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Outar, L, Turner, MJ , Wood, AG and Lowry, R (2018) "I need to go to the gym": Exploring the use of rational emotive behaviour therapy upon exercise addiction, irrational and rational beliefs. *Performance Enhancement and Health*, 6 (2). pp. 82-93. ISSN 2211-2669

DOI: <https://doi.org/10.1016/j.peh.2018.05.001>

Publisher: Elsevier

Version: Accepted Version

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

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Accepted: 22nd May 2018

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27 Abstract

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

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

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

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

63 Exercise addiction is described as pathological pursuit of exercise behaviour, that is
64 marked by psychological dysfunction in which exercise behaviour becomes out of control,
65 compulsive and dependent, resulting in a plethora and psychological and physical
66 impairments (Little, 1969, Szabo, Griffiths, & Demetrovics, 2016). At present, nosology of
67 exercise addiction remains equivocal with no official diagnostic criteria, due to this very few
68 documented cases have emerged. At present, the diagnosis of exercise addiction is largely
69 determined by clinical judgment. Clinicians screen patients to identify underlying motivators
70 pertaining to an individual’s exercise behaviour, emotional connection to exercise, and
71 influence on other facets of their life. This information is then corroborated using a valid
72 assessment tool (i.e. Exercise dependence scale; Hassenblas & Hassenblas, 2002b) to
73 ascertain the severity of exercise addiction symptoms. To this end, pathogenic exercisers (i.e.
74 exercise addiction) can be discerned from high-frequency/or committed exercisers (i.e.
75 healthy habit), like athletes or avid exercisers who maintain control over exercise, have

76 meticulous training regimes, however maintain social and professional obligations, and
77 encounter no deleterious or negative consequences as a result of their exercise practices.

78 Exercise addiction is often classified as a behavioural addiction (Egorov & Szabo,
79 2013), analogous to gambling addictions. However, as it stands the DSM-5 in its subsection
80 of “Non-substance-related disorders” includes only gambling addictions as a behavioural
81 addiction (American Psychiatric Association, 2013), with exercise addiction residing as a
82 “compensatory behaviour” of eating disorders such as Anorexia and Bulimia Nervosa.
83 Consequently, scholars working in the area of exercise addiction have relied on theoretical
84 models derived from two kinds of criteria: (1) those proposed and derived from the substance
85 dependence subsection in the DSM-IV (American Psychiatric Association 1994, Hausenblas
86 & Downs, 2002a, b) or (2) those proposed for behavioral addictions by Griffiths (1996,
87 2005). Extant literature utilising both criteria, have proposed prevalence rates of 2-3% for the
88 general exercising population (Mónok et al, 2012). However, endurance exercise populations
89 have yielded prevalence rates of up to 20% (Griffiths et al. 2015).

90 De Coverley Veale (1987) discerned between primary and secondary exercise
91 dependence. Primary exercise dependence entails pathological exercise behaviour which is
92 driven solely for psychological gratification from exercise behaviour alone (Bamber,
93 Cockeril & Carroll, 2000), whereas secondary exercise dependence relates to the use of
94 exaggerated exercise as means to regulate and control another disorder (e.g. Anorexia
95 Nervosa, Bulimia Nervosa). Thus, to avoid conceptual confound, when considering exercise
96 addiction this paper will adopt a “primary” conceptualisation, therefore utilising Hausenblas
97 & Symons-Downs (2002b) perspective to assess, describe and define exercise addiction. To
98 this end, exercise addiction is defined as “a craving for leisure time physical activity that
99 results in uncontrollable excessive exercise behaviour that manifest physiological and/or
100 psychological symptoms” (Hausenblas & Symons-Downs, 2002b p. 90). Therefore, exercise

101 addiction is marked by psychological, behavioural and social factors including: unhealthy
102 exercise intensity/frequency, exercising more than intended, lack of control over exercise,
103 withdrawal symptoms, a great deal of time pursuing exercise, reduction in other activities due
104 to exercise, and continuing to exercise despite recurring physical and/or psychological
105 problems.

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

112 To date, etiology studies of exercise addiction have proposed both neurobiological
113 and psychological explicative models (Weinstein and Weinstein 2014; Thompson & Blanton,
114 1987; Szabo, 1995). Egorov and Szabo (2013) postulated that exercise addiction could
115 manifest by utilising exercise as a coping mechanism arising from the interaction between
116 adversity and one's interpretation of such events. Once this coping method of stress is
117 adopted, the individual becomes reliant on it to function adequately. Furthermore, the
118 individual believes that he/she is engaging in a seemingly health behaviour for stress
119 management given scholastic and public health resources, providing rationalization for their
120 pathogenic exercise behaviour that begin to impede upon social and professional obligations.
121 However, eventually when life-obligations forces the individual to reduce frequency of
122 exercise bouts, causing exercise privation, consequently, psychological hardship resurfaces
123 and manifests as withdrawal symptoms (e.g. anxiety, depression, agitation, irritability).
124 Moreover, theoretical postulates have highlighted psychological traits such as trait anxiety
125 (Coen & Ogles, 1993), perfectionism (Cook, 1996), and obsessive compulsiveness (Spano,

126 2001) as predispositions to the development of exercise addiction. Finally, Egarov & Szabo
127 (2013) conceived the notion of a “black box”, relating to the idiographic mindset of an
128 individual with exercise addiction. The black describes the possible interactions between
129 personal and situational factors, which increase the onset, development and maintenance of
130 exercise addiction. Key components of the black box entail ongoing, unbearable or suddenly
131 appearing adversities (e.g. loss, break ups, bullying) which causes pain that the individual has
132 no control over. This also interacts with attentional cognition in that prior experience, inter-
133 and intra-personal thought, beliefs and conviction will influence exercise behaviour as means
134 for escape path. Considering the aforementioned, one psychological construct that has been
135 linked to the above, and thus could be valuable in understanding exercise addiction, is that of
136 irrational and rational beliefs.

137 Derived from the postulates of rational emotive behaviour therapy (REBT; Ellis,
138 1957), irrational and rational beliefs allude to cognitive pattern in which individuals holds in
139 the face of adversity (rejection, failure, loss). Rational emotive behaviour therapy is a
140 cognitive-behavioural approach to the promotion of psychological health and well-being, and
141 postulates, that all disturbance occurs as a consequences of dysfunctional information
142 processing (Ellis, 1962, 1994). REBT delineates between irrational (e.g., demandingness, low
143 frustration tolerance, awfulizing, and self-, other-, or world-depreciation) and rational beliefs
144 (e.g., preferences, high frustration tolerance, anti-awfulizing, and self-, other-, or world-
145 acceptance; Ellis & Dryden, 1997), and adopts a binary theory of emotional distress,
146 discerning between dysfunctional and functional emotions, thus being qualitatively different
147 than quantitatively. Irrational processing to internal stimuli (e.g., a pain in your leg) or
148 external stimuli (e.g., receiving negative feedback) are hypothesised to produce unhealthy or
149 maladaptive emotions reactions (i.e., UNEs; anxiety, rage, depression). In contrast rational
150 processing of stimuli are hypothesised to produce healthy or adaptive emotional reactions

151 (i.e., UNEs; concern, assertiveness, sadness). Beliefs are evaluative or appraisal mechanisms
152 and are consistent with Albeson and Rosenberg's (1958) conceptualisation of hot cognitions.
153 Beliefs evaluate representations of reality in terms of their personal significance to that
154 individual. Therefore, the primary objective of REBT is to change irrational beliefs through
155 cognitive restructuring, and to promote rational beliefs to propagate psychological health and
156 well-being (Ellis & Dryden, 1997; MacInnes, 2004). Indeed, REBT holds that neurotic
157 disturbances are a by-product of escalating one's rational, flexible, preferences into irrational,
158 inflexible, demands. To this end, people develop our irrational beliefs by what they greatly
159 desire. Furthermore, REBT posits that beliefs, irrational/and or rational, engender emotional
160 experiences that create specific action tendencies. Thus, irrational beliefs facilitate behaviour
161 tendencies to engage in escape or avoidant behaviours, contrarily rational beliefs generate
162 emotions that facilitate approach behaviours (Ellis, 1994; Dryden, 2002). More precisely,
163 Dryden delineates a gamut of behaviours/action tendencies associated with holding irrational
164 beliefs, viz. withdrawing from reinforcement, isolation, avoiding feared situations, self-
165 harming, searching for constant reassurance, repetitive behaviour, ignoring attempts to
166 restore social equilibrium. Examples of overt operant behaviours include avoiding anxiety
167 provoking situations because we have endorsed the belief that we must not experience it
168 because to do so would be completely awful, and we could not stand it. Such postulates, may
169 provide understanding to the psychological processes of an exercise addiction, with the
170 exerciser holding irrational beliefs about the prospect of missing an exercise bout, and
171 therefore displaying an array of unhealthy negative emotions (i.e. anxiety, guilt), and
172 accompanying avoidance/safety behaviours (rigid programmes, missing social obligations,
173 training whilst injured).The theory and efficacy of REBT has received support (David,
174 Szentagotai, Kallay, & Macavei, 2005) from within both clinical and non-clinical populations

175 and with youth and adult samples (e.g., Turner, 2016; Visla, Fluckiger, Holtforth, & David,
176 2016).

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

200 brings (e.g. anxiety, depression, irritability). To date, only one study has highlighted the role
201 of beliefs (rational) in exercise addiction. Halls et al. (2009) reported a relationship between
202 rational beliefs and exercise addiction, holding that unconditional self-acceptance played a
203 mediating role in exercise addiction, in that low levels of unconditional self-acceptance
204 preceded high levels of exercise addiction. However, this study did not measure irrational
205 beliefs. Past research has highlighted the importance of assessing both irrational and rational
206 beliefs, because irrational and rational beliefs are relatively orthogonal, and low irrational
207 beliefs do not necessarily mean high rational beliefs (i.e., they do not correlate highly; Ellis,
208 David, & Lynn, 2010); therefore, the specific role of irrational beliefs pertaining to exercise
209 addiction remains unknown.

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

217 Therefore, the current study aims to elucidate the influence of irrational and rational
218 beliefs on exercise addiction (e.g., Ellis, 1994; Hall et al., 2009), and in doing so will
219 examine the efficacy of an REBT intervention with exercisers reporting exercise addiction
220 symptoms, using a single-case design in line with previous literature (e.g., Turner & Barker,
221 2013). Providing examination of the effects of REBT on irrational beliefs (particularly low
222 frustration tolerance), rational beliefs (particularly unconditional self-acceptance; USA), and
223 exercise addiction symptoms. To the researcher's knowledge, no research has examined the
224 role of irrational beliefs upon exercise addiction, furthermore no research has intervened with

225 exercise addiction symptoms. Thus, considering theoretical underpinnings, it was
226 hypothesised that an REBT intervention will reduce irrational beliefs (particularly low
227 frustration tolerance), increase Unconditional self-acceptance, and reduce exercise addiction
228 symptoms, from pre- to intervention, with the effects remaining stable at follow-up.

229 **Method**

230 **Participants**

231 After liaising with a U.K. leisure centre based in the Midlands, verbal consent was
232 attained to recruit participants from their facility. The participants were three of eleven
233 volunteers that expressed an interest in taking part in a program that was advertised to bring
234 greater self-awareness of exercise beliefs. Participants were three male exercisers ($M_{age} =$
235 22.00 ; $SD = 1.73$; *Participant age*; $p_1 = 22$; $p_2 = 20$; $p_3 = 23$), with 3-5 years of gym
236 experience ($M_{exp} = 4.33$; $SD = 1.54$), who were not engaged in any other sport or physical
237 activity during the data collection for this study. Experience refers to exercising at or over the
238 government exercise guidelines for physical activity (150-minutes of moderate intensity
239 activity, and two muscle-strengthening exercise sessions per week). All participants reported
240 that they exercised 4-6 times weekly, which entailed a mixture of aerobic and resistance
241 training. Participants were selected using a screening process, which indicated that the three
242 participants reported high exercise addiction symptoms (i.e., scoring at risk of exercise
243 addiction or non-dependent symptomatic; Hausenblas & Symon-Downs, 2002), and high
244 irrational beliefs scores (compared to adult norms; Turner et al., 2016). The ED-s
245 classification postulates that less than 5% of individuals would be classified as at risk for
246 exercise dependence, 62.5–62.6% as nondependent symptomatic and 30.6–33.8% as
247 nondependent (Downs et al. 2004). Considering the postulations of Freimuth, Moniz, & Kim
248 (2011) four phase of the development of exercise addiction, at stage two (at-risk) occurs
249 when individuals perceive the intrinsically rewarding benefits of regular exercise (i.e. mood-

250 altering effects). Thus, considering the aforementioned, both exercise addiction risk and non-
251 dependent symptomatic was considered suitable for selection given risk being high and ED
252 diagnosis (<5%) being scant. Informed consent was obtained, and ethical approval granted
253 from the University before all data collection.

254 **Design**

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

269 **Measures**

270 **Irrational beliefs.** The irrational Performance Beliefs Inventory (iPBI; Turner et al.,
271 2016) was used to measure irrational performance beliefs. The iPBI comprised 28-items that
272 measure the four core beliefs (demandingness, awfulizing, low-frustration tolerance, and
273 depreciation), as well as providing a composite value (Comp) for all four core irrational
274 beliefs. Participants are asked to indicate their agreement on the 28-items on a Likert-scale

275 between 0 (*strongly disagree*) to 5 (*strongly agree*). The iPBI has shown construct validity,
276 and correlates well with established irrational beliefs measures, and with anxiety, depression,
277 and anger, demonstrating concurrent and predictive validity. For Comp, Cronbach's alpha
278 coefficient displayed acceptable to excellent internal reliability ($\alpha = .50$ to $.99$).

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

295 **Unconditional self-acceptance.** The Unconditional Self-Acceptance Questionnaire
296 (USAQ; Chamberlain & Haaga, 2001) is a 20-item scale with 11 reversed items. Participant's
297 rate items on a 7-item Likert-scale from 1 (*almost always true*) to 7 (*almost always untrue*).
298 The USAQ has been used previously in sport (Cunningham & Turner, 2016), and measures
299 the belief that one fully and unconditionally accepts oneself regardless of behaviour,

300 achievement, approval, respect, or love from others (Ellis, 1977). Cronbach's alpha
301 coefficient displayed low to good internal reliability ($\alpha = .18$ to $.76$). Whilst reporting of
302 Cronbach's alpha is important, the reader should consider the alphas reported in this study
303 cautiously due to the sample size used. Indeed, some suggest that a sample size of $n = 30$
304 (Yurdugül, 2008) or even $n = 50$ (Javali, Gudaganavar, & Raj, 2011) is required for reliable
305 Cronbach's alpha calculation.

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

321 **Data collection**

322 Data were collected over a five-month period. Participants were required to complete
323 the iPBI, EDS, and USAQ twice a week during the baseline phase (3 weeks). Thereafter, the
324 clients were required to complete the iPBI and USA twice per week through the intervention

325 phase (6 weeks) and the follow up phase (2 weeks). The EDS was required to be completed at
326 the start, middle and end of the intervention phase (week 1, 3, and 6) and at the end of follow
327 up phase (research completion). The intervention took place in the private personal training
328 consultation room of a leisure centre, that comprised conventional office amenities viz. desk,
329 chair, white board, and television screens.

330 **Intervention**

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

342 The program included three phases: education, cognitive restructuring, and
343 reinforcement.

344 The *education phase* principle aim was to teach participants the fundamentals of
345 REBT. Thus, participants were educated on how to identify beliefs (i.e. rational and
346 irrational), differentiation between irrational (i.e. demands, awfulizing, low frustration
347 tolerance, self-depreciation) and rational beliefs (preferences, anti-awfulizing, high
348 frustration tolerance, self-acceptance), and how such beliefs in the face of adversity
349 (challenge, difficulty, upset) can create either unhealthy negative emotions (e.g. anxiety,

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

369 The *cognitive restructuring phase* (also known as disputation) is the most critical
370 aspect of the intervention phase, this took place over two sessions. A core tenant of REBT
371 when restructuring cognitions (i.e. irrational beliefs) is to assume that the adversity (A) is
372 correct, and therefore reconstruct the irrational beliefs held regarding the A rather than
373 reconstruct the A (Ellis & Dryden, 1997), additionally rational beliefs are constructed and
374 promoted, thus promoting healthy emotions, and adaptive behaviour. The practitioner

375 followed a directive formulaic approach to reconstruct participant irrational beliefs, this
376 process entailed three strategies based upon evidence (where is the evidence?), logic (does it
377 make sense?), and pragmatics (is it helpful?) (DiGiuseppe, 1991).

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

400 method “rational reverse role-play” (RRR; Kassinove & DiGiuseppe, 1975), in which the
401 practitioner became the participant and role-played an exerciser with irrational beliefs, while
402 the participants identified, reconstructed and reinforced new effective rational beliefs.

403 **Results**

404 **Data analysis**

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

420 To further determine intervention effects, statistical analysis was performed to accompany
421 visual analysis (Barker & Jones, 2008; Wolfe et al, 1982). Following relevant guidelines
422 (Ottenbacher, 1986), the data were assessed for serial dependency via autocorrelation
423 analysis to ensure that the data qualified for parametric tests. Participant’s dependent
424 variables (irrational beliefs, exercise addiction, unconditional self-acceptance) were analysed

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

442 **Low frustration tolerance**

443 The mean levels indicated that for low frustration tolerance beliefs, each participant's
444 scores decreased from pre-intervention to intervention phases (Figure 1). Participants
445 reported this change immediately after the first REBT session, and there was one overlapping
446 data point for participant 1 and 2, and no overlapping data points for participant 3.
447 Furthermore, participant 1 showed a 19.87% decrease ($d = 1.70$), participant 2 showed a 32%
448 decrease ($d = 3.03$) and participant 3 showed a 32.33% decrease ($d = 2.92$), from pre-
449 intervention to intervention phases. Moreover, participant 1 showed a 38.99% decrease ($d =$

450 2.52), participant 2 a 17.65% decrease ($d = 1.19$) and participant 3 a 23.72% decrease ($d =$
451 1.65), from intervention to follow-up ($M = 13.54$; $SD = 2.10$) intervention phases.

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

455 **Composite irrational beliefs**

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

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

466 **Exercise addiction**

467 Mean levels indicated that for exercise addiction, participants' scores decreased from
468 pre-intervention to intervention phases. Moreover, participant 1 showed a 23.28% decrease (d
469 $= 1.40$), participant 2 showed a 13.11% decrease ($d = 1.78$) and participant 3 showed a 2.51%
470 decrease ($d = 1.25$), from pre-intervention to intervention phases. Moreover, participant 1
471 showed a 55.00% decrease ($d = 2.54$), participant 2 a 3.16% decrease ($d = .49$) and
472 participant 3 a 2.84% decrease ($d = 1.94$), from intervention to follow up ($M = 2.84$; $SD =$
473 $.88$) phases.

474 **Unconditional self-acceptance**

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

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

499 overlapping data points between pre-intervention to intervention phases, and the target
500 variables displayed a great magnitude of effect.

501 **Social validation data**

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

517 REBT provides emotional and behavioural control through progression of the
518 ABCDE framework. This framework guides the client to a rational philosophy, which is
519 embodied by greater quality of life through greater relations and fulfilment of goals. For
520 example, participant one commented, “It helped me with my relationships, like with my
521 girlfriend”, whilst participant three stated “I didn’t think it would help this much, when I’m at
522 work I no longer feel the need to be aggressive”. This again corroborated the responses from
523 the iPBI and USAQ. Finally, in regard to appropriateness of the procedures, social validation

524 data suggested that exercisers deemed the REBT intervention as appropriate. REBT stresses
525 the importance of developing a therapeutic alliance and progression through the ABCDE
526 framework. Exercisers expressed how the practitioner's conduct aided the delivery of REBT
527 and that the ABCDE framework was sufficient in reaching their therapeutic goals. For
528 example, participant three commented "I felt that he cared and wanted us to be better and that
529 he didn't need us to be, but he wanted us to be", whilst participant two stated "For me it was
530 perfect, so I wouldn't change a thing" and another "It gave you enough to go through it
531 properly, I wouldn't change it at all".

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

540 **Discussion**

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

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

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

573 (e.g. I want to go the gym, however, that does not mean I must, thus, I can stand it if I do
574 not), subsequently, this will generate adaptive emotions (i.e., concern, remorse), and in turn
575 lead the accompanying adaptive behaviour (i.e. healthy exercise commitment).

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

592 Limitations

593 The current study has some limitations that if addressed could strengthen the findings.
594 First, this study lacked an objective measure of functional and dysfunctional emotions and
595 behaviours. This omission occurred because although the notion of UNEs and HNEs is a
596 central element of REBT (Dryden, 2009), no accurate measure has emerged in literature. The
597 authors decided against using a unitary measure of emotions (e.g., anxiety, anger, depression)

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

623 influential, as participants may have deduced the natures of this study, however as stated
624 before this study did not deter exercise behaviour and looked at beliefs in array of life
625 spectrums (academia, relationships, exercise and occupational). Nevertheless, researchers
626 should take caution to such biases when developing interventions and exploring potential
627 underlying mechanisms.

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

638 **Conclusion**

639 To conclude, as far as the authors are aware the present study is the first to report an
640 intervention to reduce the symptoms of exercise addiction, and the first to examine the effects
641 of REBT on irrational beliefs in exercisers. The current study contributes to the growing
642 literature in exercise addiction and adds to the body of literature concerning the use of REBT
643 in sport and exercise settings (Turner & Bennett, 2018). The findings of this study suggest
644 that irrational and rational beliefs may play an important role in exercise addiction (e.g. Ellis,
645 1994; Hall et al., 2009) and supports recommendations for the treatment of exercise addiction
646 using cognitive behavioural therapy (Weinstein & Weinstein, 2014). This study has
647 highlighted the role of beliefs in the maintenance of exercise addiction and provides

648 practitioners and researchers with a framework to reduce irrational beliefs, increase rational
649 beliefs, and reduce exercise addiction symptomology. It is hoped that this research will serve
650 as a catalyst for further research into the deleterious effects of exercise addiction, the
651 treatments for exercise addiction, and to assist exercisers in developing healthy beliefs
652 regarding exercise.

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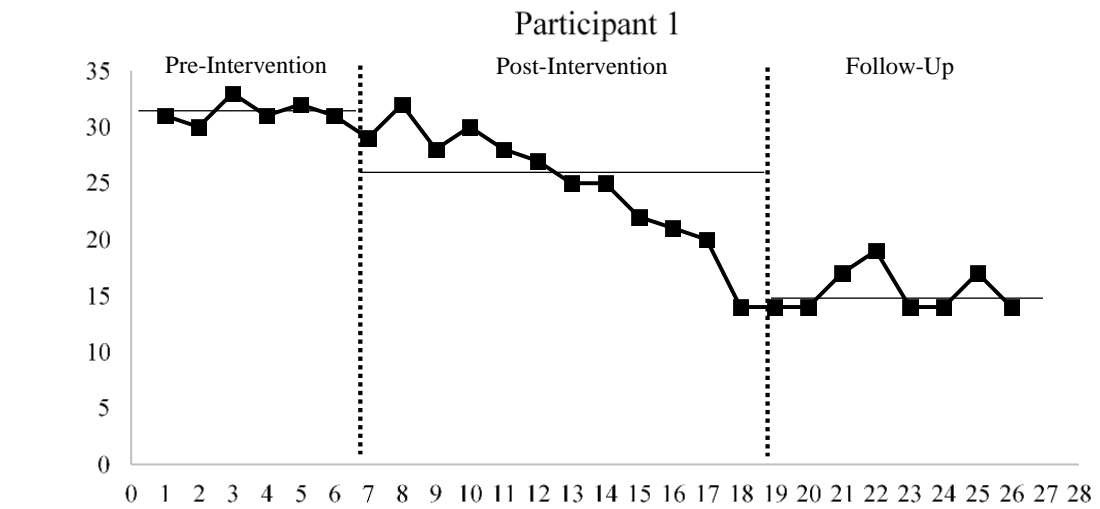
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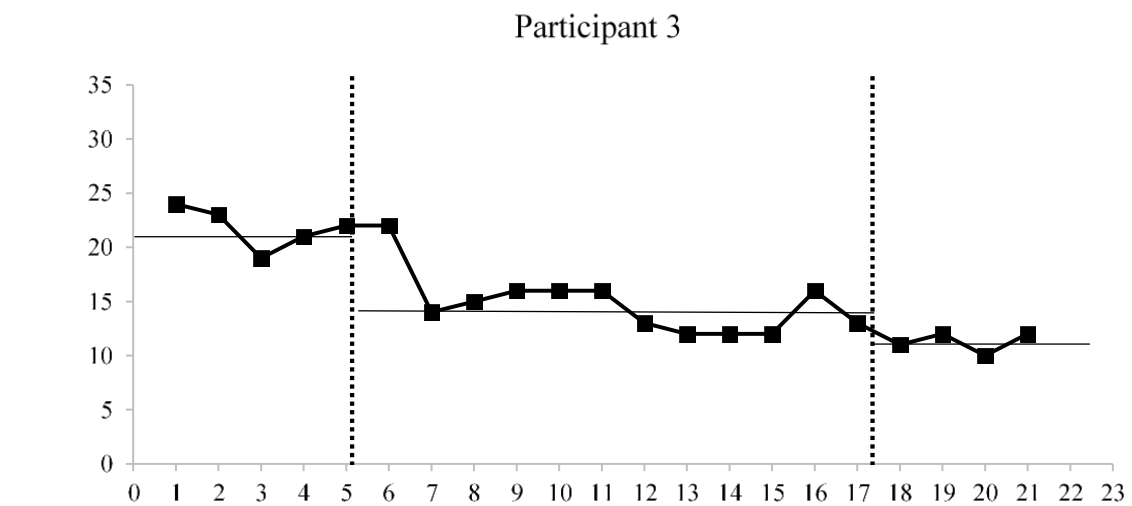
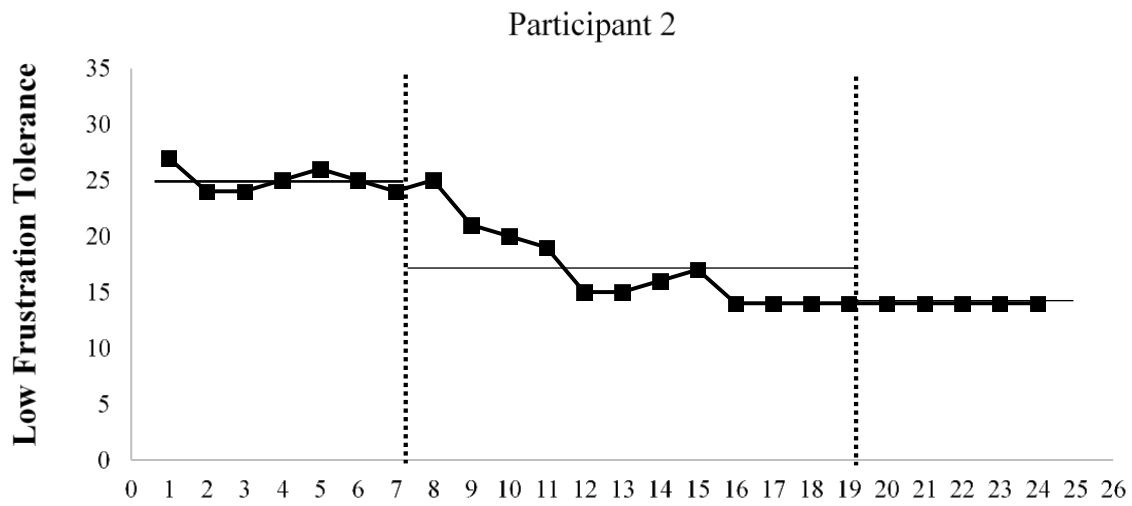
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850 Figure 1. Graphed data for low frustration tolerance across timepoints for each participant.

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

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