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Examining the effects of rational emotive behavior therapy on performance outcomes in elite paralympic athletes

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Traditionally a psychotherapeutic intervention, rational emotive behavior therapy (REBT) is receiving increasing attention within the extant literature as an intervention to enhance the athletic performance and psychological well-being of competitive athletes. Whilst the benefits of REBT on psychological health are established, less is understood about the effects on athletic performance. This study aimed to examine the immediate and maintained effects of REBT on physiological, psychological, and performance outcomes with elite Paralympic athletes. Using a single-case research design, eight athletes recruited from the same Paralympic sport ($M=40.12$, $SD=12.99$) received five, one-to-one REBT sessions. Measures of irrational beliefs were collected weekly, whereas the remaining psychological and physiological measures were collected at a pre-, post-, and at a 9-month follow-up time point. Visual and statistical analyzes of the data indicates reductions in irrational beliefs were coupled with reductions in systolic blood pressure indicative of an adaptive physiological response, improved athletic performance during competition simulations, and reductions in avoidance goals. Furthermore, social validation data indicated greater self-awareness, emotional control, and enhanced focus during competition as a result of the REBT intervention. This study contributes to growing literature supporting the efficacy of REBT as an intervention that not only facilitates psychological health but also enhances athletic performance. Results are discussed with reference to theory, limitations, and future recommendations.

KEYWORDS

elite sport, emotion, irrational beliefs, paralympic athletes, physiology, single-case design, stress

1 | INTRODUCTION

Rational emotive behavior therapy (REBT¹) is a psychotherapeutic approach that promotes psychological health. In REBT, irrational beliefs about adversity (eg, failure, rejection, and ill-treatment) lead to unhealthy negative emotions (eg, anxiety, depression, and guilt) and dysfunctional behaviors, whereas rational beliefs about adversity lead to healthy negative emotions (eg, concern, sadness, and remorse) and functional behaviors. Irrational beliefs and rational beliefs each consist of four core beliefs comprising of one primary

and three secondary beliefs.² The primary core irrational belief is a rigid and extreme demand followed by three secondary beliefs of awfulizing, discomfort intolerance, and self/other/life-depreciation. Irrational beliefs are characterized as dogmatic, rigid, inconsistent with social reality, and hinder long-term goal attainment. In contrast, the primary core rational belief is a flexible and a non-extreme preference followed by three secondary beliefs of anti-awfulizing, discomfort tolerance, and self/other/life acceptance. Rational beliefs are characterized as flexible, functional, consistent with social reality, and help long-term goal attainment.³

The detrimental effects of irrational beliefs on psychological health are well established within the extant literature.⁴ In a meta-analysis of 83 primary studies, the findings report a moderate positive association between irrational beliefs and general distress ($r=.36$), depression ($r=.33$), anxiety ($r=.41$), anger ($r=.25$), and guilt ($r=.29$;⁵) Furthermore, the efficacy of REBT as an intervention to promote psychological health has been supported with hundreds of studies and three meta-analyses (eg,⁶) Using a situational ABC (DE) model,³ when in the face of adversity (ie, failure, rejection, or poor treatment) clients are encouraged to recognize that it is their beliefs (B) about the situation (A) rather than the situation per se, that determines the functionality of their response (C). Whereby, it is their irrational beliefs (B) about the situation (A) that lead to unhealthy negative emotions and dysfunctional behaviors (C) rather than the situation (A) alone.

Although not traditionally associated with performance settings, REBT presents a model of optimal human functioning,⁷ offering a pro-active intervention to enhance psychological health and one that may facilitate athletic performance.⁴ Accordingly, research has examined the effects of REBT on performance using group-based workshops and one-to-one modalities with elite athletes. Findings have evidenced reductions in irrational beliefs, facilitative shifts in an athlete's interpretation of anxiety, and both psychological and subjective performance benefits as a result of an REBT intervention (eg,⁸⁻¹⁰) Indeed, the effects of REBT on performance appear to be promising, marking a shift in a new wave of psychological techniques employed by sport psychologists. However, complete conclusions regarding the effects of REBT on athletic performance are difficult to ascertain due to a lack of critical mass and methodological shortcomings within the extant literature. For example, research has largely favored subjective rather than objective measures to ascertain the effects on emotion, behavior, and performance (eg,^{9,10}) as well REBT has been integrated within multimodal packages (eg,¹¹) making the precise effects difficult to ascertain. Within existing applied REBT literature within sport researchers have largely favored the use of group education REBT workshops to offer a pragmatic option for practitioners operating in applied constraints (ie, cost, limited time, large teams). However, findings indicate that such a modality is unlikely to yield long-term change (eg,¹²). To promote long-term fundamental changes in ones beliefs, REBT is proposed to be most effective delivered on a one-to-one basis.¹² Overcoming previous limitations, the primary aim of this study was to investigate the effects of five-one-to-one REBT sessions on psychological, physiological, and athletic performance (ie, behavioral consequences) outcomes in elite athletes.

Whilst, researchers have alluded to the possibility that irrational beliefs harbor motivational qualities (eg,¹²) research has also proposed (eg,⁴) and reported shifts in motivational

quality (ie, increased enjoyment of the sport) rather than intensity after receiving REBT (eg,¹³). Achievement goals are proposed to signify an athlete motivation for participating in sport,¹⁴ whereby approach goals are associated with positive achievement-related processes and outcomes, whereas avoidance goals are associated with negative achievement-related processes, self-handicapping, and state anxiety (eg,¹⁵) Thus, this study investigated the effects of REBT on approach and avoidance goals to further elucidate any potential effects of REBT on an athletes' motivation.

Extant literature also indicates that rational beliefs are positively related to biological indicators of health, whereas irrational beliefs are associated with biological indicators of ill-health (ie, disease-related physiological responses¹⁶) A study of 853 healthy adults reported positive associations between irrational beliefs and C-reactive protein, interleukin-6 tumor necrosis factor, and white blood cell counts, thus suggesting irrational beliefs are a risk factor for cardiovascular diseases.¹⁷ In addition, a study by Harris et al.¹⁸ reported that participants who were asked to hold an irrational belief during a real-life stressful scenario resulted in greater increases in systolic blood pressure (SBP), whereas a rational manipulation resulted in decreases in SBP. To this end, this study harnessed objective physiological markers (ie, SBP) to examine the effects of REBT on an athlete's physiological state.

There has been a rapid growth in the representation of athletes with a disability at major competitions.¹⁹ However, there is a paucity of research that has documented the effects of psychological interventions on elite athletes with a physical disability.^{20,21} This is surprising considering athletes with a physical disability encounter various demands similar to able-bodied athletes. As well encounter physical and psychological challenges specific to their condition (eg, lack of autonomy, potential injury, medical care, and negative social reactions²²) Indeed, REBT may offer an efficacious intervention to be applied with individuals with a physical disability.²³ Therefore, a secondary purpose of this study was to provide an idiosyncratic and comprehensive investigation into the effects of a one-to-one REBT program with elite Paralympic athletes using a single-case research design within ecologically valid setting (SCD²⁰).

In sum, REBT promotes psychological health and offers a model of optimal human functioning. Research suggests REBT may help athletic performance; however, the findings remain equivocal due to an overreliance on subjective and anecdotal outcome measures making the precise effects on athletic performance unclear. This study is the first to (a) investigate the effects of REBT on physiological and psychological outcomes, and competition simulation scores indicative of athletic performance, as well as (b) examine the acute and maintenance effects of REBT using a SCD with Paralympic athletes.

2 | METHOD

2.1 | Participants

Eight elite athletes aged between 18 and 57 ($M=40.12$, $SD=12.99$) years, with experience on the Paralympic program ranging over 1 month to 17 years ($M=6.56$, $SD=7.08$), were purposively recruited from the same sport (the sporting organization wished to retain anonymity). Participants 1, 3, 4, 5, 6 were male, and participants 2, 7 and 8 were female. Pre-screening procedures confirmed all participants had no previous experience or understanding of REBT. Considering all humans harbor a biological predisposition toward irrational beliefs all athletes were included in the study.⁷ Consent was provided by all participants, and ethics approval gained through the university's Research Ethics Committee.

2.2 | Design

A single-case, staggered multiple-baseline across participants design offered an experimental and ideographic platform to observe intervention effects in ecologically valid settings was used.²⁰ Meaningful changes in participants' irrational beliefs were compared against stable and representative baseline data collected prior to the beginning of the intervention phase.²⁴ The sequential delivery of REBT using a multiple-baseline design allowed the effects to be ascertained by comparing changes in irrational beliefs from the onset of the intervention to those prior to intervention delivery, whilst controlling for extraneous variables.²⁵ Remaining outcome variables (ie, psychological, physiological, and performance scores) were collected from all participants at a pre-intervention, post-intervention, and 9-month follow-up time point.

2.3 | Measures

2.3.1 | Irrational beliefs

The Shortened General Attitudes and Beliefs Scale (SGABS²⁶) was used as a measure of total state and trait irrational beliefs. In line with previous research, all four items from the rational belief subscale were removed due to its failure to provide a reliable and sensitive measure of rational beliefs, reducing the SGABS from 26 to 22 items (eg,⁹) The SGABS has good test-retest ($r=.91$;²⁶) construct, criterion, discriminant, convergent, and concurrent reliability.²⁷ Using a survey link generated by Qualtrics Software (Qualtrics, Provo, Utah, United States) measures of total irrational beliefs were collected on the same day, on a weekly basis across pre-intervention and post-intervention phases. Trait measures of irrational beliefs were also collected at 9-month follow-up time point. The measure consisted of 22 items, forming six subscales of self-downing, other-downing, need for achievement, need for approval, need for comfort, and demand

for fairness. Total irrational belief scores were calculated as a mean across all six subscales. Higher scores indicated stronger irrational beliefs. Responses were made on a 5-point Likert-scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha coefficients for total trait and state irrational belief scores indicated internal reliability scores ranging from $\alpha=0.71$ to $\alpha=.88$.

2.3.2 | Emotions

Participants' trait anxiety (A_x) was measured using 10 items with the best psychometric properties from the trait A_x subscale of the State Trait Personality Inventory (STPI²⁸) The 10 trait anxiety items within the STPI has a high test-retest reliability ($r=.76-.86$), Cronbach's alpha coefficient ($\alpha=0.90$), content, construct, and concurrent validity.²⁸ Total trait anxiety scores were calculated as a mean across all 10 items, whereby higher scores indicate higher trait anxiety. Participants recorded their answers on a 4-point Likert-scale ranging from 1 (not at all) to 4 (very much so). Cronbach's alpha coefficients for trait anxiety scores indicated internal reliability of $\alpha=0.84$, $\alpha=0.79$, and $\alpha=0.86$ at a pre-intervention, post-intervention, and 9-month follow-up time point, respectively.

2.3.3 | Achievement goals

The Achievement Goal Questionnaire (AGQ²⁹) was used to assess the participants Mastery Approach (MAp) Mastery Avoidance (MAv), Performance Approach (PAp), and Performance Avoidance (PAv) Goals in relation to the upcoming competitive simulation. In line with previous research, the ACG originally consisting of 12 items were reduced to four items (eg,¹⁰) Total approach and avoidance scores were calculated as a mean of MAp and PAp, and MAv and PAv items, respectively. Participants reported their answers on a 7-point Likert-scale ranging from 1 (not at all true) to 7 (very true). Higher scores indicate stronger approach or avoidance orientations.

2.3.4 | Performance

To assess performance participants took part in a competitive shooting simulation mimicking the format of a major championship. Performance scores were calculated as mean scores over the course of the simulation.

2.3.5 | Physiological markers

The Finometer PRO (Finapres Medical Systems, Enschede, The Netherlands) was used to collect resting physiological measures prior to the upcoming competitive simulations. Previous research has validated the Finometer PRO

as an apparatus to measure cardiovascular indices (eg,^{30,31}) Preceding the data collection process participants were notified of the upcoming simulation, then Heart Rate (HR), Systolic Blood Pressure (SBP), and Diastolic Blood Pressure (DBP) were monitored over a five-minute period; mean scores were calculated.

2.3.6 | Social validation

Semistructured interviews were conducted at the end of the post-intervention time point to ascertain the participants' perceptions and feelings of the intervention. The interview guide consisted of a series of open questions and probes, gleaned insights into the usefulness, importance, and impact of the intervention on the participants' thoughts and behaviors.¹² Interviews were also conducted and triangulated with the head coach and team sport psychologist.³²

2.4 | Data collection

To ensure participants were accustomed and desensitized to the research protocol (eg, white coat syndrome³³) participants were first provided with a 30-minute introduction session to the research project, and then completed a trial run of the research protocol (ie, self-report, physiological, and performance measures). Using the SGABS participants' irrational beliefs were monitored and completed on a weekly basis from at least 5 weeks prior to beginning the REBT intervention, to 5 weeks after completing the intervention. Based upon a multiple-baseline across participants design the REBT intervention was delivered to participants 1 and 2 after reporting 5 weeks of stable baseline measures. Participants 3 and 4 then began the REBT intervention at week 7. Following this, participants 5, 6, and 7 started the intervention at week 8, and participant 8 on week 9.

Pre-intervention measures were collected from all participants at week 5 prior to the start of the REBT intervention, and post-intervention measures were collected the week after the final participant had completed the intervention program (week 18). To explore the maintenance effects of the REBT intervention, identical measures were collected at a 9-month follow-up. Data collected at pre-, post-intervention, and 9-month follow-up were completed over the duration of a day whereby first, each participant was allocated a time slot to complete a series of self-report measures (ie, trait irrational beliefs, trait anxiety). Following this resting HR, SBP, and DBP measures were collected, and then participants were asked to report their achievement orientation prior to taking part in the competitive simulation.

2.4.1 | Intervention

The intervention was delivered by the lead author who was a supervised trainee Sport and Exercise Psychologist registered

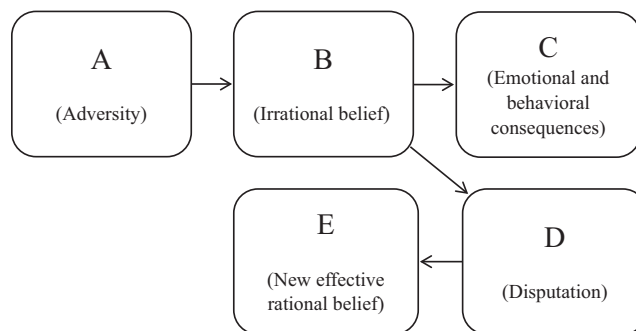


FIGURE 1 A schematic of the ABCDE framework used within the REBT process

within the Division of Sport and Exercise Psychology (DSEP) and an accredited primary practitioner in REBT. Participants received a REBT intervention program consisting of five-one-to-one sessions each lasting for 30 minutes, as well as four intersession homework tasks on a weekly or fortnightly basis. One and 2 week intervals were considered sufficient to maintain momentum, whilst allowing enough time for participants to take responsibility in the self-change process.³⁴ The intervention was separated into education, disputation, and reinforcement phases guided by the ABCDE framework (see Figure 1). For an overview of applying REBT in sport see Turner and Barker.¹² Participant 6 completed three of the five intended sessions due to availability.

2.5 | Data analysis

Due to injury (participant 7 and 8) and technical reasons (participant 5), no data were collected for participant 7, and no performance scores were collected for participant 5 and 8 at the 9-month follow-up time point.

2.5.1 | Visual analysis

A combination of visual and graphical analysis was used to investigate intervention effects on participants' irrational beliefs as is typical in SCD research.²⁰ Intervention effects were inferred when at least two of the following criteria were met: (a) The last few data points of the baseline were stable, or in the opposite direction to the predicted effects of the intervention; (b) there were a minimal number of overlapping data points between baseline and treatment phases, (c) there was an immediate effect following the intervention, and (d) there was a larger effect size in comparison with the baseline.²⁴ Participants' irrational beliefs were visually inspected using graphical and descriptive statistics.

2.5.2 | Statistical analysis

Statistical analysis was used to compliment visual inspection of the irrational belief data.²⁵ Descriptive statistics,

percentage change scores, immediate change scores, and Non-Overlapping Data points (NDP) were calculated between pre-intervention and post-intervention phases (see Table 1). The percentage of non-overlapping data points was calculated from the treatment data that overlapped with the most extreme baseline data point.³⁵ To conduct statistical analysis and ensure the data met parametric assumptions, participants' total irrational belief scores were assessed for serial dependency via auto-correlational analysis.³⁶ Scores were assessed between pre-intervention (onset of baseline to start of intervention) and post-intervention (intervention onset—5 weeks post-intervention conclusion) phases. Initially, both pre- and post-intervention scores for participants 1 and 2 were collapsed and analyzed together as there was fewer than six baseline data points. Subsequent analysis revealed non-significant autocorrelations between all but Participant 2's SGABS scores ($r=.86$). To negate violating the assumption of serial dependence a first difference data transformation was conducted, subsequently reporting a non-auto correlated data and permitted statistical analysis, whilst retaining original scores for visual analysis (see Figure 2). To determine the magnitude of the intervention effect, Cohen's d was calculated between pre-intervention and post-intervention phases.³⁷ Single-case data were interpreted in reference to small effect size <0.87 ; medium effect size $0.87-2.67$; and large effect size >2.67 categories.³⁸ In line with previous research (eg,⁹) and as is typical in SCD, changes in total irrational belief scores between pre- and post-intervention phases were analyzed using an independent samples t test for each participant. Two non-parametric correlations (Spearman's rho) were also used to examine the associations between irrational beliefs and physiological markers ([a] pre-intervention and post-intervention; [b] pre-intervention and 9-month

follow-up time point). Statistical significance was set at $P<.05$.

2.5.3 | Procedural reliability

To ensure the intervention was (a) delivered in a consistent manner, (b) received effectively, and (c) participants enacted on the intervention, a session-by-session REBT booklet guided by the ABC (DE) model was created (see Figure 1; available from the first author). Aligned with REBT practice guidelines (see^{2,3}) a list of pre-determined procedural checklists was compiled by the research team (ie, session structure, session content, time-spent on each section, key outcomes). At the end of each session, participants were encouraged to reflect and verbalize their comprehension of the session content and provided with a homework task. At start of each session, a review of the previous session/s and homework completion was conducted to clarify participants' understanding, as well influence the content of the current session.³ To minimize drifts in intervention delivery and assess procedural reliability, the lead author engaged in personal reflections and peer supervision with the research team over the course of the intervention. To control for co-intervention bias, the team sport psychologist provided no support/mention of topics related to beliefs or REBT theory.

3 | RESULTS

The results of this study are presented in two sections. First, the effects of REBT on outcome variables are outlined. Second, using social validation data we report the participants, head coach and sport psychologists' perceptions and thoughts about the intervention.

TABLE 1 Mean values, standard deviations, percentage change scores, immediate change, non-overlapping data points, and effect sizes of state irrational beliefs scores from pre- to post- intervention phases. As well, trait irrational beliefs and percentage changes scores between a 9-month follow-up time point and post-intervention phases

Participant	State irrational beliefs					Follow-up trait irrational beliefs		
	Pre	Post	Change scores (%)	Immediate change	Non-overlapping data points (%)	Effect size	Follow-up (trait)	Change scores (%)
1	2.69±0.19	2.95±0.22*	9.67	No	92.31	1.37	2.95	9.67
2	2.38±0.14	1.49±0.70*	-37.39	No	76.92	6.36	1.55	4.03
3	2.04±0.39	1.39±0.24**	-31.86	No	91.67	1.67	1.36	-2.16
4	3.85±0.16	2.66±0.70**	-30.91	No	83.33	7.44	2.68	-0.75
5	1.65±0.41	1.17±0.08**	-29.09	No	78.57	1.17	1.55	32.47
6	2.92±0.24	2.77±0.15	-4.81	No	22.22	0.58	2.95	6.50
7	1.60±0.46	1.26±0.12*	-21.25	No	7.14	0.74	N/A	N/A
8	2.67±0.24	2.46±0.18*	-9.33	No	7.69	1.09	2.41	-2.03

* $P<.05$, ** $P<.001$.

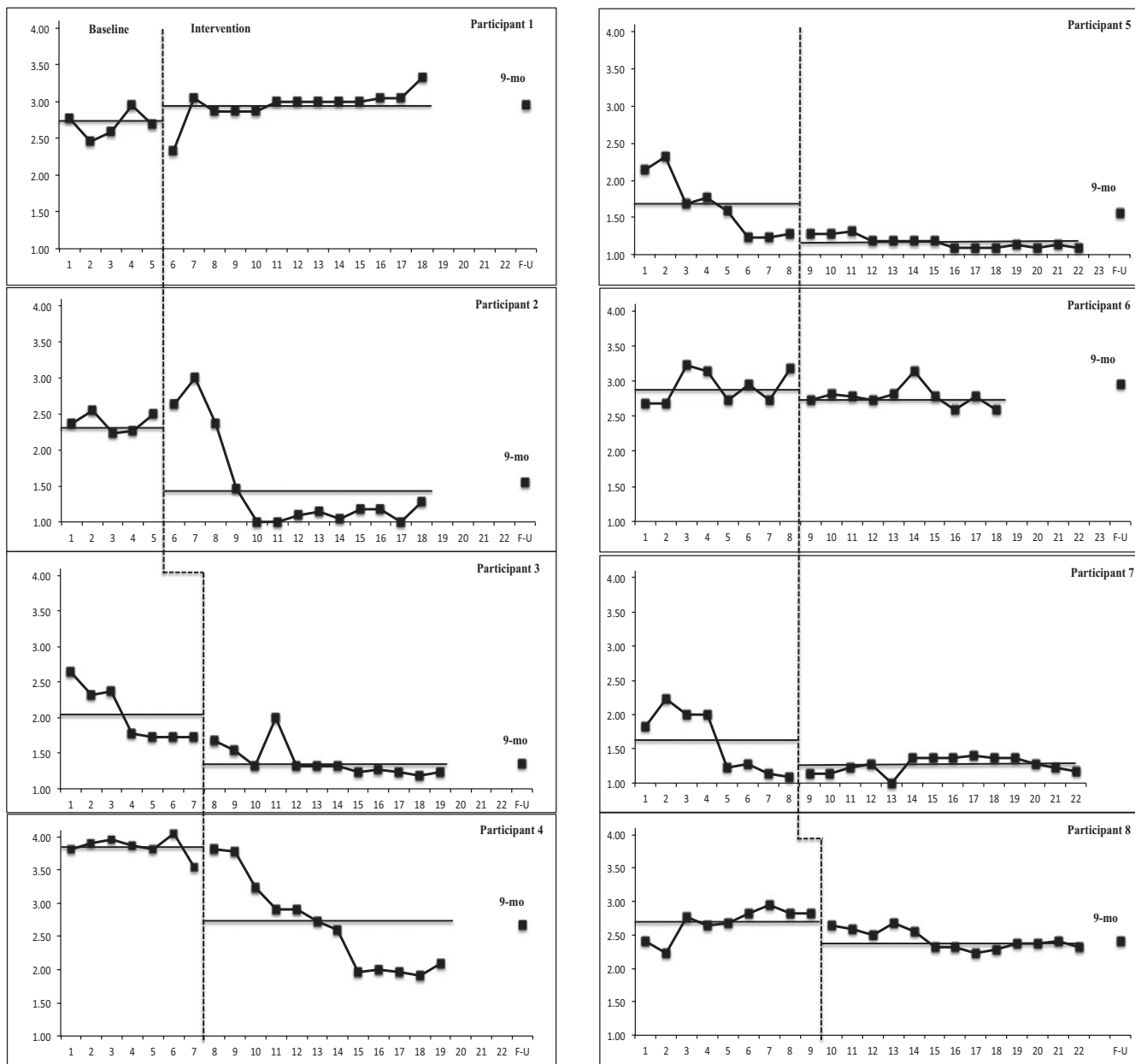


FIGURE 2 Graphed data of total irrational beliefs collected across pre-intervention, post-intervention phases, and at a 9-month follow-up time point

3.1 | Irrational beliefs

Six participants (P 2, 3, 4, 5, 7, 8) reported substantial mean reductions in irrational beliefs between pre-intervention and post-intervention phases, constituting one small, three medium, and two large effect sizes (see Table 1). Notably, the REBT intervention brought about maintained reductions in irrational beliefs for five (P, 2, 3, 4, 5, 8) of a possible seven participants between the pre-intervention phase and at a 9-month follow-up. Further, three of five participants (P 3, 4, 8) reported reductions between the post-intervention phase and 9-month follow-up. Participant 1 recorded a statistically significant increase in irrational beliefs after the onset

of the REBT intervention, which plateaued for the remainder of post-intervention phase (see Figure 2). Participant 6 who received only three of the five intended REBT sessions reported no significant changes in irrational beliefs between pre- and post-intervention phases. No participants reported an immediate change in irrational beliefs at the start of the intervention, indicating a delayed intervention effect (see Figure 2). In sum, data indicates short- and long-term reductions in irrational beliefs as a result of the REBT intervention. However, participants 5 and 7 exhibited both a downward trend and strong floor effects prior to the onset of the intervention and therefore should be interpreted with caution.

TABLE 2 Mean values for trait anxiety, approach goals, avoidance goals, and competition simulation performance scores collected at each time point

Participant	Approach goals			Approach goals			Avoidance goals			Simulation performance scores		
	Pre	Post	Follow-up	Pre	Post	Follow-up	Pre	Post	Follow-up	Pre	Post	Follow-up
1	16	18	25	4.5	2.5	5.5	3.5	1	4	28.45	28.30	28.02
2	17	13	14	4.5	3	5	2	2	2	14.85	22.50	22.39
3	11	10	12	5	4	4	5	1.5	3	23.90	27.06	N/A
4	23	23	20	5.5	4	6	5	4.5	6	22.88	23.80	23.75
5	18	16	17	4	2	4	3.5	2	2.5	25.27	23.75	25.50
6	28	25	21	5.5	5	5	4	3.5	2.5	24.25	24.69	25.15
7	18	18	N/A	5.5	5	N/A	3	3	N/A	22.60	24.75	N/A
8	16	17	16	6	5	6	5	4.5	4	25.20	N/A	23.90

3.2 | Trait anxiety

Three of the five participants (P 2, 4, 5) who reported reductions in irrational beliefs also reported reductions in trait anxiety between pre-intervention and 9-month follow-up (see Table 2). Participant 1 who reported significant increases in irrational beliefs recorded increases in trait anxiety scores between both pre- and post-intervention, and at a 9-month follow-up time point. Nonetheless, only one of the six participants (P 2) who reported significant reductions in irrational beliefs showed substantial reductions in trait anxiety between pre- and post-intervention (see Table 2).

3.3 | Physiological measures

Three of the eight (P 2, 4, 6) participants reported reductions in mean resting SBP scores between pre- and post-intervention time points. Whereas all seven participants reported a reduction in mean resting SBP between a pre-intervention and 9-month follow-up time point. Five of six participants (P 2, 3, 4, 5, 8) who reported significant reductions in irrational beliefs between pre- and post-intervention phases also reported reductions in mean resting SBP between pre-intervention and 9-month follow-up time points (see Table 3). Spearman rho indicated a non-significant but moderate positive correlation between reductions in irrational beliefs and SBP from pre-intervention to 9-month follow-up ($r_s(7) = .57, P = .18$). Whereby, 44% of the variance in change SBP scores were accounted for by the change scores in irrational beliefs. In contrast, there was a very weak negative correlation in changes in irrational beliefs and SBP from pre-intervention to post-intervention ($r_s(8) = -.07, P = .86$) time points. Furthermore, data suggests the intervention brought about reductions in resting blood pressure for participants who initially reported high levels and significant reductions in irrational beliefs. To illustrate, participants 2 and 4 indicated staggered reductions in SBP and DBP across all three-time points; thus, reductions in irrational beliefs may have a lagged effect on the mean

resting SBP of the participants approaching a competition simulation.

3.4 | Performance scores

Five of seven participants (P 2, 3, 4, 6, 7) recorded improvements in competitive simulation performance from pre- to post-intervention (see Table 2). Four of five participants who reported significant reductions in mean irrational beliefs from pre- to post-intervention phases (P 2, 3, 4, 8) also recorded improvements in performance scores from pre- to post-intervention. Four of six participants (P 2, 4, 5, 6) reported performance increases between pre-intervention and 9-month follow-up. In sum, the data indicated reductions in irrational beliefs brought about by the REBT intervention were paralleled with increases in the participants' performance scores between pre-, post-intervention, and 9-month follow-up time points. Considering the variations in the magnitude of change in each participant's performance scores, such conclusions are drawn tentatively; in addition, participant 1 exhibited strong ceiling effects in performance scores across all time points.

3.5 | Achievement goals

All six participants who reported significant reductions in mean irrational beliefs from pre- to post-intervention (P 2, 3, 4, 5, 7, 8) also reported small reductions in approach goals (see Table 2). Furthermore, five of these six participants (P 3, 4, 5, 7, 8) also reported reductions in avoidance goals from pre- to post-intervention. All participants reported a maintained (P 3, 6) or an increase (P 1, 2, 4, 5, 8) in approach goals from post-intervention to 9-month follow-up; whereas, four of seven participants reported a maintained (P 2) or reduction (P 1, 4, 5, 8) in avoidance goals. These data suggest the REBT intervention may have brought about reductions in approach goals and greater and sustained reductions in avoidance goals.

TABLE 3 Mean values and standard deviations for resting heart rate, diastolic blood pressure, and systolic blood pressures prior to competition simulations, collected at each time point

Participant	Heart rate			Systolic blood pressure			Diastolic blood pressure		
	Pre	Post	Follow-up	Pre	Post	Follow-up	Pre	Post	Follow-up
1	90.67±3.58	92.69±2.54	89.15±3.60	152.04±6.58	157.96±7.11	147.89±6.17	89.00±3.65	92.91±3.76	93.49±3.42
2	78.86±2.43	70.77±2.49	77.96±2.59	141.24±4.43	134.51±3.88	125.51±4.54	86.56±2.74	83.25±2.55	79.31±2.91
3	83.03±2.91	85.99±3.32	91.59±2.29	152.03±6.92	158.14±10.18	141.33±8.66	91.43±3.86	99.52±5.09	99.23±3.09
4	73.80±3.77	61.26±3.47	70.96±5.37	163.70±11.95	150.69±7.27	132.66±6.77	99.42±8.62	94.88±4.06	82.91±3.92
5	83.39±1.52	75.35±1.58	89.60±1.78	97.89±3.39	105.33±2.73	97.22±3.20	60.80±1.42	67.16±1.54	66.16±1.74
6	88.21±3.21	82.44±3.77	82.58±4.81	151.86±24.61	133.41±1.76	140.85±7.02	93.45±11.52	93.93±1.19	89.83±4.26
7	81.48±5.06	77.02±4.26	N/A	133.26±5.73	139.18±6.00	N/A	74.94±3.39	85.33±4.95	N/A
8	65.20±4.35	91.73±4.18	76.70±4.03	139.36±5.62	143.01±6.17	135.01±4.54	79.17±4.21	84.85±3.83	82.07±3.10

3.6 | Social validation

Interviews revealed that the participants, head coach, and sport psychologist perceived the REBT intervention positively, and reported a shift toward a rational philosophy. In response to adversity, participants noted improvements in: taking perspective, confidence, and autonomy to manage their emotions, self-awareness, and the autonomy to use rational self-talk that subsequently enhanced their self and other perceptions. To illustrate, participant 2 noted “I feel these sessions have been incredibly helpful and I have gained tools that I will use for the rest of my life”. Participants also reported performance improvements as a result of the REBT intervention including: managing negative thoughts, improved competition concentration, and the ability to respond proportionately to competition stressors. To illustrate, participant 6 stated “It has allowed me to focus on my performance without wasting my mental energy”. All parties reported the REBT intervention developed inter-personal relations within the team through the use of rational language and rational phraseology. For example, participant 8 stated “I don’t put other people in boxes anymore and place a big X next to them”. As a result of the intervention, both the head coach and sport psychologist reported no changes in participants’ motivation. In addition, the participants were reported to have engaged and been receptive to the intervention, which was facilitated, by the content, style of delivery and establishing trust with the practitioner.

4 | DISCUSSION

Moving beyond previous research this study was the first to examine the immediate and maintained effects of REBT on psychological, physiological, and performance outcomes with elite Paralympic athletes. As well, offering an idiosyncratic examination into the effects of REBT in an underrepresented elite sample of Paralympic athletes. In line with previous research (eg,^{8,9}) the findings reported short-term and maintained reductions in irrational beliefs as a consequence of the REBT intervention. However, such reductions in irrational beliefs were not coupled with reductions in anxiety as reported in previous studies (eg,⁹) This may be explained by the conceptualization of emotion as a binary construct.³⁹ Here, rational beliefs lead to functional negative emotions, whilst irrational beliefs lead to dysfunctional negative emotions.³ Therefore, both functional and dysfunctional emotions can be experienced under low, medium, and high intensities. Hence, marginal or no reductions in anxiety would be predicted as a result of the REBT intervention. Research employing measures that accurately capture emotional functionality are warranted to better ascertain the effects of irrational beliefs on emotion and athletic performance.

Although, little changes were reported in trait anxiety, reductions in irrational beliefs as result of the REBT intervention were mostly matched by enhanced athletic performance. These findings support the subjective performance benefits outlined in recent studies (eg,⁹) and importantly contributing to the dearth of research investigating the effects of REBT on objective markers of athletic performance (eg,¹³). Not restricted to sport, the data also contributes to the relatively scant evidence base associating reductions in irrational beliefs with adaptive behavioral performance. Both greater and maintained reductions in avoidance compared to approach goals may provide one explanation by which reductions in irrational beliefs brought around increases in athletic performance. When facing an important competition it is plausible that reductions in irrational beliefs (eg, “it would be terrible if I failed and this would make me a complete failure”) led to experiencing healthy negative emotions (eg, concern), thus encouraging a shift in focus from what could go wrong, to what could be achieved. Indeed, research has evidenced approach goals to be associated with positive achievement-related processes compared to avoidance goals.^{14,15} To further understand the effects of REBT on athletic performance, a comprehensive examination into the association between beliefs and quality of motivation would offer a fruitful and impactful line of enquiry.⁴ Theoretically, the influence of irrational beliefs on cognitive appraisals⁴⁰ may also explain improvements in a participant’s performance, whereby irrational and rational beliefs influence an individual’s representation of reality in terms of its personal significance.¹² Therefore, when facing adversity (ie, competition) irrational and rational beliefs influence one’s primary and secondary appraisals.⁴¹ To illustrate, when approaching or during an important competition we posit irrational beliefs may distort and place too great a demand on the athlete and amplify the prospect of failure. Therefore, low levels of irrational beliefs will reduce the likelihood of a stress appraisal oriented around harm/loss and threat, and instead reappraise challenging situations (eg, anticipating future gain from encounter⁴²).

Analysis of physiological data indicated reductions in irrational beliefs was coupled with reductions in resting SBP between pre- and post-intervention time points. Furthermore, reductions in SBP were maintained at 9-month follow-up. In line with previous research (eg,¹⁸) these findings show reductions in absolutistic and rigid irrational beliefs may also be associated with lower levels of resting SBP. To explain, Harris et al. proposed “mental rigidity” (p. 5) leads to autonomic rigidity (ie, increased SBP), whilst “mental flexibility” leads to autonomic flexibility. Thus, raising the possibility that reductions in irrational beliefs signify a biological indicator of health and the process of REBT may foster long-term and adaptive shifts in an athlete’s physiological state. Whilst this finding is novel and supports the notion that irrational beliefs are detrimental for physical health (eg,

increased inflammation¹⁷) this may have larger implications for practitioners working with elite athletes with a physical disability. For example, researchers purport high blood pressure is symptomatic in elite athletes who have suffered spinal cord injuries.⁴³

Supporting previous research social validation data indicated subjective performance benefits as a result of the REBT intervention (eg,¹³). The ABC (DE) model was reported to provide athletes with enhanced self-awareness, greater emotional control, and increased autonomy when encountering a challenging situation. Furthermore, participants were able reappraise challenging situation, rationalizing the importance or significance of an event and use functional self-talk to enhance competition concentration.

Although by definition and much of the current findings indicate irrational beliefs are unhelpful for performance, one participant suggested the contrary. Aligned with previous suggestions (see⁴) this case highlighted that for some irrational beliefs may instead harbor adaptive qualities for acute athletic performance. The notion is interesting and has implications for professional practice. For example, it would be ill advised for practitioners to reinforce an irrational approach in athletes considering the detrimental effects on psychological health.⁵ Yet during competition the adoption of irrational self-talk during key moments may offer performance-enhancing effects. Researchers are recommended to look beyond what appears to be a simplistic and dichotomized view into the effect of irrational and rational beliefs on human performance. Specifically, researchers would be prudent to examine the mechanisms between irrational and/or rational beliefs and their subsequent effects on both performance and psychological health.

Collectively, the study reports the promising effects of REBT; however, there are certain limitations that should be acknowledged. First, the participants’ medical records were not collected prior to the data collection process; thus, the precise effects of any medication on the outcomes measures although controlled were difficult to garner. Second, we were unable to control for fluctuations in environmental conditions during the competition simulations, invariably this may have had some bearing on the participant’s performance scores. Finally, using a single-case research design the current study provided a rigorous idiosyncratic investigation²⁵ into intervention effects. However, the nature of longitudinal applied research makes it vulnerable to various contextual and individual fluctuations. Nevertheless, the use of self-report, objective, and social validation measures goes some way to mitigate against these effects.²⁰ Although, the current study reported sustained reductions in irrational beliefs, social validation data collected from the lead sport psychologist brings to light various complexities and applied considerations when working with Paralympic athletes. Specifically, the athletes’ disability, medical history, and traumatic experiences were

reported to influence participants' ability to learn, comprehend, and adopt principles associated with REBT. Therefore, to ensure effective application, the duration and pace of REBT should be tailored to meet the individual's needs. Although providing a validated and pragmatic measure of irrational beliefs, the SGABS provides only a general rather than performance-specific measure. In light of this, future researchers could use measures of rational beliefs and irrational beliefs (ie, Irrational Performance Beliefs Inventory⁴⁴) that are specific to performance contexts.

5 | PERSPECTIVE

The current study provides an idiosyncratic investigation into the effects of REBT on physiological, performance, and psychological markers in elite Paralympic athletes. The study findings contribute to the growing body of research supporting the efficacy of REBT as valuable intervention that brought around immediate and maintained improvements in athletic performance, as well as psychological and physiological health. In addition, the study reports the successful application of a valuable psychological intervention within a specialized population group that has been under represented within the extant sport psychology literature. Although traditionally a psychotherapeutic model, the core features of REBT offer a model of optimal human functioning, targeting underlying beliefs that elicit fundamental shifts in an athlete philosophy toward sport (eg,¹³) that traditional psychological skills (ie, relaxation, self-talk) are unable to access. Ultimately, the application of REBT marks a shift in perspective for effective interventions to enhance athlete well-being and performance within sport psychology.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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