25
	nost	1.20	0.00	0.20
Depression	Pre	15.5 ± 5.26	4.33 ± 2.34	2.40 ± 2.6
	During	11.5 ± 3.00	2.00 ± 0.00	2.00 ± 0.0
	Post	6 ± 0.00	0.00 ± 0.00	0.00 ± 0.0
	RCI pre-	94	55	09
	during		100	105
	RCI	-1.67	- 61	- 61
	during-	1107	101	101
	post			
	RCI pre-	-2.27	-1.04	57
	post			
Anxiety	Pre	19.5 ± 4.43	7.67 ± 2.94	3.20 ± 2.2
	During	14.5 ± 6.61	2.67 ± 1.15	3.00 ± 1.4
	Post	12.00 +	3.00 ± 1.41	1.00 ± 1.4
		0.00		
	RCI pre-	-1.00	-1.00	04
	during			
	RCI	62	.08	49
	during-			
	post			
	RCI pre-	-1.50	93	44
	post			
Stress	Pre	10.00 \pm	1.67 ± 0.82	2.40 ± 1.6
		4.32		
	During	4.00 ± 0.00	2.00 ± 0.00	2.00 ± 0.0
	Post	0.00 ± 0.00	2.00 ± 0.00	0.00 ± 0.0
	RCI pre-	-2.21	.12	15
	during			
	RCI	-4.73	0	-2.36
	during-			
	post			
	RCI pre-	-3.68	.12	88
	post			

Table 1 (sensing ad)

ence transformation to reduce serial dependency to non-significant so that the data for statistical analysis no longer violated astions for parametric testing (Ottenbacher, 1986). Original scores retained for visual analysis (Table 1 and Fig. 1).

r statistical analysis, for each participant, two t-tests were perd for each of the dependent variables to examine differences bepre-to during intervention and during to post-intervention. Alpha t at p < 0.05. Only statistically significant *t*-tests are reported. In nining the statistical reliability of the change in scores for each pant, we used the Reliable Change Index (RCI; Cunningham & r, 2016; Jacobson & Truax, 1991). Change was assessed in comirrational beliefs, exercise addiction, USA, depression, anxiety, ress. For the present study, we examined the difference in scores een pre and during, pre and post, and during and post, and then divided by the Standard Error of the difference between the two (Jacobson & Truax, 1991). If the RCI score is greater than 1.96, the likelihood of the change being random is less than 0.05. All RCI scores can be seen in Table 1.

Participant 1. Visual inspection revealed reductions in irrational

 $1.86{\pm}0.27^1$

-.86

-1.00

beliefs (PIB, 4.81%, d = 2.00; FI, 12.46%, d = 1.95; AWF, 5.95%, d = 2.53; DEP, 8.97%, d = 2.83), exercise addiction (9.59%, d = 0.34), and psychological distress (Depression, 25.81%, d = 0.93; Anxiety, 25.64% d = 0.89; Stress, 60%, d = 1.96), as well as an increase in USA (6.29%, d = 4.59) from pre-to during REBT. Irrational beliefs (PIB, 12.05% d = 1.86; FI, 13.08% d = 1.61; AWF, 11.88% d = 2.60; DEP, 11.93% d = 2.00) and psychological distress (Depression, 47.83%, d = 2.59 Anxiety, 17.24%, d = 0.53; Stress, 100%) continued to decrease from during to post-REBT. Exercise addiction symptomology increased slightly from during to post-REBT (1.02%, d = 0.50). Effect sizes for change in measured variables were large across timepoints, excluding exercise addiction. Participant 1 had two overlapping data points for composite irrational beliefs (Fig. 1) and FI between timepoints.

Statistically, there was a significant increase in USA from during to post-REBT, t(13) = -2.10, p = 0.03. RCIs indicated significant decreases in stress from pre- to during and during to post-, and significant decreases in frustration intolerance, depression and stress from pre-to postfor participant 1.

Participant 2. Visual inspection revealed reductions in most irrational beliefs (PIB, 35.82% *d* = 3.42; FI, 27.50% *d* = 4.10; AWF, 46.64% d = 2.70), exercise addiction (19.88% d = 0.33), and psychological distress (Depression, 16.67%, *d* = 0.22; Anxiety, 6.25% *d* = 0.11; Stress, 16.67%, *d* = 0.34), as well as an increase in USA (17.92% *d* = 4.91) from pre-to during REBT. Self-depreciation beliefs increased from pre- to during REBT (29.85% d = 3.39). Irrational beliefs (PIB, 25.41% d =3.81; FI, 29.60% *d* = 4.07; AWF, 33.07% *d* = 2.79), exercise addiction (32.12% d = 0.29) and psychological distress (Depression, 100%; Anxiety, 66.67% d = 1.42; Stress, 100%) continued to decrease from during to post-REBT, whilst USA (4.72% d = 5.00) continued to increase from during to post-REBT. Although self-depreciation beliefs increased from pre- to post intervention, they decreased below baseline levels (31.03% d = 3.40) from during to post-REBT. Effect sizes for change in measured variables were large across timepoints, excluding exercise addiction. Participant 2 had one overlapping data point for composite irrational beliefs (Fig. 1) between timepoints.

Statistically, there was a significant increase in self-depreciation from pre-to during REBT(t(13) = -2.15, p = 0.03), and a significant reduction in self-depreciation from during to post REBT (t(12) = 2.69, p = 0.01). RCIs indicated significant decreases in demandingness, frustration intolerance, and awfulizing from pre-to during, and from pre-to post- for participant 2. RCI also indicated significant increases in unconditional self-acceptance from pre-to post- for participant 2.

Participant 3. Visual inspection revealed reductions in most irrational beliefs (PIB, 26.90% d = 2.00; FI, 35.04% d = 1.95; AWF, 31.18% d = 2.53), exercise addiction (10.77% d = 0.34), and psychological distress (Depression, 53.81%, d = 1.41; Anxiety, 65.19% d = 2.24), as well as an increase in USA (8.50% d = 4.59) from pre-to during REBT. Self-depreciation beliefs increased from pre to during REBT (10.82% d = 2.83). Irrational beliefs (PIB, 17.34% d = 1.86; FI, 24.71% d = 1.61; AWF, 24.00% d = 2.60), exercise addiction (11.78% d = 0.50) and psychological distress (Depression, 100%) continued to decrease from during to post-REBT, whilst USA (12.87% d = 4.51) continued to increase from during to post-REBT. Although self-depreciation beliefs increased from pre-to during REBT, they decreased below baseline levels (20.76% d = 2.00) from during to post-REBT. Effect sizes for change in measured variables were large across timepoints, excluding exercise addiction. Participant 3 had no overlapping data points.

Statistically, there was a significant reduction in self-depreciation from during to post-REBT, t(15) = 3.50, p < 0.01. RCIs indicated significant decreases in demandingness and awfulizing, and significant increases in unconditional self-acceptance pre-to during for participant 3. RCIs also indicated significant decreases in demandingness, frustration intolerance, and awfulizing, and significant increases in unconditional self-acceptance pre-to follow up for participant 3. Lastly, RCI indicated significant decreases in stress during to post- for participant 3. In sum, visual and statistical analyses revealed that the REBT intervention brought about meaningful reductions in irrational beliefs, psychological distress, and exercise addiction symptomology, as well as increases in USA for all participants. Changes from pre-to during REBT were particularly strong for all participants, replicating the findings of Outar et al. (2018). The changes that occurred happened immediately post-intervention and given the staggered delivery of the intervention, these changes can more confidently be attributed to the REBT sessions.

4. Social validation

Social validation data collected at the end of the study indicate three key areas where exercisers gained new skills from the REBT intervention. The first area identified their ability to apply a rational philosophy to all facets of life. P1 stated that "[before the intervention], I usually made everyone late" and now "[she] has learnt perseverance with herself and others, to take a step back and think about things and bring things down and rationalise [them]." P3 commented that "[my] new rational philosophy helps me in other stressful aspects of life like my PhD, for instance." The second area centred around learning new coping skills. For example, P2 stated that she feels more relaxed and less guilty if she has to miss a scheduled exercise session and P1 remarked that she "feels better equipped when there is an unexpected adversity." In addition, all participants noted that they were better able to control their emotions and behaviour, resulting in positive outcomes (i.e., more focus and productivity at work and with studies). All participants commented on finding the delivery of sessions excellent and finding the content clear and easy to understand. P2 remarked that "[the practitioner] kept me in check and made sure I understood before continuing." Although there were lots of positive remarks, there was also commentary regarding the length of the intervention. All participants felt that they needed more time and/or more sessions to be able to embed the changes they had made once the intervention finished. Overall, social validation data indicated that participants found the intervention effective for changing their emotional and behavioural responses to stressful situations, which is reflected in the change in iPBI, USA-Q and DASS-21 scores. Participants were pleased with the delivery of sessions by the primary researcher and found that applying the GABCDE framework was useful not only for targeting behaviours and emotions related to exercise but to all areas of life, such as relationships and work/academia. Participants felt that the intervention would have been even more effective if they had longer to implement behavioural changes.

5. Discussion

This study is the first to examine the effects of REBT on irrational beliefs and symptoms of primary exercise addiction with female exercisers. The current study contributes to the emerging literature in exercise addiction, adding to the body of research within REBT in sport and exercise settings (Turner & Bennett, 2018). The findings support previous research in that irrational and rational beliefs play an important role in both exercise addiction (e.g., Outar et al., 2018) and psychological well-being (Turner et al., 2022). The results from visual and statistical analyses revealed that REBT is effective in reducing irrational beliefs, exercise addiction, and psychological distress, as well as increasing USA from pre-to during REBT. Effects were maintained on all variables two weeks later for two of the participants (Table 1). These results were substantiated by social validation data, indicating reconstructed exercise beliefs, and improved mental health as a result. Irrational exercise beliefs, exercise addiction and psychological distress have not directly been investigated previously, however one can see why they may be inter-related. When beliefs about exercise are illogical and extreme ("I must go to the gym, and I'm worthless if I don't"), the thought of not exercising can cause psychological harm (i.e., depression, anxiety). Hence, when events occur that hinder one's goal of sticking to an exercise routine (e.g., injury), behaviours will continue in order to

negate the intrusive, maladaptive thoughts that come from behavioural cessation. By reconstructing beliefs about exercise to rational beliefs (i. e., self-acceptance), interruptions in exercise are likely to be met with adaptive emotions and behaviours (i.e., remorse, healthy recovery and commitment), reducing the risk of psychological harm (i.e., from injury). As it is inevitable that clients will face adversity in pursuit of their goals, a focus on setting worthwhile goals is a key part of REBT (Turner, 2022). By re-assessing goals around exercising, clients learn to establish long term, meaningful goals that focus on wellbeing, not just exercise success. This in turn helps them to apply rational beliefs when facing adversity so that they respond with healthier emotions and behaviours. In REBT, focusing on how one's goals impact their responses is just as important as learning to replace irrational beliefs with rational beliefs (Ellis, 1994).

Of the irrational and rational beliefs, frustration intolerance and USA are two that have been linked to the development and maintenance of exercise addiction (Ellis, 1994; Hall et al., 2009). Ellis (1994) postulated that compulsion is developed when termination of a behaviour leads an individual to believe that they cannot cope with said termination. By this, when an individual believes that they must exercise, and that they cannot stand it if they do not, exercise addiction is likely to be developed, and also maintained by a perceived inability to cope without exercise. As evidenced within the current study, and from comparable research (Outar et al., 2018), REBT helped to highlight the futility of beliefs, decreasing frustration intolerance, and in turn reduced exercise addiction symptomology, and psychological distress. In addition, REBT increased USA. USA influences the development and maintenance of exercise addiction (Hall et al., 2009). Hall et al. (2009) note that low USA precedes high exercise addiction. Advancing this proposition, we identify that REBT is efficacious in both reducing irrational beliefs, and increasing rational beliefs (i.e., USA), to in turn improve exercise addiction symptomology and psychological distress. Supporting previous research and postulations (Hall et al., 2009; Outar et al., 2018), the development of USA is pivotal for not only the reduction in irrational beliefs, but the endorsement of rational beliefs in tandem.

As this is the first study to explore the benefits of psychological treatment for exercise addiction in females, it is pertinent to understand the nature of exercise addiction for the participants involved. The literature suggests that secondary exercise addiction is more common than primary exercise addiction in females (Lichtenstein et al., 2017). To draw comparisons with the findings from Outar et al., 's (2018) research, this study aimed to investigate the effects of REBT on females with primary exercise addiction. Participants in this study were deemed to have symptoms of exercise addiction of a primary nature as all three of them stated during sessions that their intention to exercise was for psychological gratification. In the early sessions, when identifying participants' GABCs, they consistently identified an increase in stress or anxiety if they could not stick to their exercise routine and felt that they would not be able to cope that day. Participants mentioned that they would feel irritated and snap at others during the day if they had missed their exercise routine and also struggled to concentrate, as thoughts about when they could fit in their next exercise session became all consuming. The main reasons stated for feeling anxious and unable to cope were around not being able to excel further in their chosen exercise rather than concerns around shape or weight.

The results of this study are comparable to the findings of Outar et al., 2018, who demonstrated the effectiveness of REBT for reducing irrational beliefs and exercise addiction symptomology in males. Contrary to another study (Bamber at al., 2003), the women in the current study were deemed to have symptoms of primary exercise addiction, suggesting that female's beliefs around exercise are not always related to a desire for weight loss. This gives research in the field of exercise addiction more scope to focus on treatment options specifically for primary exercise addiction in both men and women, who hold irrational beliefs about their coping ability in the face of adversity and therefore continue to exercise excessively, with negative consequences. To expand on this study, future research should endeavour to understand the mechanisms behind the effectiveness of REBT for those at risk of exercise addiction by exploring other variables that may change as a result of REBT, such as motivation (e.g., Turner & Barker, 2013) and to explore any differences that may arise between male and female exercisers.

Even though the overall trend in the data of this study is positive, there are some fluctuations that were noted (see Fig. 1), as well as maintained effects that were only seen for two of the participants. Whilst aggregated scores improved across participants during and post intervention, there were cases where there were immediate increases in irrational beliefs above pre-intervention levels during the intervention, only to then go down below pre-intervention levels. This fluctuation, alongside other fluctuations evidenced, could be due to factors outside of the intervention that may have made it more difficult for participants to recognise and dispute their irrational beliefs. This highlights the need for some individuals to receive more REBT sessions to allow sufficient time for them to implement skills that they have learnt.

6. Limitations

Although it is fair to suggest that irrational beliefs were reduced and rational beliefs were increased following REBT, there is no clear supported measure of rational beliefs for use in exercise populations. In this study USA was used as a measure of rational beliefs. Unconditionally accepting one's self-worth does not necessarily mean that an individual possesses other rational beliefs. Most rational beliefs were not measured (i.e., preference, anti-awfulizing, high frustration tolerance). When an individual reports low irrational beliefs, this is not to say that they also possess rational beliefs, as they are two relatively orthogonal constructs (Ellis et al., 2010). Not only are they orthogonal, but irrational and rational beliefs may also co-exist. Orwell's (1949) 'double think' hypothesis suggests that we can hold and accept two contradictory beliefs simultaneously (both irrational and rational beliefs; Turner, 2016), and as such, can draw back to either belief at contextually appropriate moments. Whilst irrational beliefs deny logic ('I must exercise'), they can also serve to help goal attainment (e.g., improve fitness). Irrational beliefs may be dormant (and rational beliefs dominant) when thinking about exercise behaviours more broadly, but one may think irrationally in a moment when aiming to reach an imminent goal (i.e., completing the last kilometre of a 10 km run with an injury). With reference to the present study, it may be so that outward portrayals of irrational beliefs about exercise behaviour were reduced, though in a different context (i. e., in the middle of a 10 km run), these irrational beliefs may be dominant, potentially deteriorating physical and psychological health if there are wider complications (e.g., injuries).

Additionally, the iPBI and USA-Q that were used in this study did not specifically measure beliefs about exercise. To strengthen future research among the exercising population, there is a need for validation and use of a measure where irrational and rational exercise beliefs are assessed. Although the use of an idiosyncratic method in the form of single-case research design is considered a strength of this study (Barker et al., 2011), future studies applying REBT within an exercise context may wish to consider using a randomised controlled trial (RCT) design to advance the field and our understanding of the application of REBT further (Jordana et al., 2020). An RCT design would help to reduce some biases that may have been present in the current study that could have influenced participants' behaviour, such as social desirability and to provide stronger generalisable evidence (Jordana et al., 2020). An RCT would allow researchers to draw rigorous comparisons and establish robust effects of REBT between control and experimental groups. Finally, to further our understanding of the impact that REBT has in improving symptoms of exercise addiction and reducing psychological distress, physiological changes could be measured as objective markers, since REBT may foster long-term shifts in physiological state (Wood et al., 2017).

A further limitation is that aside from age, no other sample

characteristics data were collected. It could be helpful for researchers to gather further demographic information about participants in future research studies, particularly because the mechanisms behind the effectiveness of REBT for exercise addiction are still largely unknown. Researchers may wish to explore how other characteristics (e.g., academic level) may impact participants' change in scores throughout the intervention.

Limitations notwithstanding, the results of this study have advanced the field of sport and exercise psychology by exploring possible treatment options for those at risk of exercise addiction. It is the first study to report the effectiveness of REBT for female exercisers and provides a foundation for REBT practitioners and sport and exercise psychologists to continue exploring the issues surrounding exercise addiction further.

7. Conclusion

To conclude, this study has helped to contribute to the sparse literature on effective treatment options for individuals with primary exercise addiction. In line with previous research (Outar et al., 2018, 2021), the findings from this study suggest that REBT could be helpful in reducing irrational beliefs and increasing USA for females showing signs of exercise addiction. However, more evidence is needed on the effectiveness of interventions for individuals who are at risk of exercise addiction to establish robust treatment interventions.

Lay Summary

A study exploring the application of a psychological intervention as treatment for exercise addiction. Use of a single-case study design, to investigate the effects of an REBT intervention on irrational beliefs, exercise addiction symptomology, unconditional self-acceptance and psychological distress in female exercisers. Adding further evidence to the current literature.

Implications for Practice

- REBT is effective for improving aspects of an individual's life that are affected negatively by their exercise routine
- Rehearsing rational beliefs could play a role in improving flexibility for females at risk of exercise addiction
- · Psychological wellbeing of females at risk of exercise addiction can be improved through the application of REBT

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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