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Final Draft

"I need to go to the gym": Exploring the use of rational emotive behaviour therapy upon exercise dependence, irrational and rational beliefs.

Outar, L.*¹, Turner, M. J.¹, Wood, A. G.¹, & Lowry, R.²

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1. Centre for Sport, Health and Exercise Research, Staffordshire University
2. Department of Sport and Exercise Sciences, University of Chichester

*corresponding author: B180, Brindley Building, Staffordshire University, Leek Road, Stoke on Trent, St4 4DF, m.turner@staffs.ac.uk

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Abstract

32 Extant research suggests that irrational and rational beliefs may play an important role
33 in both substance and behavioural addictions. However, the influence of irrational and
34 rational beliefs pertaining exercise addiction has yet to be investigated. Rational
35 emotive behaviour therapy (REBT) is a cognitive-behavioural approach that provides a
36 theoretical framework to identify and change irrational beliefs through cognitive
37 restructuring and endorsing rational beliefs. The principal aim of the current study is to
38 examine the effectiveness of a one-to-one REBT programme in decreasing irrational
39 beliefs and exercise addiction symptoms, and increasing unconditional self-acceptance,
40 in three male exercisers. The exercisers present high symptoms of exercise addiction,
41 and high irrational beliefs. A single-case, staggered multiple-baseline across participant
42 A-B design is used in the current study to examine the effects of a six-week REBT
43 program comprising six 45-minute one-to-one counselling sessions and 5 homework
44 assignments. Visual and statistical analyses, and social validation data indicate strong
45 reductions in low-frustration tolerance, composite irrational beliefs, and exercise
46 addiction from pre- to intervention phase. In addition, all participants report increased
47 unconditional self-acceptance. This is the first study to report the effects of REBT in an
48 exercise population, and the first to demonstrate that exercise addiction symptoms can
49 be attenuated using REBT. This study supports literature suggesting that irrational and
50 rational beliefs are an important mechanism in exercise addiction and provides
51 important implications for the development of its treatment.

52 Keywords: Intervention; cognitive behavioral; case-study; rational beliefs; exercise

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56 “I need to go to the gym”: Exploring the use of rational emotive behaviour therapy upon
57 exercise addiction, irrational and rational beliefs.

58 A large corpus of empirical evidence exists associating regular practice of physical
59 exercise with a plethora of psychological and physical benefits (Bouchard, Sheppard, &
60 Stephens, 1994). However, research has shown that, as with behaviours such as gambling or
61 internet-use, the practice of physical exercise can acquire an addictive character (Sussman et
62 al. 2011). In such cases, the person adopts a behavioural pattern that is meticulous, and
63 inflexible, making it difficult to reduce intensity, frequency, or time committed to exercise,
64 this occurs even in the presence of negative consequences such physical injury and
65 disregarding social and professional obligations (Freimuth et al. 2011), in such instances of
66 behaviour this relate to exercise addiction.

67 Exercise addiction is described as pathological pursuit of exercise behaviour, that is
68 marked by psychological dysfunction in which exercise behaviour becomes out of control,
69 compulsive and dependent, resulting in a plethora and psychological and physical
70 impairments (Little, 1969, Szabo, Griffiths, & Demetrovics, 2016). At present, nosology of
71 exercise addiction remains equivocal with no official diagnostic criteria, due to this very few
72 documented cases have emerged. At present, the diagnosis of exercise addiction is largely
73 determined by clinical judgment. Clinicians screen patients to identify underlying motivators
74 pertaining to an individual’s exercise behaviour, emotional connection to exercise, and
75 influence on other facets of their life. This information is then corroborated using a valid
76 assessment tool (i.e. Exercise dependence scale; Hassenblas & Hassenblas, 2002b) to

77 ascertain the severity of exercise addiction symptoms. To this end, pathogenic exercisers (i.e.
78 exercise addiction) can be discerned from high-frequency/or committed exercisers (i.e.
79 healthy habit), like athletes or avid exercisers who maintain control over exercise, have
80 meticulous training regimes, however maintain social and professional obligations, and
81 encounter no deleterious or negative consequences as a result of their exercise practices.

82 Exercise addiction is often classified as a behavioural addiction (Egorov & Szabo,
83 2013), analogous to gambling addictions. However, as it stands the DSM-5 in its subsection
84 of “Non-substance-related disorders” includes only gambling addictions as a behavioural
85 addiction (American Psychiatric Association, 2013), with exercise addiction residing as a
86 “compensatory behaviour” of eating disorders such as Anorexia and Bulimia Nervosa.
87 Consequently, scholars working in the area of exercise addiction have relied on theoretical
88 models derived from two kinds of criteria: (1) those proposed and derived from the substance
89 dependence subsection in the DSM-IV (American Psychiatric Association 1994, Hausenblas
90 & Downs, 2002a, b) or (2) those proposed for behavioral addictions by Griffiths (1996,
91 2005). Extant literature utilising both criteria, have proposed prevalence rates of 2-3% for the
92 general exercising population (Mónok et al, 2012). However, endurance exercise populations
93 have yielded prevalence rates of up to 20% (Griffiths et al. 2015).

94 De Coverley Veale (1987) discerned between primary and secondary exercise
95 dependence. Primary exercise dependence entails pathological exercise behaviour which is
96 driven solely for psychological gratification from exercise behaviour alone (Bamber,
97 Cockeril & Carroll, 2000), whereas secondary exercise dependence relates to the use of
98 exaggerated exercise as means to regulate and control another disorder (e.g. Anorexia
99 Nervosa, Bulimia Nervosa). Thus, to avoid conceptual confound, when considering exercise
100 addiction this paper will adopt a “primary” conceptualisation, therefore utilising Hausenblas
101 & Symons-Downs (2002b) perspective to assess, describe and define exercise addiction. To

102 this end, exercise addiction is defined as “a craving for leisure time physical activity that
103 results in uncontrollable excessive exercise behaviour that manifest physiological and/or
104 psychological symptoms” (Hausenblaus & Symons-Downs, 2002b p. 90). Therefore, exercise
105 addiction is marked by psychological, behavioural and social factors including: unhealthy
106 exercise intensity/frequency, exercising more than intended, lack of control over exercise,
107 withdrawal symptoms, a great deal of time pursuing exercise, reduction in other activities due
108 to exercise, and continuing to exercise despite recurring physical and/or psychological
109 problems.

110 Despite a large corpus of research investigating this phenomenon and its detriments,
111 there remains a paucity of research identifying underlying mechanisms that contribute to the
112 onset, development, and maintenance of exercise addiction. Moreover, scant attempts of
113 treatment have been reported within literature, however, as with other behavioural addictions,
114 cognitive behavioural therapy (CBT) has been recommended to help exercisers to reconstruct
115 their maladaptive beliefs concerning exercise (Weinstein & Weinstein, 2014).

116 To date, etiology studies of exercise addiction have proposed both neurobiological
117 and psychological explicative models (Weinstein and Weinstein 2014; Thompson & Blanton,
118 1987; Szabo, 1995). Egorov and Szabo (2013) postulated that exercise addiction could
119 manifest by utilising exercise as a coping mechanism arising from the interaction between
120 adversity and one’s interpretation of such events. Once this coping method of stress is
121 adopted, the individual becomes reliant on it to function adequately. Furthermore, the
122 individual believes that he/she is engaging in a seemingly health behaviour for stress
123 management given scholastic and public health resources, providing rationalization for their
124 pathogenic exercise behaviour that begin to impede upon social and professional obligations.
125 However, eventually when life-obligations forces the individual to reduce frequency of
126 exercise bouts, causing exercise privation, consequently, psychological hardship resurfaces

127 and manifests as withdrawal symptoms (e.g. anxiety, depression, agitation, irritability).
128 Moreover, theoretical postulates have highlighted psychological traits such as trait anxiety
129 (Coen & Ogles, 1993), perfectionism (Cook, 1996), and obsessive compulsiveness (Spano,
130 2001) as predispositions to the development of exercise addiction. Finally, Egarov & Szabo
131 (2013) conceived the notion of a “black box”, relating to the idiographic mindset of an
132 individual with exercise addiction. The black describes the possible interactions between
133 personal and situational factors, which increase the onset, development and maintenance of
134 exercise addiction. Key components of the black box entail ongoing, unbearable or suddenly
135 appearing adversities (e.g. loss, break ups, bullying) which causes pain that the individual has
136 no control over. This also interacts with attentional cognition in that prior experience, inter-
137 and intra-personal thought, beliefs and conviction will influence exercise behaviour as means
138 for escape path. Considering the aforementioned, one psychological construct that has been
139 linked to the above, and thus could be valuable in understanding exercise addiction, is that of
140 irrational and rational beliefs.

141 Derived from the postulates of rational emotive behaviour therapy (REBT; Ellis,
142 1957), irrational and rational beliefs allude to cognitive pattern in which individuals holds in
143 the face of adversity (rejection, failure, loss). Rational emotive behaviour therapy is a
144 cognitive-behavioural approach to the promotion of psychological health and well-being, and
145 postulates, that all disturbance occurs as a consequences of dysfunctional information
146 processing (Ellis, 1962, 1994). REBT delineates between irrational (e.g., demandingness, low
147 frustration tolerance, awfulizing, and self-, other-, or world-depreciation) and rational beliefs
148 (e.g., preferences, high frustration tolerance, anti-awfulizing, and self-, other-, or world-
149 acceptance; Ellis & Dryden, 1997), and adopts a binary theory of emotional distress,
150 discerning between dysfunctional and functional emotions, thus being qualitatively different
151 than quantitatively. Irrational processing to internal stimuli (e.g., a pain in your leg) or

152 external stimuli (e.g., receiving negative feedback) are hypothesised to produce unhealthy or
153 maladaptive emotions reactions (i.e., UNEs; anxiety, rage, depression). In contrast rational
154 processing of stimuli are hypothesised to produce healthy or adaptive emotional reactions
155 (i.e., UNEs; concern, assertiveness, sadness). Beliefs are evaluative or appraisal mechanisms
156 and are consistent with Albeson and Rosenberg's (1958) conceptualisation of hot cognitions.
157 Beliefs evaluate representations of reality in terms of their personal significance to that
158 individual. Therefore, the primary objective of REBT is to change irrational beliefs through
159 cognitive restructuring, and to promote rational beliefs to propagate psychological health and
160 well-being (Ellis & Dryden, 1997; MacInnes, 2004). Indeed, REBT holds that neurotic
161 disturbances are a by-product of escalating one's rational, flexible, preferences into irrational,
162 inflexible, demands. To this end, people develop our irrational beliefs by what they greatly
163 desire. Furthermore, REBT posits that beliefs, irrational/and or rational, engender emotional
164 experiences that create specific action tendencies. Thus, irrational beliefs facilitate behaviour
165 tendencies to engage in escape or avoidant behaviours, contrarily rational beliefs generate
166 emotions that facilitate approach behaviours (Ellis, 1994; Dryden, 2002). More precisely,
167 Dryden delineates a gamut of behaviours/action tendencies associated with holding irrational
168 beliefs, viz. withdrawing from reinforcement, isolation, avoiding feared situations, self-
169 harming, searching for constant reassurance, repetitive behaviour, ignoring attempts to
170 restore social equilibrium. Examples of overt operant behaviours include avoiding anxiety
171 provoking situations because we have endorsed the belief that we must not experience it
172 because to do so would be completely awful, and we could not stand it. Such postulates, may
173 provide understanding to the psychological processes of an exercise addiction, with the
174 exerciser holding irrational beliefs about the prospect of missing an exercise bout, and
175 therefore displaying an array of unhealthy negative emotions (i.e. anxiety, guilt), and
176 accompanying avoidance/safety behaviours (rigid programmes, missing social obligations,

177 training whilst injured). The theory and efficacy of REBT has received support (David,
178 Szentagotai, Kallay, & Macavei, 2005) from within both clinical and non-clinical populations
179 and with youth and adult samples (e.g., Turner, 2016; Visla, Fluckiger, Holtforth, & David,
180 2016).

181 Extant research has positively associated irrational beliefs with substance (e.g.
182 cocaine; Moller et al. 2007; Greven, 1985; Penn & Brooks, 2000) and behavioural addictions
183 (e.g. Internet use and gambling: Petry et al. 2007; Young, 2007; Lupu & Lupu, 2013; Cardak,
184 Koc, & Kolac, 2009). Indeed, Ellis (1994) in his only formal contribution within sport and
185 exercise psychology literature highlighted the potential problem of overindulgence in
186 exercise, remarking “like avoidance, overindulgence usually has strong elements of low
187 frustration tolerance that sparks it and keeps it going. Thus, compulsive exercising and
188 playing in sports often stems from irrational beliefs such as, "Because I like exercise [or
189 sports] I should be able to participate in it all the time without harming myself. I can't stand
190 limiting myself. It's awful if I'm restricted." (p. 258). To this end, REBT interventions
191 fundamental goal would be to identify irrational beliefs in addictive behaviours that result in
192 maladaptive emotions and behaviours (i.e. anxiety, guilt, substance abuse, gambling). More
193 precisely, Ellis et al. (1988) postulated that treatment involves changing self-defeating
194 thinking about discomfort and maintaining abstinence through development of high
195 frustration tolerance (HFT), this contention was supported by Ko et al. (2008), highlighting
196 Low frustration tolerance (LFT) as a principal antecedent of addictive behaviours. Low
197 frustration tolerance is one of the central concepts in REBT theory and arises from beliefs
198 that frustration (or discomfort) is unbearable and therefore must be avoided regardless of
199 cost. Low frustration tolerance can be depicted in beliefs such as “things should be as I want
200 them to be, I can't stand it when they are not,” and are considered to be driven by immediate
201 gratification, at the expense of long-term damage (Ellis, 2002). In exercise addiction, this

202 relates to the individual's inability to reduce exercise intensity or stop exercise especially
203 when medically prohibited, due to wanting to avoid the discomfort that exercise withdrawal
204 brings (e.g. anxiety, depression, irritability). To date, only one study has highlighted the role
205 of beliefs (rational) in exercise addiction. Halls et al. (2009) reported a relationship between
206 rational beliefs and exercise addiction, holding that unconditional self-acceptance played a
207 mediating role in exercise addiction, in that low levels of unconditional self-acceptance
208 preceded high levels of exercise addiction. However, this study did not measure irrational
209 beliefs. Past research has highlighted the importance of assessing both irrational and rational
210 beliefs, because irrational and rational beliefs are relatively orthogonal, and low irrational
211 beliefs do not necessarily mean high rational beliefs (i.e., they do not correlate highly; Ellis,
212 David, & Lynn, 2010); therefore, the specific role of irrational beliefs pertaining to exercise
213 addiction remains unknown.

214 In sum, exercise addiction represents a condition that poses a threat to physical and
215 psychological health and wellbeing (e.g., Hausenblas & Symons-Downs, 2002b). At present
216 there is a dearth of literature implicating potential underlying mechanisms that pertain the
217 development and maintenance of exercise addiction. Furthermore, given exercise addictions
218 complicated history establishing conceptualisation, definitions, and theoretical frameworks
219 there remains a paucity of literature providing sound empirical approaches to its treatment,
220 with mere mentions of suitable treatment methods (Weistein & Weistein, 2014).

221 Therefore, the current study aims to elucidate the influence of irrational and rational
222 beliefs on exercise addiction (e.g., Ellis, 1994; Hall et al., 2009), and in doing so will
223 examine the efficacy of an REBT intervention with exercisers reporting exercise addiction
224 symptoms, using a single-case design in line with previous literature (e.g., Turner & Barker,
225 2013). Providing examination of the effects of REBT on irrational beliefs (particularly low
226 frustration tolerance), rational beliefs (particularly unconditional self-acceptance; USA), and

227 exercise addiction symptoms. To the researcher's knowledge, no research has examined the
228 role of irrational beliefs upon exercise addiction, furthermore no research has intervened with
229 exercise addiction symptoms. Thus, considering theoretical underpinnings, it was
230 hypothesised that an REBT intervention will reduce irrational beliefs (particularly low
231 frustration tolerance), increase Unconditional self-acceptance, and reduce exercise addiction
232 symptoms, from pre- to intervention, with the effects remaining stable at follow-up.

233 **Method**

234 **Participants**

235 After liaising with a U.K. leisure centre based in the Midlands, verbal consent was
236 attained to recruit participants from their facility. The participants were three of eleven
237 volunteers that expressed an interest in taking part in a program that was advertised to bring
238 greater self-awareness of exercise beliefs. Participants were three male exercisers ($M_{age} =$
239 22.00 ; $SD = 1.73$; *Participant age*; $p_1 = 22$; $p_2 = 20$; $p_3 = 23$), with 3-5 years of gym
240 experience ($M_{exp} = 4.33$; $SD = 1.54$), who were not engaged in any other sport or physical
241 activity during the data collection for this study. Experience refers to exercising at or over the
242 government exercise guidelines for physical activity (150-minutes of moderate intensity
243 activity, and two muscle-strengthening exercise sessions per week). All participants reported
244 that they exercised 4-6 times weekly, which entailed a mixture of aerobic and resistance
245 training. Participants were selected using a screening process, which indicated that the three
246 participants reported high exercise addiction symptoms (i.e., scoring at risk of exercise
247 addiction or non-dependent symptomatic; Hausenblas & Symon-Downs, 2002), and high
248 irrational beliefs scores (compared to adult norms; Turner et al., 2016). The ED-s
249 classification postulates that less than 5% of individuals would be classified as at risk for
250 exercise dependence, 62.5–62.6% as nondependent symptomatic and 30.6–33.8% as
251 nondependent (Downs et al. 2004). Considering the postulations of Freimuth, Moniz, & Kim

252 (2011) four phase of the development of exercise addiction, at stage two (at-risk) occurs
253 when individuals perceive the intrinsically rewarding benefits of regular exercise (i.e. mood-
254 altering effects). Thus, considering the aforementioned, both exercise addiction risk and non-
255 dependent symptomatic was considered suitable for selection given risk being high and ED
256 diagnosis (<5%) being scant. Informed consent was obtained, and ethical approval granted
257 from the University before all data collection.

258 **Design**

259 The study utilised a single-case, staggered multiple-baseline across participant A-B
260 design (Barker, McCarthy, Jones, & Moran, 2011), which has been used in previous REBT
261 research (Turner & Barker, 2013). Participants established a stable baseline (iPBI, EDS,
262 USAQ) before the intervention onset, which is important because a stable baseline aids the
263 establishment of whether any change (statistical, meaningful, or both) has occurred. The A-B
264 design is a robust procedure for assessing effect of the intervention (i.e. REBT) on the target
265 variables (i.e. exercise addiction, irrational beliefs, and USA), and it allows the practitioner to
266 ascertain whether the intervention brought about change (Kazdin, 1982). REBT was applied
267 sequentially across participants at different time points, to allow for changes in the dependent
268 variables to be attributed to the intervention rather than extraneous variables (Kazdin, 1982).
269 Specifically, participant 1 commenced the intervention phase in Week 4, participant 2 in
270 Week 5, and Participant 3 in week 6. Through this design one would expect changes to occur
271 in the target participant(s) only, with the participant's data in the baseline phase remaining
272 stable (Barker et al., 2011).

273 **Measures**

274 **Irrational beliefs.** The irrational Performance Beliefs Inventory (iPBI; Turner et al.,
275 2016) was used to measure irrational performance beliefs. The iPBI comprised 28-items that
276 measure the four core beliefs (demandingness, awfulizing, low-frustration tolerance, and

277 depreciation), as well as providing a composite value (Comp) for all four core irrational
278 beliefs. Participants are asked to indicate their agreement on the 28-items on a Likert-scale
279 between 0 (*strongly disagree*) to 5 (*strongly agree*). The iPBI has shown construct validity,
280 and correlates well with established irrational beliefs measures, and with anxiety, depression,
281 and anger, demonstrating concurrent and predictive validity. For Comp, Cronbach's alpha
282 coefficient displayed acceptable to excellent internal reliability ($\alpha = .50$ to $.99$).

283 **Exercise addiction.** The Exercise Dependence Scale-21 (EDS; Hausenblas &
284 Symons-Downs, 2002a, 2002b) is a multi-dimensional measure used to establish individuals'
285 risk of exercise dependence. It considers individuals risk by presence of exercise dependence
286 symptoms and derives from the DSM-IV criteria for substance dependence (American
287 Psychiatric Association, 1994). The scale includes 21 items grouped into seven subscales,
288 which relate to different aspects of exercise dependence (tolerance, withdrawal, intention
289 effect, lack of control, time, reduction in other activities and continuance). Participants rate
290 items on a 6-item Likert-scale from 1 (*Never*) to 6 (*Always*), which allows for categorization
291 as 'at risk', 'non-dependent symptomatic' or 'non-dependent asymptomatic' based upon their
292 responses. 'At risk' categorization refers to potential exercise dependence, non-dependent
293 symptomatic and 'non-dependent asymptomatic' refer to a lack of dependence however
294 symptoms pertaining to dependence for the former. In this study participants one and three
295 were categorised as "at risk" and participant two as "non-dependent symptomatic." The scale
296 has been used in a plethora of research and has demonstrated content and concurrent validity.
297 Furthermore, the ED-S has demonstrated adequate test-retest reliability. Cronbach's alpha
298 coefficient displayed good to excellent internal reliability ($\alpha = .86$ to $.97$)

299 **Unconditional self-acceptance.** The Unconditional Self-Acceptance Questionnaire
300 (USAQ; Chamberlain & Haaga, 2001) is a 20-item scale with 11 reversed items. Participant's
301 rate items on a 7-item Likert-scale from 1 (*almost always true*) to 7 (*almost always untrue*).

302 The USAQ has been used previously in sport (Cunningham & Turner, 2016), and measures
303 the belief that one fully and unconditionally accepts oneself regardless of behaviour,
304 achievement, approval, respect, or love from others (Ellis, 1977). Cronbach's alpha
305 coefficient displayed low to good internal reliability ($\alpha = .18$ to $.76$). Whilst reporting of
306 Cronbach's alpha is important, the reader should consider the alphas reported in this study
307 cautiously due to the sample size used. Indeed, some suggest that a sample size of $n = 30$
308 (Yurdugül, 2008) or even $n = 50$ (Javali, Gudaganavar, & Raj, 2011) is required for reliable
309 Cronbach's alpha calculation.

310 **Social validation.** Social validation allows for the addition of subjective data as a
311 supplement to objective data (Wolf, 1978). Furthermore, it allows the practitioner to ascertain
312 participant satisfaction of the intervention which is important as it ties the intervention effect
313 with the social context and guides future applied work (Storney & Horner, 1991). Social
314 validation data were collected at the end of the follow-up phase to establish clinical
315 significance of the intervention. A focus group format was utilised to collect qualitative data
316 from all three participants with regards to the perceptions of intervention, delivery, and
317 efficacy (Hrycaiko & Martin, 1996; Kazdin, 1982; Schwartz & Baer, 1991). The social
318 validation focus-group was conducted by a third-person, not known to the participants, to
319 minimize social desirability. The focus-group allowed for divulgence of their personal and
320 joint experiences with reference to changes in the dependent variables and broader
321 implications in life, furthermore the focus group involved topics which highlighted the social
322 significance of goals, social importance of effects and social appropriateness of the procedure
323 of the intervention, which are outlined as the key requirements for the evaluation of social
324 validation (Page & Thewell, 2013).

325 **Data collection**

326 Data were collected over a five-month period. Participants were required to complete
327 the iPBI, EDS, and USAQ twice a week during the baseline phase (3 weeks). Thereafter, the
328 clients were required to complete the iPBI and USA twice per week through the intervention
329 phase (6 weeks) and the follow up phase (2 weeks). The EDS was required to be completed at
330 the start, middle and end of the intervention phase (week 1, 3, and 6) and at the end of follow
331 up phase (research completion). The intervention took place in the private personal training
332 consultation room of a leisure centre, that comprised conventional office amenities viz. desk,
333 chair, white board, and television screens.

334 **Intervention**

335 The intervention comprised a six-week REBT program comprising six 45-minute one-
336 to-one counselling sessions and 5 homework assignments (between each session) conducted
337 by the first author. The first author was a 27-year-old male with a degree in psychology and
338 Master of Science degree in sports and exercise psychology. Furthermore, he had undergone
339 REBT training at the Albert Ellis institute at the University of Birmingham and was under
340 supervision of a British Psychological Society (BPS) Chartered, Health Care Professions
341 Council Registered, and REBT-trained sport and exercise psychologist (second author).
342 Session agendas were planned prior to sessions and followed a pre-determined structure to
343 ensure intervention procedural reliability across participants. Sessions adhered to guidelines
344 within REBT literature (Dryden & Branch, 2008; Dryden & DiGiuseppe, 1990; Ellis &
345 Dryden, 1997; Turner & Barker, 2014).

346 The program included three phases: education, cognitive restructuring, and
347 reinforcement.

348 The *education phase* principle aim was to teach participants the fundamentals of
349 REBT. Thus, participants were educated on how to identify beliefs (i.e. rational and
350 irrational), differentiation between irrational (i.e. demands, awfulizing, low frustration

351 tolerance, self-depreciation) and rational beliefs (preferences, anti-awfulizing, high
352 frustration tolerance, self-acceptance), and how such beliefs in the face of adversity
353 (challenge, difficulty, upset) can create either unhealthy negative emotions (e.g. anxiety,
354 depression, unhealthy envy) or healthy negativity emotions (e.g. concern, sadness, healthy
355 envy). Furthermore, clients were educated that it was their beliefs (B) that determined their
356 emotional and behaviour consequences (C), and not the event or adversity (A). In this phase,
357 great emphasis was placed on accountability of emotional and behavioural responses. Thus,
358 participants were taught that irrespective of the adversity, they can have autonomy over their
359 beliefs, and therefore emotional and behavioural responses being either irrational
360 (dysfunctional) or rational (functional). For example, participant 1 expressed irrational beliefs
361 (B) regarding achievement (e.g. “I want to achieve, therefore I must achieve, it would be
362 unbearable if I did not and I would be a complete failure”). In relation to exercise this
363 manifested into anxiety (C) when missing exercise bouts(A), which led to avoidance
364 strategies (C) including missing social/employment obligations and rigid exercise routines or
365 over compensatory behaviour (exercising twice a day) when a bout was missed. A
366 fundamental component of the ABCDE process is goal setting, in the form of beliefs,
367 emotions and behaviour, thus, participants were asked to consider how they would like to
368 respond (C), and how such change would aid their goals (e.g. exercise enjoyment, improved
369 social life etc). For example, participant one wanted to not feel extremely anxious when
370 missing an exercise bout, and subsequently adopt a plethora of avoidance strategies, rather,
371 instead feel concerned/nervous and subsequently having a more flexible approach to exercise
372 (e.g. attending social events even when conflicting with exercise regimes)

373 The *cognitive restructuring phase* (also known as disputation) is the most critical
374 aspect of the intervention phase, this took place over two sessions. A core tenant of REBT
375 when restructuring cognitions (i.e. irrational beliefs) is to assume that the adversity (A) is

376 correct, and therefore reconstruct the irrational beliefs held regarding the A rather than
377 reconstruct the A (Ellis & Dryden, 1997), additionally rational beliefs are constructed and
378 promoted, thus promoting healthy emotions, and adaptive behaviour. The practitioner
379 followed a directive formulaic approach to reconstruct participant irrational beliefs, this
380 process entailed three strategies based upon evidence (where is the evidence?), logic (does it
381 make sense?), and pragmatics (is it helpful?) (DiGiuseppe, 1991).

382 The *reinforcement phase* entails rehearsal of new strategies and beliefs (i.e. rational
383 beliefs). This occurred throughout the intervention and specifically in the latter stages. First,
384 this is achieved through setting homework assignments to support self-awareness, self-
385 reflection, and affirmations of its principles (Ellis & Dryden, 1997) Moreover, participants
386 were educated an array of methods including cognitive, emotional, and behavioural methods
387 to reinforce and internalize their rational philosophy. Cognitive assignments involved
388 working through ABCDE self-help worksheets, reconstructing workbooks and creating
389 rational self-statements. Emotive assignments included rational emotive imagery (REI
390 Dryden, 1997), in which the client utilised imagery techniques to identify emotions and
391 reconstruct cognitions to practice before real life application. Finally, behavioural
392 assignments include testing rational philosophies in challenging situations. For example,
393 participants were asked to go the gym however to not exercise and to simply stand by. This
394 allowed participants to test their rational philosophies in the face of adversity (e.g. “I want to
395 exercise, however that does not mean that I must”. Additionally, REBT encourages
396 individuals to abandon self-rating and self-esteem, and instead invest in Unconditional self-
397 acceptance (USA; Chamberlain & Haaga, 2001). Extant literature postulates the importance
398 of USA in exercise addiction, thus, sessions emphasised to role of USA to support a rational
399 philosophy. First, this was achieved by outlining the difference between self-esteem and
400 USA. Second, by utilising Dryden’s (2009) Realistic USA Credo, to develop a tailored credo

401 in which the practitioner and participant worked in collaboration, this supported the
402 comprehension, and investment of the construct. Finally, the final session included a review
403 of the content to test the clients understanding of REBT. Here the practitioner used the
404 method “rational reverse role-play” (RRR; Kassinove & DiGiuseppe, 1975), in which the
405 practitioner became the participant and role-played an exerciser with irrational beliefs, while
406 the participants identified, reconstructed and reinforced new effective rational beliefs.

407 **Results**

408 **Data analysis**

409 Visual analysis of the data was conducted to ascertain whether the REBT
410 intervention brought about any meaningful changes upon the dependent variables (Bloom,
411 Fischer & Orme 2009). The graphical display has adopted a single data point format to allow
412 the data level between and within intervention phases to reveal intervention effectiveness
413 (Franklin, Alison, & Gorman, 1996). Through graphical interpretation it is possible to
414 determine whether a meaningful change in the data has occurred. Hrycaiko and Martin (1996)
415 proposed that this can be achieved by (a) the immediacy of effect at intervention phase (b) the
416 number of overlapping data points between the pre-intervention, intervention, and follow-up
417 phases, and (c) the magnitude of the effect following the intervention. Visual analysis of low-
418 frustration tolerance, composite irrational beliefs, and USA occurred for each participant
419 using graphs and descriptive statistics. Low-frustration tolerance has been specifically
420 examined due to its consideration as being fundamental in the development and maintenance
421 of exercise dependence. Cohens *d* (1988) was generated, to allow indication of the effect size
422 in changes between pre-intervention, intervention, and follow-up phase mean levels (Table
423 1).
424 To further determine intervention effects, statistical analysis was performed to accompany
425 visual analysis (Barker & Jones, 2008; Wolfe et al, 1982). Following relevant guidelines

426 (Ottenbacher, 1986), the data were assessed for serial dependency via autocorrelation
427 analysis to ensure that the data qualified for parametric tests. Participant's dependent
428 variables (irrational beliefs, exercise addiction, unconditional self-acceptance) were analysed
429 for serial dependency, apart from participants 3's exercise addiction scores, as there were too
430 few data points (< 10 data points; Ottenbacher, 1986). Autocorrelation analyses revealed
431 significant autocorrelation in iPBI scores for participant 1 and 2, however not in participant 3
432 (P1, $r = 0.93$; P2, $r = 0.86$, P3, $r = 0.66$), with all other data yielding non-significant
433 autocorrelation in exercise addiction (P1, $r = 0.58$, P2, $r = 0.42$) and USA (P1, $r = 0.44$; P2, r
434 $= 0.50$, P3, $r = 0.36$). The autocorrelated data were rendered suitable for statistical analysis
435 utilising guidelines for first difference data transformation (Ottenbacher, 1986), producing
436 non-autocorrelated data for participant 1's and 2's iPBI scores, thus permitting statistical
437 analysis, with the retention of original scores for visual analysis. The dependent variables
438 (irrational beliefs, USA, and exercise addiction) were examined for changes across
439 timepoints using independent-samples t -tests. For irrational beliefs and USA, for each
440 participant two t -tests were performed (pre-intervention to intervention, and intervention- to
441 follow-up). For exercise addiction, for each participant only one t -test was performed (pre-
442 intervention to intervention) because the follow-up phase included only one exercise
443 addiction data point. For statistical analyses, statistical alpha was set at $p < .005$, after
444 Bonferroni correction (9 tests) and for brevity, only statistically significant t -tests are
445 reported, raw data can be found in Table 1.

446 **Low frustration tolerance**

447 The mean levels indicated that for low frustration tolerance beliefs, each participant's
448 scores decreased from pre-intervention to intervention phases (Figure 1). Participants
449 reported this change immediately after the first REBT session, and there was one overlapping
450 data point for participant 1 and 2, and no overlapping data points for participant 3.

451 Furthermore, participant 1 showed a 19.87% decrease ($d = 1.70$), participant 2 showed a 32%
452 decrease ($d = 3.03$) and participant 3 showed a 32.33% decrease ($d = 2.92$), from pre-
453 intervention to intervention phases. Moreover, participant 1 showed a 38.99% decrease ($d =$
454 2.52), participant 2 a 17.65% decrease ($d = 1.19$) and participant 3 a 23.72% decrease ($d =$
455 1.65), from intervention to follow-up ($M = 13.54$; $SD = 2.10$) intervention phases.

456 Statistical analyses revealed that participant 3, $t(15) = 5.05$, $p = .001$, reported a
457 significant reduction in low-frustration tolerance from pre- intervention to intervention
458 phases.

459 **Composite irrational beliefs**

460 The mean levels indicated that for composite data, each participant's scores decreased
461 from pre-intervention to intervention phases. Participants experienced this change
462 immediately after the first REBT session, additionally there were no overlapping data points
463 for all three participants. Moreover, participant 1 showed a 21.00% decrease ($d = 1.80$),
464 participant 2 showed a 26.93% decrease ($d = 4.15$) and participant 3 showed a 26.84%
465 decrease ($d = 2.73$), from pre-intervention to intervention phases. Participant 1 showed a
466 41.12% decrease ($d = 2.75$), participant 2 a 7.10% decrease ($d = .82$), and participant 3 a
467 14.36% decrease ($d = 1.28$), from intervention to follow-up ($M = 10.08$; $SD = 1.37$) phases.

468 Statistical analyses revealed that participant 3, $t(15) = 4.79$, $p = .001$, showed a
469 significant reduction in composite scores from pre-intervention to intervention phases.

470 **Exercise addiction**

471 Mean levels indicated that for exercise addiction, participants' scores decreased from
472 pre-intervention to intervention phases. Moreover, participant 1 showed a 23.28% decrease (d
473 $= 1.40$), participant 2 showed a 13.11% decrease ($d = 1.78$) and participant 3 showed a 2.51%
474 decrease ($d = 1.25$), from pre-intervention to intervention phases. Moreover, participant 1
475 showed a 55.00% decrease ($d = 2.54$), participant 2 a 3.16% decrease ($d = .49$) and

476 participant 3 a 2.84% decrease ($d = 1.94$), from intervention to follow up ($M = 2.84$; $SD =$
477 $.88$) phases.

478 **Unconditional self-acceptance**

479 The mean levels indicated that for unconditional self-acceptance, each participant's
480 scores increased from pre-intervention to intervention phases (Figure 3). Participants
481 experienced this change immediately after the first REBT session, each participant
482 experienced overlapping data points, participant 1 and 3 both experienced one overlap with
483 participant 2 experiencing six overlapping data points. Participant 1 showed a 10.78%
484 increase ($d = -1.51$), participant 2 showed a 4.14% increase ($d = -.92$), and participant 3
485 showed a 3.29% increase ($d = -.76$), from pre-intervention to intervention phases. In addition,
486 the data illustrates that scores were upheld and slightly increased for USA from intervention
487 to follow-up phase, for example participant 1 displayed a 5.9% increase, participant 2 a
488 4.25% increase and participant 3 a 2.8% increase, from intervention to follow-up phases.
489 Statistical analyses revealed that participant 1, $t(16) = -3.38$, $p = .001$, showed a significant
490 reduction in composite scores from pre-intervention to intervention phases.

491 In summary, visual and statistical analysis of the target variables indicated that REBT
492 brought about meaningful reductions in low-frustration tolerance, composite irrational
493 beliefs, and exercise addiction in all participants, changes from pre-intervention to
494 intervention phases were particularly strong in all participants. In addition, all participants
495 reported increased USA. Changes occurred from the introduction of REBT and therefore all
496 changes that occurred can be attributable to the REBT sessions. Moreover, withdrawal (i.e.
497 follow up phase) of the intervention resulted in further reductions in irrational beliefs,
498 exercise addiction, and further increased in USA. Considering visual analysis guidelines
499 (Hrycaiko & Martin, 1996), meaningful changes reductions were shown in low-frustration
500 tolerance, composite irrational beliefs, and meaningful increases were shown in USA.

501 Specifically, for low-frustration tolerance, composite irrational beliefs, and USA, immediate
502 effects occurred (within two data points) after REBT implementation, there were few
503 overlapping data points between pre-intervention to intervention phases, and the target
504 variables displayed a great magnitude of effect.

505 **Social validation data**

506 Social validation data indicate that exercisers thought that the REBT intervention was
507 significant to their social goals. Exercise played a fundamental role within their lives, thus
508 possessing healthier, functional, and adaptive behaviours and emotions towards exercise was
509 congruent with their own goals. Greater self-awareness of irrational beliefs (B) and
510 subsequently the cognitive restructuring of such beliefs (D), followed by the promotion of
511 rational beliefs (E) lead to such goals. For example, participant one commented that before
512 the REBT intervention “I used to feel anxious or angry if I did not go to the gym, since the
513 sessions now I feel more relaxed as I know that I do not need to come to the gym”, whilst
514 participant 3 stated “It helped me identify the difference between rational and irrational and
515 the consequences for each one and therefore I was able to promote the more rational side”.
516 Exercisers greater awareness lead to reductions of irrational beliefs and promotion of rational
517 beliefs, which consequently resulted in healthier exercise behaviours, this was supported
518 through their responses in the iPBI, USAQ, and EDS. Furthermore, regarding the importance
519 of these effects, social validation data suggested that exercisers deemed the REBT
520 intervention important.

521 REBT provides emotional and behavioural control through progression of the
522 ABCDE framework. This framework guides the client to a rational philosophy, which is
523 embodied by greater quality of life through greater relations and fulfilment of goals. For
524 example, participant one commented, “It helped me with my relationships, like with my
525 girlfriend”, whilst participant three stated “I didn’t think it would help this much, when I’m at

526 work I no longer feel the need to be aggressive”. This again corroborated the responses from
527 the iPBI and USAQ. Finally, in regard to appropriateness of the procedures, social validation
528 data suggested that exercisers deemed the REBT intervention as appropriate. REBT stresses
529 the importance of developing a therapeutic alliance and progression through the ABCDE
530 framework. Exercisers expressed how the practitioner’s conduct aided the delivery of REBT
531 and that the ABCDE framework was sufficient in reaching their therapeutic goals. For
532 example, participant three commented “I felt that he cared and wanted us to be better and that
533 he didn’t need us to be, but he wanted us to be”, whilst participant two stated “For me it was
534 perfect, so I wouldn’t change a thing” and another “It gave you enough to go through it
535 properly, I wouldn’t change it at all”.

536 In summary, social validation data suggested the REBT intervention brought about
537 intentional changes to reduce irrational beliefs and increase rational beliefs, and this in turn
538 promoted healthier exercise behaviour (i.e., reduction in exercise addiction symptom). Social
539 validation indicated that REBT enhanced emotional and behavioural control that transferred
540 outside of the exercise domain into general life. Specifically, exercisers perceived REBT to
541 be socially important and helpful within their life and relationships with others. Finally,
542 social validation data suggested that exercisers deemed REBT as appropriate, specifically the
543 authors conduct and progression through the ABCDE framework.

544 **Discussion**

545 The principal aim of this study was to explore the effects of an REBT intervention on
546 reducing irrational beliefs, exercise addiction, and increasing unconditional self-acceptance in
547 a sample of male exercisers. This is the first study to explore the postulates of the role of
548 irrational and rational beliefs upon exercise addiction (Ellis, 1994; Hall et al., 2009),
549 however, more importantly to identify potential framework for its treatment. As such, it was

550 hypothesised that an REBT intervention would decrease irrational beliefs and exercise
551 addiction and increase unconditional self-acceptance.

552 The results from the visual and statistical analysis of the data indicate that REBT was
553 effective in reducing irrational beliefs, exercise addiction and increasing unconditional self-
554 acceptance from pre-intervention to intervention phases. These changes continued from
555 intervention to follow-up phases, illustrating that REBT had a lasting effect on irrational
556 beliefs, exercise addiction and unconditional self-acceptance at 4 weeks, follow up phase.
557 The results were corroborated by social validation data indicating that all participants
558 reconstruction in their exercise beliefs, consequently, changed their behaviour towards
559 exercise.

560 Low frustration tolerance beliefs were postulated an important antecedent in
561 behavioural addictions (Ellis, 1988, 2002; Ko et al. 2008). This study supported such notions
562 highlighting the reduction of low frustration tolerance (and other beliefs) indeed brought
563 about changes in exercise addiction symptomology. There are a variety of mechanism by
564 which low-frustration tolerance beliefs may contribute to the development and maintenance
565 of exercise addiction. Ellis (1994) conceived that the compulsive nature of exercise derives
566 from the endorsement of beliefs such as “I want to go the gym, therefore I need to go the
567 gym, if I were to not I could not stand it”, therefore an exerciser endorsing such beliefs when
568 missing an exercise bout may appraise such situations as unbearable. Indeed, considering the
569 aforementioned literature on the role of emotion generation of irrational beliefs, exercisers
570 holding such appraisals may engage in safety or avoidance behaviours (excessive repetitive
571 behaviour) which manifest as exercise addiction. For example, the injured exerciser may
572 continue to exercise regardless of medial contradiction, as they believe they may not have
573 relevant resources to cope with stressors other than exercise (Dryden, 2008). Therefore,
574 feelings of anxiety, guilt may arise when the individual is forced to miss the gym. Thus, by

575 cognitive reconstruction of an exercisers beliefs (i.e., low-frustration tolerance) to rational
576 beliefs (i.e. high-frustration tolerance), consequently, leading to more functional appraisals
577 (e.g. I want to go the gym, however, that does not mean I must, thus, I can stand it if I do
578 not), subsequently, this will generate adaptive emotions (i.e., concern, remorse), and in turn
579 lead the accompanying adaptive behaviour (i.e. healthy exercise commitment).

580 Another important tenet of exercise addiction is the role of unconditional self-
581 acceptance, implicated as a mediator in exercise addiction (Hall et al., 2009). The data
582 reported increases in unconditional acceptance in all participants, with participant one
583 experiencing significant increase. Therefore, the notions postulated by Hall et al. (2009) have
584 been corroborated by this study highlighting the role of rational belief in exercise addiction.
585 More precisely, the underlying notion of unconditional self-acceptance holds that individual's
586 unconditional accept themselves despite unfavourable behaviours (e.g. missing exercise;
587 Ellis, 1997). Therefore, exercisers endorsing depreciation beliefs such as “not exercising
588 would make me a failure, loser, terrible person”, may engage in addictive exercise behaviours
589 (e.g. continuance, tolerance, time) and when missing an exercise bout may suffer withdrawal
590 symptoms (anxiety, irritability, agitation, insomnia), contrarily, an exerciser endorsing
591 unconditional self-acceptance beliefs such as “missing an exercise bout would not make me
592 a failure, nor determine my worth” are likely to engage in more adaptive behaviours (e.g.
593 appropriate injury recovery, social engagement, non-compensatory exercise). The role of
594 Unconditional self-acceptance is an important one, as it highlights the role of appraising
595 one's worth in relation to important facets in one's life (i.e. exercise).

596 **Limitations**

597 The current study has some limitations that if addressed could strengthen the findings.
598 First, this study lacked an objective measure of functional and dysfunctional emotions and
599 behaviours. This omission occurred because although the notion of UNEs and HNEs is a

600 central element of REBT (Dryden, 2009), no accurate measure has emerged in literature. The
601 authors decided against using a unitary measure of emotions (e.g., anxiety, anger, depression)
602 due to the significant time already being spent by participants on completing questionnaire,
603 and because the unitary measurement of emotions is not in keeping with REBT theory. As a
604 result, it is not possible to accurately infer emotional changes in the current study. In addition,
605 Hausenblas, Gauvin, Symons-Downs and Duley (2008) have suggested that positive and
606 negative mood states may be independently influenced by exercise abstinence. Future
607 research should be invested in developing an accurate measure of UNEs and HNEs for use in
608 applied research. Moreover, whilst the present study brought some insight into the role of
609 irrational beliefs (chiefly low-frustration tolerance), one cannot infer that a reduction in low
610 frustration tolerance results in an increase in high-frustration tolerance, because irrational and
611 rational beliefs are relatively orthogonal (Ellis, David, & Lynn, 2010); low irrational beliefs
612 does not equate to high rational beliefs. At present, there is no contrasting rational version to
613 the iPBI and there are very few rational beliefs questionnaires. Therefore, to enhance the
614 rigorous investigation of the influence of cognitive reconstruction from irrational to rational
615 beliefs, a rational performance beliefs inventory (measuring high frustration tolerance, anti-
616 awfulizing, preferences, and acceptance) is warranted. Furthermore, objective measures of
617 exercise behaviour were not measured. Hausenblas and Symons-Downs (2002b) pointed out,
618 exercise behaviour is not a strong predictor of exercise addiction and given that there is no
619 objective amount of exercise that is considered detrimental or harmful, inferences made
620 would be fruitless. To be clear, the current study aimed to reduce exercise addiction
621 symptomology, rather than deter exercise behaviour. Second, a caveat when intervening with
622 exercise addiction is the role of cognitive biases. In this study, the researcher was not blind to
623 research parameters and therefore the halo effect may have taken place, however to
624 circumvent this bias, the researcher followed the ABCDE framework, and adhered to a

625 systematic approach to the intervention delivery, with general beliefs being the main foci of
626 the discussion, rather than exercise beliefs per se. Indeed, the Hawthorne effect too could be
627 influential, as participants may have deduced the natures of this study, however as stated
628 before this study did not deter exercise behaviour and looked at beliefs in array of life
629 spectrums (academia, relationships, exercise and occupational). Nevertheless, researchers
630 should take caution to such biases when developing interventions and exploring potential
631 underlying mechanisms.

632 Finally, although the design of the current study is line with single-case research
633 guidelines, data from only three participants is considered who are demographically
634 homogenous (males aged between 20 and 23). Therefore, the results of the current study are
635 difficult to generalise to other populations. Although the effectiveness of REBT has been
636 demonstrated a wide variety of populations (e.g., Turner, 2016), the same study with female
637 exercisers may yield different results, given that primary exercise addiction is more prevalent
638 in males (Costa et al., 2013). Therefore, researchers should conduct larger-scale cross-
639 sectional studies examining the role of irrational and rational beliefs in exercise addiction
640 across a wider range of samples and could also repeat the methods in the current study, but
641 with different populations.

642 **Conclusion**

643 To conclude, as far as the authors are aware the present study is the first to report an
644 intervention to reduce the symptoms of exercise addiction, and the first to examine the effects
645 of REBT on irrational beliefs in exercisers. The current study contributes to the growing
646 literature in exercise addiction and adds to the body of literature concerning the use of REBT
647 in sport and exercise settings (Turner & Bennett, 2018). The findings of this study suggest
648 that irrational and rational beliefs may play an important role in exercise addiction (e.g. Ellis,
649 1994; Hall et al., 2009) and supports recommendations for the treatment of exercise addiction

650 using cognitive behavioural therapy (Weinstein & Weinstein, 2014). This study has
651 highlighted the role of beliefs in the maintenance of exercise addiction and provides
652 practitioners and researchers with a framework to reduce irrational beliefs, increase rational
653 beliefs, and reduce exercise addiction symptomology. It is hoped that this research will serve
654 as a catalyst for further research into the deleterious effects of exercise addiction, the
655 treatments for exercise addiction, and to assist exercisers in developing healthy beliefs
656 regarding exercise.

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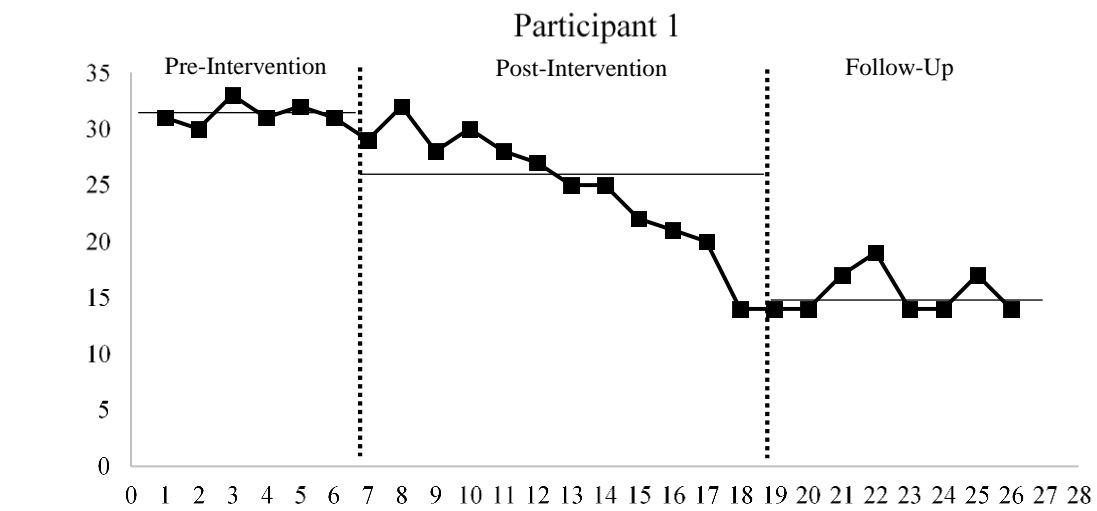
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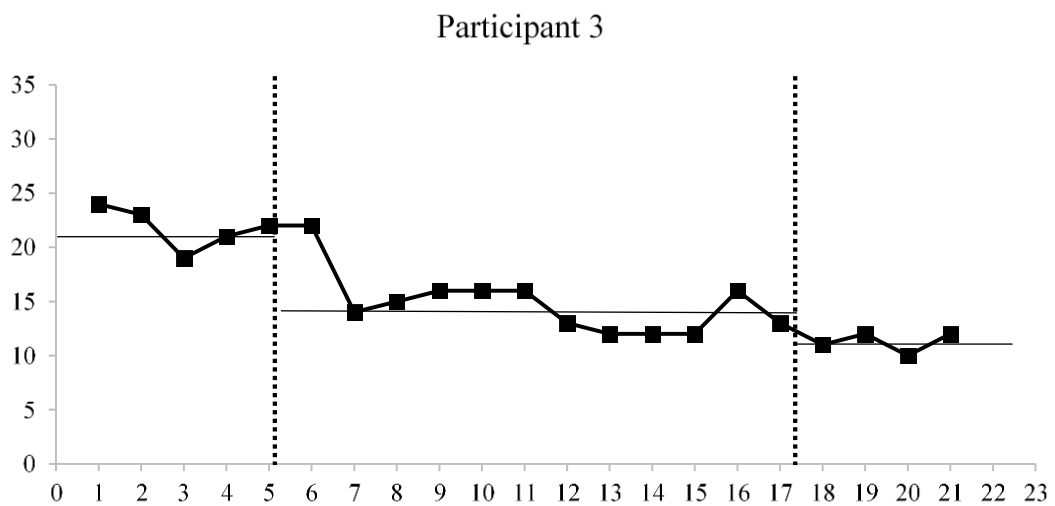
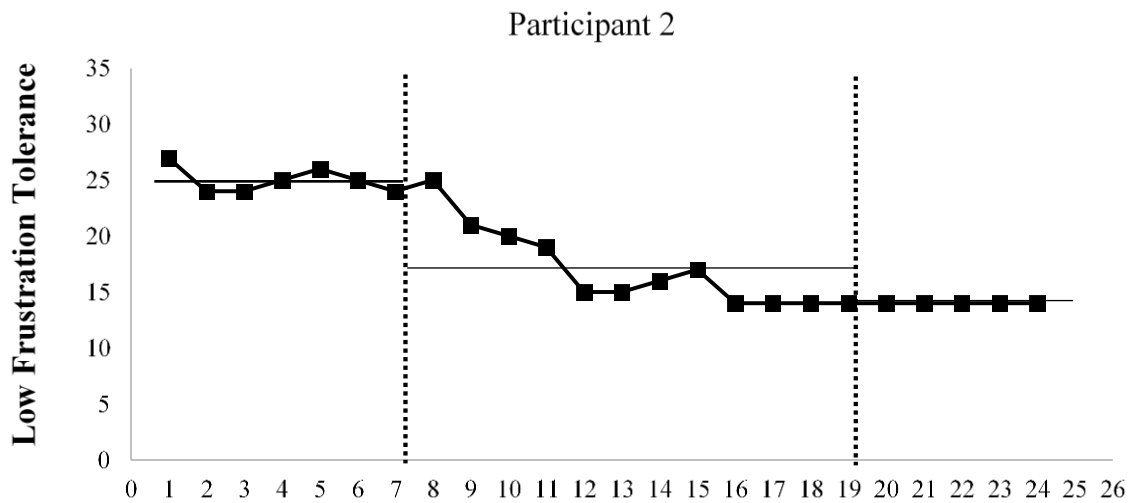
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854 Figure 1. Graphed data for low frustration tolerance across timepoints for each participant.

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891 Figure 2. Graphed data for unconditional self-acceptance (USA) across timepoints for each
 892 participant

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