



Agentic emotion regulation in high-risk sport: An in-depth analysis across climbing disciplines

Willegers, Marley; Woodman, Tim; Tilley, Flo

Personality and Individual Differences

Published: 01/04/2023

Peer reviewed version

[Cyswllt i'r cyhoeddiad / Link to publication](#)

Dyfyniad o'r fersiwn a gyhoeddwyd / Citation for published version (APA):

Willegers, M., Woodman, T., & Tilley, F. (2023). Agentic emotion regulation in high-risk sport: An in-depth analysis across climbing disciplines. *Personality and Individual Differences*, 204, Article 112061.

Hawliau Cyffredinol / General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

This article was accepted in its current form in *Personality and Individual Differences* on 14th December 2022.

Agentic emotion regulation in high-risk sport: An in-depth analysis across climbing disciplines

Marley Willegers, Tim Woodman, Flo Tilley
Institute for the Psychology of Elite Performance, Bangor University, UK

Author Note

Correspondence should be addresses to Marley Willegers, Institute for the Psychology of Elite Performance, Bangor University, UK. Email: pepa3a@bangor.ac.uk

Abstract

1
2 Research has now debunked the standpoint that high-risk sports participants are a homogenous
3 group of sensation seekers (Barlow et al., 2013); the process of agentic emotion regulation is a
4 primary motive for high-engagement high-risk sports (i.e., mountaineering). The evidence,
5 however, remains cross-sectional, and there is currently no evidence to support the timeline of
6 this process. We aimed to bridge that gap by investigating the process of agentic emotion
7 regulation over three post-participation time points across different disciplines of climbing that
8 vary in risk and objective danger. Emotion regulation is the process by which individuals alter
9 the nature, intensity, and duration of their emotions (Gross, 2008). Agency refers to individuals'
10 perceived control over their internal beliefs, desires, intentions, and actions (Bandura, 1997). The
11 results from two retrospective ($n = 161$, $n = 134$) studies and one longitudinal ($n = 45$) study
12 revealed that those who engage in high-risk forms of climbing (i.e., traditional climbing)
13 experience a greater increase in agency and emotion regulation difficulty after participation than
14 individuals who participate in lower-risk forms of climbing (i.e., sport climbers) and other
15 relatively low-risk sports (i.e., swimming). This research supports the benefits of high-risk
16 activities for regulating participants' agentic emotion regulation difficulties.

17
18 *Keywords:* risk-taking sport, transferable effects, sensation seeking, mountaineering,
19 traditional climbing

20

21

22

46 Although Zuckerman's theory has helped, in part, to explain the motives underlying some high-
47 risk sports (e.g., skydiving), the literature and media have perpetuated the narrative that high-risk
48 sport participants are a homogenous group of sensation seekers (see Breivik, 1996; Horvath &
49 Zuckerman, 1993; Zuckerman, 1994, 2007). However, these conclusions run counter to the
50 motives reported by other high-risk sport participants, such as mountaineers and trans-Ocean
51 rowers (Castanier et al., 2010; Lester, 2004; Woodman et al., 2010). Importantly, Zuckerman,
52 Eysenck, and Eysenck's (1978) Sensation Seeking Scale (SSS-V) was never intended to be used
53 as a measure of motives for high-risk sport (see Barlow et al., 2013). Specifically, the SSS-V
54 measures individuals' propensity to engage in activities that Zuckerman assumed to increase
55 stimulation and arousal, not their motivation for such activities (Zarevski et al., 1998;
56 Zuckerman, 2007). In summary, Zuckerman never put forth sensation seeking theory as a *motive*
57 for high-risk sports (cf. Barlow et al., 2013) so it is unsurprising that this theory has limited value
58 for understanding such motives.

59 **1.2 Agentic Emotion Regulation theory**

60 Woodman, Hardy, and Barlow (2010) developed Agentic Emotion Regulation theory to
61 explain the motives that might underpin participation in high-engagement high-risk sports (such
62 as mountaineering and trans-ocean rowing, which require considerable planning and
63 preparation). Emotion regulation is the process by which individuals' actions alter the emotions
64 that they experience, when they experience them, and how they experience and express them
65 (Gross, 2008). Agentic Emotion Regulation theory proposes that some high-risk sports provide
66 the opportunity to experience external and easily identifiable sources of anxiety, and overcoming
67 this anxiety helps bolster participants' sense of emotional control (Woodman et al., 2008;
68 Woodman et al., 2009). The physical dangers implicit in high-risk activities require individuals

69 to exercise a variety of antecedent and response-based emotion regulation strategies (Gross,
70 2008) to manage strong emotions; failure to do so can have life-threatening consequences
71 (Barlow et al., 2015; Breivik, 2010). Another facet of Agentic Emotion Regulation theory is
72 agency. Agentic people intentionally influence their development and life circumstances
73 (Bandura, 1997). The most fundamental mechanism of agency is individuals' perception of their
74 ability to exercise control over important events in their life, in which they are in control of their
75 internal beliefs, desires, and intent (Bandura, 1997). In contrast to the decisions made in
76 domestic life, high-risk sports participants are often making decisions that will determine
77 whether they live or die (Woodman et al., 2009). Thus, the high-risk sports domain requires a
78 great deal of physical and emotional control to manage these risks. Participants report that
79 engaging in high-risk sport is their only opportunity to manage these physical and emotional
80 challenges and to meet their agentic emotion regulation expectations (Barlow et al., 2013; Lester,
81 2004; Woodman et al., 2010).

82 Woodman et al. (2010) found that expeditionary high-risk sports participants, such as
83 mountaineers and trans-Atlantic rowers, displayed a greater difficulty regulating their emotions
84 and a depleted sense of agency in daily life. However, they were able to assuage this difficulty
85 by actively regulating their emotions in the high-risk domain. Mountaineers' and trans-Atlantic
86 rowers' post-participation experience speaks to an agentic emotion regulation transfer benefit
87 from their sporting to their interpersonal domain. These findings illuminate the agentic emotion
88 regulation affordances of the high-risk sport domain and the regulatory function that
89 participation therein may serve.

90 Within this agentic emotion regulation framework, Barlow et al. (2013) developed the
91 Sensation Seeking, Emotion Regulation and Agency Scale (SEAS), which allows researchers to

92 explore different motives for engaging in high-risk activities. Using the SEAS, they revealed that
93 mountaineers were predominantly motivated by agentic emotion regulation and that skydivers
94 were motivated by sensation seeking. Additionally, mountaineers and controls displayed no
95 differences on any sensation seeking factors, further refuting the universal sensation seeking
96 view of high-risk sports. Importantly, only the mountaineers experienced positive emotion
97 regulation and agency transfer effect from the mountaineering domain back into aspects of
98 everyday life.

99 **1.3 Purpose of the present research**

100 Although research has identified that high-risk sports participants can derive immediate
101 agentic emotion regulation benefits from participation and transfer these benefits back into their
102 daily life (see Barlow et al., 2013; Woodman et al., 2010), we know nothing about the process of
103 agentic emotion regulation thereafter. In short, although we understand that some high-risk
104 sports participants derive an agentic emotion regulation benefit from their activity, we do not
105 understand how their agentic emotion regulation difficulty evolves over time after participation.
106 Such an understanding would go some way to explain the motives that underlie participants'
107 repeated return to the danger of the high-risk sport domain. The purpose of the present research
108 was to begin to address this gap and to investigate the relative decay of the agentic emotion
109 regulation benefits derived from one's activity. Studies 1 and 2 aimed to provide a retrospective
110 account of any differences between high-risk climbers' (mountaineers, traditional climbers) and
111 low-risk sport participants' (sport climbing, bouldering, hiking, swimming) agency and emotion
112 regulation difficulty post-participation. In Study 3, the national lockdown laws to control the
113 COVID-19 pandemic resulted in individuals being temporarily unable to participate in their
114 activity, which is unusual for many avid participants. This scenario provided an opportunity to

115 measure post-participation emotional regulation and agency difficulty in real-time (i.e.,
116 longitudinally). Further to this, we also aimed to confirm Barlow et al.'s (2013) finding that
117 sensation seeking was not a motive for participation in some high-risk sports such as climbing.
118 To that end, this paper aimed to test the following hypothesis across three studies.

119 **1.4 Agency and emotion regulation hypothesis**

120 Unlike low-risk sporting participants, high-risk climbers are motivated by the emotion
121 regulation and agency function of participation. Thus, we hypothesized that only high-risk
122 climbers' (i.e., mountaineers, traditional climbers) *difficulty with emotion regulation and agency*
123 would significantly increase in the time after participation, with no such increase for low-risk
124 climbers (i.e., sport climbers) and low-risk sport controls.

125 **1.5 Sensation seeking hypothesis**

126 High-risk climbers and low-risk sporting participants are not motivated by the sensation
127 need satisfaction function of participation. Specifically, both high-risk climbers' (i.e.,
128 mountaineers, traditional climbers) and low-risk sporting participants' (i.e., sport climbers,
129 runners) *sensation need satisfaction* will not significantly increase in the time after participation.

130 **2. Study 1**

131 The aim of Study 1 was to explore the retrospective sensation need satisfaction, emotion
132 regulation, and agency difficulties of high-risk climbers (i.e., traditional climbers and
133 mountaineers), relatively low-risk climbers (i.e., sport climbers), and low-risk sport controls (i.e.,
134 hikers, swimmers, golfers, cyclists) one day, one week, and six weeks after participation in their
135 respective sporting activities. We selected these groups to allow us to investigate the sensation
136 need satisfaction, emotion regulation, and agency difficulty of high-risk climbers after
137 participation while controlling for environmental (sport climbing in mountainous natural

138 environments) and physical (physicality of low-risk sport) factors. Observing an increase in
139 high-risk climbers' agency and emotion regulation difficulty and sensation need satisfaction after
140 participation would speak to the regulatory function that their sport serves. In contrast, finding no
141 change in agentic emotion regulation difficulty or sensation need satisfaction after participation
142 would suggest that participants do not engage in their sport to regulate their sense of agentic
143 emotion regulation (i.e., low-risk sports participants) or fulfil their sensation seeking needs.

144 **2.1 Methods**

145 **2.2 Participants**

146 We conducted an *a priori* G*Power analysis (Faul et al., 2007) for testing a 3 (time) \times 4
147 (group) mixed-model ANOVA with a small effect size ($\eta_p^2 = .02$) and an alpha level of .05. The
148 results showed that a total sample size of 116 (i.e., $n = 29$ per group) would be required to
149 achieve a power of .80. The first and third author used convenience and snowball sampling
150 methods via online social media platforms (i.e., Facebook, sporting online forums) to recruit 663
151 participants from various sporting activities (mountaineering, traditional rock climbing, sport
152 climbing, golf, squash, swimming, cycling, rowing). Based on the demographic information
153 provided therein, the first author categorized 161 participants from the initial 663 sample into
154 their respective sporting groups. Specifically, *Mountaineers* were individuals who stated that
155 mountaineering was their preferred sport and who reported being *intermediate to expert* in
156 ability. *Traditional rock climbers* were individuals who stated that traditional climbing was their
157 preferred sport, who reported being *intermediate to expert* in ability. *Sport climbers* were
158 individuals who stated that sport climbing was their preferred sport and who did not participate
159 in traditional climbing or mountaineering as a secondary sport. *Low-risk sport control* were
160 individuals who participated in various low-risk sporting activities (such as hiking, golf, squash,

161 swimming, cycling, rowing) and did not participate in any high-risk sporting activities. In this
162 study, there were no missing data from the 161 eligible participants.

163 **2.2.1 High-risk climbing groups**

164 Thirty-two participants were operationalized as *mountaineers* (27 men, 5 women; $M_{\text{age}} =$
165 38.41 , $SD = 16.02$; $M_{\text{years of participation}} = 16.34$, $SD = 14.55$). Mountaineering most often involves
166 an attempt to reach a high point in remote mountainous terrain, which can require days, weeks,
167 or months of walking and climbing, typically with no external aid. The dangers include
168 avalanches, rock fall, falling (i.e., off a mountain face, into a crevasse), hypothermia, and
169 frostbite, all of which can result in serious injury or death (Schöffl et al., 2012).

170 Fifty-eight participants were operationalized as *traditional rock climbers* (49 men, 9
171 women; $M_{\text{age}} = 33.54$, $SD = 17.20$; $M_{\text{years of participation}} = 14.35$, $SD = 15.78$). Traditional rock
172 climbing is one of the most dangerous climbing disciplines (Schöffl et al., 2012). Traditional
173 climbing involves climbing outdoor rock faces and placing unfixed anchors and protection into
174 cracks in the rock. If climbers fall and this protection fails, they will fall until the next piece of
175 protection, which may fail due to the dynamic load placed upon that protection. As the protection
176 is not fixed into the rock, the risk of severe injury or death is omnipresent (Schöffl et al., 2012).

177 **2.2.2 Low-risk climbing group**

178 Twenty-one participants were operationalized as *sport climbers* (13 men, 8 women; M_{age}
179 $= 34.00$, $SD = 13.09$; $M_{\text{years of participation}} = 9.38$, $SD = 7.15$). Sport climbing involves climbing rock
180 faces or artificial indoor climbing walls with fixed protection bolts in the rock/wall and requires
181 no self-placed unfixed protection. Lead climbers may fall twice the distance of the previously
182 fixed protection that they clipped into, but the risk of the fixed protection bolts failing in the
183 event of a fall is extremely low. Due to the security of these fixed bolts, sport climbing poses

184 minimal risk of severe injury and is a low-risk activity (Schöffl et al., 2012).

185 **2.2.3 Low-risk sport controls**

186 Fifty participants were operationalized at *low-risk sport controls* (25 men, 26 women;
187 $M_{\text{age}} = 32.78$, $SD = 13.99$; $M_{\text{years of participation}} = 16.60$, $SD = 12.57$).

188 **2.3 Measures**

189 We used the between-participation Sensation Seeking, Emotion Regulation and Agency
190 Scale (SEAS) consisting of six sensation-seeking items (i.e., *I look forward to getting a physical*
191 *thrill from participating*), six emotion regulation items (i.e., *The emotional elements of my life*
192 *are difficult to deal with*), and six agency items (i.e., *I feel like people or circumstances are*
193 *trying to impose limits on me*; Barlow et al., 2013). Participants responded on a Likert scale from
194 1 (*strongly disagree*) to 7 (*strongly agree*).

195 We asked participants to complete three different between-participation SEAS, by
196 adopting the mindset of being absent from their sport for one day (Time 1), one week (Time 2),
197 and six weeks (Time 3). These timeframes allowed us to measure the sensation seeking, emotion
198 regulation, and agency fluctuation that participants experience after bouts of participation
199 (Barlow et al., 2013). This design allowed us to capture any increased difficulty as a function of
200 time since their last participation (see Barlow et al., 2013; Castanier et al., 2010, 2011;
201 Woodman et al., 2009, 2010). Specifically, participants received the following introductions for
202 each of the between-participation SEAS: Time 1, *Please answer the following statements*
203 *thinking about your feeling toward your life the day after participating in your preferred sport or*
204 *activity*; Time 2, *Please answer the following statements thinking about your feeling towards*
205 *your life the week after participating in your preferred sport or activity*; Time 3, *Please answer*
206 *the following statements thinking about your feeling towards your life six weeks after*

207 *participating in your preferred sport or activity.*

208 ¹Given the modification to the opening instructions to the SEAS, we sought to ensure that
209 we retained the internal consistency of the scale. To that end, we tested the reliability of this
210 version of the SEAS using the Hayes and Coutts (2020) SPSS OMEGA macro. McDonald's
211 omega and Cronbach's alphas demonstrated very good reliability for all the SEAS 6-item factors
212 across all three time points (see Table 1).

213 **2.4 Procedure**

214 The first author and third author, under supervision of the second author, shared a URL
215 link on several social media platforms (i.e., Facebook, Instagram) that directed participants to the
216 welcome page. The welcome page informed participants of the nature of the study and the data
217 confidentiality and protection regulations in place. Participants provided informed consent and
218 demographic information before completing the retrospective SEAS for one day, one week, and
219 six weeks post participation; they were opted into a £100 prize draw on completion of the
220 survey. The institutional ethics committee granted ethical approval.

221 **2.5 Analysis strategy**

222 We conducted statistical analyses using SPSS (IBM, Armonk, NY). We explored the
223 hypothesized time \times group interaction on emotion regulation difficulty, agency difficulty, and
224 sensation need satisfaction. Specifically, we conducted a time \times group mixed-model ANOVA for
225 each of the SEAS factors and explored significant interactions using repeated measures ANOVA
226 and one-way ANOVA follow-up tests where appropriate. This method allowed us to identify
227 differences between high-risk and low-risk sports groups' sensation need satisfaction, emotion

¹ Using Mplus version 8.5, we conducted an additional Bayesian structural equation model (BSEM) to test the factor structure and model fit of the SEAS. We direct the interested reader to the supplementary material.

228 regulation, and agency difficulty over the three after participation time points (i.e., one day, one
229 week, and six weeks). We reported Greenhouse-Geisser corrections and Bonferroni multiple
230 comparisons when the analysis assumptions were violated (Bathke et al., 2009).

231 **3. Results²**

232 **3.1 Main analysis**

233 **3.1.1 Emotion Regulation**

234 The 3 (time) \times 4 (group) mixed-model ANOVA results provided support for the emotion
235 regulation hypothesizes. Specifically, the results revealed a significant main effect for Time,
236 $F(1.47, 231.63) = 13.30, p < .01, \eta_p^2 = .07$, and a significant time \times group interaction for emotion
237 regulation $F(4.42, 231.63) = 3.19, p = .01, \eta_p^2 = .05$ (see Figure 1). Probing of the interaction via
238 one-way repeated measures ANOVAs revealed a significant increase in emotion regulation
239 difficulty across time for mountaineers $F(1.52, 47.16) = 11.46, p < .01, \eta_p^2 = .27$ and traditional
240 climbers $F(1.48, 84.68) = 14.77, p < .01, \eta_p^2 = .20$. Bonferroni comparisons revealed that both
241 mountaineers' and traditional climbers' difficulty with emotion regulation significantly increased
242 between one day and one week (mountaineers $p = .02$; tradition climbers $p < .01$), and between
243 one day and six weeks (mountaineers $p < .01$; traditional climbers $p < .01$) post-activity.
244 Traditional climbers' difficulty also increased between one week and six weeks ($p = .02$). The
245 follow-up tests for sport climbers ($p = .95$) and low-risk sport controls ($p = .50$) revealed no
246 significant differences across time (see Table 1).

247 **3.1.2 Agency**

248 The 3 (time) \times 4 (group) mixed-model ANOVA results did not support the agency

² Across all three studies in this paper, all significant interactions held when controlling for sex and years of sporting participation.

249 hypotheses. Specifically, the results revealed a significant main effect for Time, $F(1.39, 216.62)$
250 $= 13.97, p < .01, \eta_p^2 = .08$, and no significant time \times group interaction for agency, $F(4.13,$
251 $216.62) = .86, p = .48, \eta_p^2 = .01$ (see Figure 2 & Table 1). Follow-up tests for the main effect for
252 time revealed that participants significantly increased in agency difficulty between one day and
253 one week ($p < .01$), one week and six weeks ($p < .01$), and one day and six weeks ($p < .01$).

254 **3.1.3 Sensation Seeking**

255 The 3 (time) \times 4 (group) mixed-model ANOVA provided support for the sensation
256 seeking hypothesis. Specifically, the results revealed a significant main effect for Time,
257 $F(1.54, 242.13) = 4.08, p = .02, \eta_p^2 = .02$, and no significant main effect for Group, $F(3, 157) =$
258 $2.58, p = .06, \eta_p^2 = .04$, and no time \times group interaction for sensation seeking, $F(4.62, 242.13) =$
259 $1.02, p = .39, \eta_p^2 = .01$ (see Figure 3 & Table 1). The follow-up tests for the main effects
260 revealed no significant increase in sensation need satisfaction across time.

261 **4. Discussion**

262 The aim of Study 1 was to test our hypothesis that high-risk climbers (i.e., traditional
263 climbers and mountaineers) would display different emotion regulation and agency profiles in
264 the time after sports participation to comparable low-risk climbers (i.e., sport climbers) and low-
265 risk controls (i.e., hikers, swimmers, golfers, cyclists). Consistent with our hypothesis,
266 mountaineers' and traditional climbers' emotion regulation profiles differed significantly from
267 low-risk sport climbers and low-risk sport controls. Specifically, as hypothesized, difficulty in
268 emotion regulation significantly increased across time only for mountaineers and traditional
269 climbers. These findings demonstrate that mountaineers and traditional climbers experience
270 better emotion regulation one day after participation compared to one week and/or six weeks
271 afterward, indicating the emotion regulation function that high-risk climbing may serve.

272 The findings for agency revealed no such differentiation between the sports. That is,
273 regardless of the nature of the sport (i.e., high- or low-risk), participants experienced greater
274 agentic difficulty as time increased from their previous participation. However, previous research
275 indicates that agency is not a primary motive for engaging in low-risk activities (Barlow et al.,
276 2013; Woodman, MacGregor, & Hardy, 2020), so this effect clearly warrants further attention.

277 None of the groups displayed significant differences in sensation need satisfaction.
278 Specifically, mountaineers' and traditional climbers' sensation-seeking profiles were no different
279 from low-risk sport climbers, hikers, and swimmers. Thus, these results support our hypothesis
280 and further refute the longstanding view that high-risk sports participants form a homogenous
281 sensation seeking group (Freixanet, 1991; Zuckerman, 2007). In summary, the results supported
282 the hypothesis that higher risk climbers would experience greater emotion regulation difficulties
283 after participation but did not support the hypothesis that agency would reveal a similar pattern.

284 **5. Study 2**

285 The aim of Study 2 was twofold. First, we aimed to retest the hypotheses from Study 1.
286 Second, we aimed to focus more sharply on different rock-climbing disciplines to test the
287 hypothesis that traditional climbers will demonstrate significantly different emotion regulation
288 and agency profiles during the time after sports participation compared to low-risk forms of
289 climbing (such as sport climbers and boulderers) and low-risk sport controls. Specifically, only
290 traditional climbers will significantly increase in agentic emotion regulation difficulty post
291 participation.

292 **6. Methods**

293 **6.1 Participants**

294 We recruited a different sample of participants ($n = 291$) adopting the same method as

295 Study 1 (i.e., convenience and snowball sampling via social media platforms). Based on the
296 demographic information provided therein, the first author categorized 134 participants from the
297 initial 291 sample into their respective sporting groups. The first author used the same inclusion
298 criteria from study 1 to categorise *traditional rock climbers*, *sport climbers*, and *low-risk sport*
299 *controls* in study 2. With a sharper focus on different rock climbing disciplines, we sampled a
300 population of *boulderers*. Bouldering is a form of rock climbing performed on small rock
301 formations or artificial climbing walls without ropes or gear placement for protection. Boulders
302 are typically 1-4 meters high with large foam mats (i.e., bouldering mats) placed around the
303 falling zone for protection in the event of a fall. Due to the relatively low consequences of a fall
304 (i.e., falling 1-4 meters onto foam mats), the risk of severe injury or death is minimal, and
305 therefore we consider bouldering a low-risk sport. *Boulderers* were individuals who stated that
306 bouldering was their preferred sport and who did not participate in traditional climbing or
307 mountaineering as a secondary sport. The first author checked participants' email addresses to
308 ensure the same participants did not participate in multiple studies. The groups were 35
309 traditional climbers (28 men, 7 women; $M_{\text{age}} = 29.82$, $SD = 12.34$; $M_{\text{years of participation}} = 9.87$, $SD =$
310 10.87), 30 sport climbers (22 men, 7 women, 1 other; $M_{\text{age}} = 24.06$, $SD = 5.49$; $M_{\text{years of participation}}$
311 $= 7.56$, $SD = 4.86$), 32 boulderers (24 men, 8 women; $M_{\text{age}} = 27.64$, $SD = 10.59$; $M_{\text{years of participation}}$
312 $= 8.12$, $SD = 10.49$), and 37 low-risk sport controls (18 men, 19 women; $M_{\text{age}} = 34.27$, $SD =$
313 15.00 ; $M_{\text{years of participation}} = 10.36$, $SD = 12.77$). In this study, there were no missing data from the
314 134 eligible participants.

315 **6.2 Measures and procedures**

316 Participants in Study 2 completed the same procedures and measures as those in Study 1.
317 McDonald's omega and Cronbach's alphas demonstrated very good reliability for all the SEAS

318 6-item factors across all three time points (see Table 2).

319 7. Results

320 7.1 Main analysis

321 7.1.1 Emotion Regulation

322 The 3 (time) \times 4 (group) mixed-model ANOVA results provided support for the emotion
323 regulation hypothesizes. Specifically, the results revealed a significant main effect for Time,
324 $F(1.55, 202.62) = 16.94, p < .01, \eta_p^2 = .11$, Group, $F(3, 130) = 2.95, p = .03, \eta_p^2 = .06$ and a
325 significant time \times group interaction for emotion regulation, $F(4.67, 202.62) = 5.62, p < .01, \eta_p^2 =$
326 $.11$; see Figure 4 & Table 2). Probing of the interaction revealed a significant increase in emotion
327 regulation difficulty across time for traditional climbers only, $F(1.54, 52.36) = 14.98, p < .01, \eta_p^2$
328 $= .30$. Bonferroni comparisons revealed traditional climbers' difficulty with emotion regulation
329 significantly increased between one day and one week ($p < .01$), and between one day and six
330 weeks ($p < .01$). The between-groups differences were significant at Time 2, $F(3, 130) = 3.35, p$
331 $= .02, \eta_p^2 = .07$, and at Time 3, $F(3, 130) = 4.97, p < .01, \eta_p^2 = .10$, not at Time 1 ($p = .65$).
332 Bonferroni multiple comparisons revealed that traditional climbers experienced significantly
333 greater emotion regulation difficulty compared to low-risk sport participants one week ($p = .01$)
334 and six weeks ($p < .01$) after sport participation.

335 7.1.2 Agency

336 The 3 (time) \times 4 (group) mixed-model ANOVA results provided support for the agency
337 hypothesizes. Specifically, the agency results revealed a significant main effect for Time, $F(1.57,$
338 $205.29) = 9.68, p < .01, \eta_p^2 = .06$ and a significant time \times group interaction, $F(4.73, 205.29) =$
339 $.781, p < .01, \eta_p^2 = .15$ (see Figure 5 & Table 2). Probing of the interaction via one-way repeated
340 measures ANOVAs revealed a significant increase in agency difficulty across time for traditional

341 climbers only, $F(1.65, 56.33) = 13.31, p < .01, \eta_p^2 = .28$. Bonferroni comparisons revealed that
342 traditional climbers' difficulty with agency significantly increased between one day and six
343 weeks ($p < .01$), and between one week and six weeks ($p < .01$). Low-risk controls difficulty
344 with agency significantly decrease post participation $F(1.55, 55.57) = 7.11, p < .01, \eta_p^2 = .16$.
345 Bonferroni comparisons revealed that low-risk controls difficulty with agency significantly
346 decreased between one day and one weeks ($p = .01$), and between one day and six weeks ($p =$
347 $.02$). There was also a between-group difference in agency difficulty at six weeks after sport
348 participation, $F(3, 130) = 4.77, p < .01, \eta_p^2 = .09$, with no such differences at one day ($p = .75$) or
349 one week ($p = .26$). Bonferroni comparisons revealed that traditional climbers experienced
350 significantly greater difficulty in agency than low-risk sports participants six weeks after sports
351 participation ($p < .01$), which further supports the hypothesis.

352 7.1.3 Sensation Seeking

353 The 3 (time) \times 4 (group) mixed-model ANOVA results supported the sensation seeking
354 hypothesis, revealing no main effect for Time, $F(1.69, 220.75) = 1.51, p = .22, \eta_p^2 = .01$, and
355 Group, $F(3, 130) = .103, p = .38, \eta_p^2 = .02$, and no significant time \times group interaction for
356 sensation seeking, $F(5.09, 220.75) = .74, p = .59, \eta_p^2 = .01$ (see Figure 6 & Table 2).

357 8. Discussion

358 The purpose of Study 2 was to retest the hypothesis of Study 1 with a sharper focus on
359 different rock-climbing disciplines. Specifically, we aimed to test the hypothesis that traditional
360 climbers would demonstrate a profile of emotion regulation and agency difficulty different from
361 that of their relatively low-risk counterparts (i.e., sport climbers, boulderers, and low-risk
362 controls). The results supported this hypothesis; only traditional climbers experienced a
363 significant increase in emotional regulation and agency difficulty across time. Furthermore, the

364 sensation seeking results supported our hypothesis and results from Study 1, in which none of the
365 groups differed from one another or increased in sensation need satisfaction across time. These
366 findings further debunk the sensation seeking explanation for participating in all high-risk
367 activities. The results thus support the notion that the greater agentic emotion regulation
368 experiences that traditional climbing provide serve a regulatory function to reduce participants'
369 agentic emotion regulation difficulties (Barlow et al., 2013).

370 **9. Study 3**

371 The aim of Study 3 was twofold. First, we aimed to retest the hypotheses from Studies 1
372 and 2; that traditional climbers will demonstrate significantly more pronounced emotion
373 regulation and agency difficulty after sports participation compared to low-risk participants.
374 Second, we aimed to address the main limitation of Studies 1 and 2; namely, the cross-sectional
375 retrospective design. Specifically, we had not been in a position ethically to require participants
376 to withdraw for long periods of time from their meaningful activity. Rather perversely, the recent
377 COVID-19 pandemic provided a unique opportunity to test the hypotheses in a longitudinal
378 design while people were temporarily prevented from participating in their activity.

379 **10. Methods**

380 **10.1 Participants**

381 We conducted an *a priori* G*Power analysis (Faul et al., 2007) for testing a 3 (time) \times 3
382 (group) mixed-model ANOVA with a small effect size ($\eta_p^2 = .02$) and an alpha level of .05. The
383 results showed that a total sample size of 102 (i.e., $n = 34$ per group) would be required to
384 achieve a power of .80. The first author recruited a sample of 161 participants, adopting the same
385 method as in Studies 1 and 2. Based on the demographic information provided therein, the first
386 author categorized 45 participants from the initial 161 sample into their respective sporting

387 groups. The first author used the same inclusion criteria from study 1 and 2 to categorise
388 *traditional rock climbers, sport climbers, boulderers* and *low-risk sport controls* in study 3. The
389 first author checked participants' email addresses to ensure the same participants did not
390 participate in multiple studies. The groups were 16 traditional climbers (6 men, 10 women; M_{age}
391 = 31.75, $SD = 10.40$; $M_{\text{years of participation}} = 9.62$, $SD = 8.40$); 17 low-risk climbers (i.e., sport
392 climbers and boulderers; 6 men, 11 women; $M_{\text{age}} = 28.72$, $SD = 9.52$; $M_{\text{years of participation}} = 4.88$, SD
393 = 4.62); and 12 low-risk sport controls (6 men, 6 women; $M_{\text{age}} = 33.91$, $SD = 15.15$; $M_{\text{years of}}$
394 $\text{participation} = 25.33$, $SD = 18.24$). We combined sport climbers and boulderers into a single group as
395 there were insufficient numbers within each group to analyze separately. We deemed this
396 appropriate given that both sports are low-risk climbing activities and both groups reported
397 similar profiles when observed separately in Study 2. Due to participant dropout and sporting
398 participation during the study, we struggled to recruit a satisfactory sample size for this study.
399 Thus, the following analysis, with a sample size 45 participants, was only sensitive to identifying
400 medium effect sizes ($\eta_p^2 = .06$, total sample size required 36; Faul et al., 2007).

401 **10.2 Measures and Procedure**

402 We largely replicated the measures and procedures from Studies 1 and 2 (i.e.,
403 demographic survey, SEAS, convenience, and snowball sampling via social media platforms).
404 However, rather than completing the SEASs retrospectively at a single time point, participants
405 completed the SEAS three times over fourteen days. After agreeing to participate, participants
406 stated when they last participated in their sport before completing the first SEAS. We then
407 contacted participants via email seven and fourteen days later to complete the second and third
408 SEAS, respectively. Participants completed the study at different time points throughout the
409 pandemic, and therefore the time between participants' last sporting participation and the

410 completion of the first SEAS varied. Participants time away from their sport, prior to
411 participating the study, would have most likely affected their sense of agentic emotion
412 dysregulation. Thus, we included the number of days participants had been absent from their
413 sport prior to participation in this study as a covariate to control for this. This design allowed us
414 to investigate participants' emotion regulation and agency fluctuation over a two-week period of
415 sporting absence. To screen for sporting participation during this time, participants reported
416 whether they had participated in their sport over this two-week period. The uncertainty of the
417 ongoing government guidelines and international laws regarding social and sporting activities
418 throughout the pandemic led us to restrict the timeline to a two-week period, thus ensuring that
419 participants remained in lockdown for this study. Furthermore, based on traditional climbers'
420 reports, we considered a 2-week period long enough to capture the fluctuation of these
421 individuals' sense of agentic emotion regulation (Barlow et al., 2013; Lester, 2004). As such, we
422 provided the following introductory statement to the SEAS; *Please answer the following*
423 *statements thinking about your feelings toward your life after not participating in your preferred*
424 *sport or activity for [insert number of days absence] days. Upon completing all three SEASs,*
425 participants were eligible to enter a £50 prize draw.

426 McDonald's omega and Cronbach's alphas demonstrated good reliability for all the
427 SEAS 6-item factors across all three time points (see Table 3).

428 **11. Results³**

429 **11.1 Main analysis**

430 **11.1.1 Emotion Regulation**

³ The interactions in Study 3 held when controlling for time spent away from sport prior to the study.

431 The 3 (time) \times 3 (group) mixed-model ANOVA results supported the emotion regulation
432 hypothesis. Specifically, the results revealed a significant time \times group interaction for emotion
433 regulation, $F(4, 84) = 2.78, p = .03, \eta_p^2 = .11$ (see Figure 7 & Table 3). Probing the interaction
434 revealed a significant increase in emotion regulation difficulty across time for traditional
435 climbers only, $F(2, 30) = 7.09, p < .01, \eta_p^2 = .32$. Bonferroni comparisons revealed traditional
436 climbers' difficulty with emotion regulation significantly increased between Day 1 and Day 14
437 ($p = .02$). The repeated measures ANOVAs revealed no significant differences in emotion
438 regulation difficulty across time for low-risk climbers ($p = .54$) and low-risk controls ($p = .75$).
439 We also performed one-way ANOVAs to identify differences in emotion regulation difficulty
440 between groups at each of the three time points. Results revealed a significant group difference at
441 Day 7, $F(2, 42) = 3.47, p = .04, \eta_p^2 = .14$; and Day 14, $F(2, 42) = 3.98, p = .02, \eta_p^2 = .16$; no such
442 differences emerged for Day 1 ($p = .06$). Multiple comparisons revealed that traditional climbers
443 experienced significantly greater difficulty in emotion regulation compared to low-risk control
444 participants on Day 7 ($p = .05$) and Day 14 ($p = .02$). No significant differences were observed
445 between traditional climbers and low-risk climbers on Day 7 ($p = .97$) and Day 14 ($p = .75$) or
446 low-risk climbers and controls on Day 7 ($p = .07$) and Day 14 ($p = .09$).

447 **11.1.2 Agency**

448 The 3 (time) \times 3 (group) mixed-model ANOVA results provided support for the agency
449 hypothesis. Specifically, the results revealed a significant time \times group interaction for agency,
450 $F(4, 84) = 3.85, p < .01, \eta_p^2 = .15$ (see Figure 8 & Table 3). Bonferroni tests revealed a
451 significant increase in agency difficulty across time for traditional climbers only, $F(2, 30) = 8.54,$
452 $p < .01, \eta_p^2 = .36$; traditional climbers' difficulty with agency significantly increased between
453 Day 1 and Day 14 ($p < .01$), and between Day 7 and Day 14 ($p < .01$). There were no such

454 differences in agency difficulty across time for low-risk climbers ($p = .14$) and low-risk controls
455 ($p = .64$). These results support the hypothesis. Furthermore, one-way randomized ANOVAs
456 revealed a significant group difference in agency difficulty at Day 14, $F(2, 42) = 4.58, p = .01$,
457 $\eta_p^2 = .17$, with no differences at Day 1 ($p = .11$) or Day 7 ($p = .24$). Multiple comparisons
458 revealed that traditional climbers experienced significantly greater difficulty in agency compared
459 to low-risk climbers ($p = .02$) and low-risk controls ($p = .05$) 14 days after sports participation.

460 **11.1.3 Sensation Seeking**

461 The 3 (time) \times 3 (group) mixed-model ANOVA results provided support for the
462 sensation seeking hypothesis. Specifically, the results revealed no significant time \times group
463 interaction for sensation seeking, $F(4, 82) = .49, p = .74, \eta_p^2 = .02$ (see Table 3), and no main
464 effect for Time, $F(2, 82) = .06, p = .93, \eta_p^2 = .02$ or Group, $F(2, 41) = .86, p = .42, \eta_p^2 = .04$
465 (see Figure 9 and Table 3).

466 **12. Discussion**

467 The purpose of Study 3 was to replicate the findings of Studies 1 and 2 and address the
468 limitation of the cross-sectional retrospective design by investigating the *in vivo* effects of sports
469 absence. The present study supported our hypothesis and replicated the emotional regulation and
470 sensation seeking findings from Studies 1 and 2 and the agency findings of Study 2. Specifically,
471 only traditional climbers experienced a significant increase in emotional regulation and agency
472 difficulty after participation, compared to the low-risk climbers and low-risk controls who
473 experienced no change. Furthermore, none of the groups differed from one another or increased
474 in sensation need satisfaction across time. These longitudinal results provide further evidence for
475 the agentic emotion regulation function that high-risk climbing serves and individuals'
476 associated motive, specifically to benefit from an agentic emotion regulation transfer from their

477 activity to everyday life.

478 **13. General Discussion**

479 This research aimed to investigate the process of agentic emotion regulation and
480 sensation need satisfaction in the time after sports participation. We conducted three studies
481 aimed to demonstrate that high-risk climbers (i.e., traditional climbers) display different emotion
482 regulation and agency profiles in the time after sports participation than comparable low-risk
483 climbers (i.e., sport climbers and boulderers) and low-risk sport controls (i.e., footballers,
484 swimmers).

485 **13.1 Agency and emotion regulation profiles**

486 Consistent with our hypothesis, our retrospective and longitudinal results revealed that
487 high-risk climbers possess different *emotion regulation* and *agency* profiles in the time after
488 sporting participation than low-risk climbers and sport controls. Specifically, only high-risk
489 climbers experienced an increase in *agency* and *emotion regulation difficulty* in the time after
490 their sporting participation, as hypothesized. These results further support Barlow et al.'s (2013)
491 cross-sectional research, in which mountaineers' emotion regulation and agency profiles before,
492 during, and immediately after participation significantly differed from that of skydivers and sport
493 controls.

494 As we have, in part, accounted for physical (i.e., the physical requirements of low-risk
495 sporting activities) and environmental (i.e., the mountainous natural environment of sport
496 climbing and bouldering) factors, one could attribute the emotion regulation and agency benefits
497 that high-risk climbers experience to the specific risk that is inherent in their sport. This
498 increased risk provides high-risk climbers a greater opportunity to experience and subsequently
499 regulate externally-derived emotions (i.e., fear) in ways that are not readily available in

500 individuals' normative everyday lives or low-risk sports (see Barlow et al., 2013; Woodman et
501 al., 2010).

502 Unlike in low-risk sports, physical danger is innate in mountaineering and traditional
503 climbing. The associated risk requires participants to control strong emotions derived from the
504 demanding environment and to act agentially to mitigate potentially life-threatening situations
505 (Woodman et al., 2010). The emotions that are experienced in the high-risk climbing domain are
506 predominantly driven by sources within participants' control. For example, when controlling
507 feelings of fear to avoid falling when climbing or finding a way past a crevasse, the climber acts
508 as an agent, rather than reacting to uncontrollable forces (Lester, 2004). Thus, the experience of
509 emotion regulation and agency is central to mountaineers' and traditional climbers' engagement
510 with their activity. Furthermore, our findings suggest that men and women do not differ in their
511 agentic emotion regulation motives for high-risk climbing activities. In other words, our
512 interactions held across all three studies when controlling for sex. These findings contrast
513 previous literature suggesting sex differences in motives for physical activity (Deaner, Balish, &
514 Lombardo, 2016). The risk-agentic emotion regulation process that individuals experience during
515 high-risk climbing activities may, in part, explain men's and women's similarities in motivation.
516 Specifically, intense agentic emotion regulation experiences are an implicit part of high-risk
517 climbing activities that participants experience and are likely motivated to experience regardless
518 of sex.

519 In line with Castanier et al.'s (2011) proposal, the positive agentic emotion regulation
520 benefits that high-risk climbers transferred back into their daily lives did not last long (i.e., less
521 than six weeks). Across the mountaineering and traditional climbing literature, participants have
522 reported a plethora of difficulties establishing control over the self and interpreting and

523 regulating their emotions in their daily life domains (Lester, 2004). These intrapersonal
524 difficulties subsequently magnified the difficulty and distress they experienced in their
525 interpersonal lives (see Barlow et al., 2013; Woodman et al., 2010). Lester (1983) suggested that
526 for high-risk climbers many aspects of domestic life, especially maintaining romantic
527 relationships “were more stressful to the average team member than were the icy conditions in a
528 fragile tent on a snowy ridge in high winds with inadequate oxygen” (p. 34). Thus, the rate at
529 which these positive agentic emotion regulation benefits deplete could be accentuated by their
530 return to their domestic environment where they have trouble establishing control over
531 themselves and regulating their emotions. Collectively, these findings provide compelling
532 evidence for the agentic emotion regulation function that high-risk climbing serves.

533 **13.2 Sensation seeking**

534 These results across all three studies support our hypothesis that mountaineers' and
535 traditional climbers' sensation need satisfaction profiles are no different from low-risk climbers'
536 or low-risk sports participants'. Specifically, as hypothesized, none of the groups significantly
537 differed from one another or significantly increased in *sensation need satisfaction* after
538 participation. These results thus expand upon previous literature (Cronin, 1991; Maher et al.,
539 2015; Zuckerman, 2007) suggesting that high-risk sportspeople are simply a homogenous group
540 of sensation seekers. Specifically, these findings confirm previous research (Barlow et al., 2013;
541 Woodman et al., 2020) and participants' reported experiences (Lester, 1983, 2004) that sensation
542 seeking is not a primary motive for such high-risk climbing endeavors.

543 **13.3 Implications, limitations, and future research directions**

544 The current findings have important implications for risk-taking research. First, the
545 present findings suggest a link between increased high-risk sports absence and agentic emotion

546 regulation difficulty. These findings indicate the positive regulatory function that high-risk sports
547 serve and individuals' motives to participate as a means of gleaning such a benefit. Second, a
548 wealth of research has identified causal relationships between agency and emotion regulation
549 difficulties and antisocial risk-taking behaviors, especially among adolescents (Eisenberg et al.,
550 2001). As inferred by the present data, high-risk sports can effectively regulate one's agency and
551 emotional difficulties (Barlow et al., 2013) and may benefit individuals who engage in
552 unacceptable risk-taking by engaging in specific forms of high-risk sports (Eisenberg et al.,
553 2001). For example, high-risk sports could allow these individuals to experience a high level of
554 control over the self, regulate externally derived identifiable emotions, and glean an agency,
555 emotion regulation, and self-esteem benefit (see Woodman et al., 2020). Similarly, future
556 research would do well to investigate the antecedent and response-based emotion regulation
557 strategies high-risk sports exercise and their effect on regulating strong emotions in domestic life
558 (see process model of emotion regulation; Gross, 2008). Evidently, more research is needed to
559 illuminate these theoretical relationships or indeed any such benefits.

560 The SEAS is a scale that measures the motive for any activity, not just high-risk sports. In
561 other words, although it was developed to explore motivation in high-risk sports, it can be
562 applied to any setting. It is likely that other environments (high-risk or otherwise) will benefit
563 from the application of agentic emotion regulation theory (and SEAS measurement) when there
564 is thought to be an agency, emotion regulation, or sensation-seeking motive. Particularly when
565 other motivational theories may be considered limited in understanding such motives (see
566 Woodman, MacGregor, & Hardy 2020). Thus, we encourage future research to explore the
567 generalizability of agentic emotion regulation theory to other high-risk activities, including high-
568 risk occupations and antisocial risk-taking activities.

569 The retrospective data collection method was a clear limitation of Studies 1 and 2. Study
570 3 allowed us to measure individuals' post-participation profiles during the sporting restrictions
571 imposed by governments to combat the COVID-19 pandemic. Thus, by adopting a longitudinal
572 design, we overcame these limitations and confirmed the validity of the retrospective design
573 reflected by the concurring results of the three studies. However, the small sample size in Study
574 3 points to the need for replication and further exploration.

575 Despite its clear longitudinal strength, Study 3 is not without limitations that pervade the
576 studies and this research as a whole. Firstly, our research is limited by reliance on self-report
577 measures. One solution to this limitation - and an interesting prospect for future research – would
578 be to cross substantiate participants' reports of agentic emotion dysregulation with that of their
579 closest others (triangulation design; Turner, Cardinal, & Burton, 2017). Such a design would
580 improve the reliability of the results by cross-validating participants' accounts with their peers
581 (Paunonen & O'Neill, 2010).

582 Secondly, the use of a static timeline to capture participants after participation agentic
583 emotion dysregulation is another limitation of this research. Specifically, this design is not
584 sensitive to interindividual differences for what constitutes a meaningful amount of time away
585 from one's activity to cause an agentic emotion dysregulation. For example, a 6 week absence
586 from mountaineering may be routine for a participant who has just returned from a prolonged
587 arduous expedition. However, a 6 week absence from traditional climbing may be unthinkable
588 for an individual who climbs 2-3 days a week. Future research may overcome this limitation by
589 applying the SEAS inventory and an audio diary in a daily concurrent repeated measures design.
590 A mixed methods design such as this would enable the examination of participants'
591 interindividual differences in agentic emotion dysregulation after participation (Turner, Cardinal,

592 & Burton, 2017). Despite using a blunt timeframe to capture participants after participation
593 agentic emotion dysregulation, our hypothesis was supported by the data across three studies.

594 Lastly, we did not randomly assign participants to groups or manipulate groups allowing
595 us to measure factors that may determine the magnitude of high-risk climber agentic emotion
596 regulation transfer benefits, such as the danger, intensity, and duration of individuals' latest
597 participation. Indeed, this would be a fruitful and interesting avenue for future research but may
598 be very difficult to implement as the prospect of another prolonged sporting absence would be
599 hard to contemplate for most participants (see Barlow et al., 2013).

600 **13.4 Conclusion**

601 The present studies provide compelling evidence that mountaineers and traditional
602 climbers experience different emotion regulation and agency trajectories than low-risk climbers
603 and sport controls. In short, the agentic emotion regulation benefits decay more evidently for
604 those who engage in high-risk activities. One may thus conclude that this agentic emotion
605 regulation difficulty is a primary motive for the need to return to the high-risk domain to glean
606 an agentic emotion regulation benefit again. The present studies provide further evidence for the
607 value of agentic emotion regulation theory in explaining the motives for activities that seem less
608 easily captured by other motivational frameworks such as self-determination theory (Woodman
609 et al., 2020). The findings further support the positive agentic emotion regulation effects of
610 engaging in high-risk sports, which are considerably different to other risk-taking endeavors (i.e.,
611 substance abuse). In summary, high-risk sports can provide a positive and effective means of
612 regulating one's agency and emotion regulation difficulties.

613 **Acknowledgments**

614



615



Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

- Asparouhov, T., & Muthén, B. (2010). Bayesian analysis of latent variable models using Mplus. Version 4, 55-63.
- Asparouhov, T., Muthén, B., & Morin, A. J. S. (2015). Bayesian Structural Equation Modeling with Cross-Loadings and Residual Covariances: Comments on Stromeier et al. *Journal of Management*, *41*, 1561-1577. <https://doi.org/10.1177/0149206315591075>
- Bandura, A. (1997). Theoretical perspectives. *Self-efficacy: the exercise of control*, 1-35.
- Barlow, M., Woodman, T., & Hardy, L. (2013). Great expectations: Different high-risk activities satisfy different motives. *Journal of Personality & Social Psychology*, *105*, 458-475. <https://doi.org/10.1037/a0033542>
- Barlow, M., Woodman, T., Chapman, C., Milton, M., Stone, D., Dodds, T., & Allen, B. (2015). Who takes risks in high-risk sport? The role of alexithymia. *Journal of Sport & Exercise Psychology*, *37*, 83-96. <https://doi.org/10.1123/jsep.2014-0130>
- Bathke, A. C., Schabenberger, O., Tobias, R. D., & Madden, L. V. (2009). Greenhouse–Geisser adjustment and the ANOVA-type statistic: cousins or twins?. *The American Statistician*, *63*, 239-246. <https://doi.org/10.1198/tast.2009.08187>
- Breivik, G. (1996). Personality, sensation seeking and risk-taking among Everest climbers. *International Journal of Sport Psychology*, *27*, 308-320.
- Breivik, G. (2010). Trends in adventure sports in a post-modern society. *Sport in Society*, *13*, 260-273. <https://doi.org/10.1080/17430430903522970>
- Castanier, C., Le Scanff, C., & Woodman, T. (2010). Beyond sensation seeking: Affect regulation as a framework for predicting risk-taking behaviors in high-risk sport. *Journal of Sport & Exercise Psychology*, *32*, 731-738. <https://doi.org/10.1123/jsep.32.5.731>

- Castanier, C., Le Scanff, C., & Woodman, T. (2011). Mountaineering as affect regulation: The moderating role of self-regulation strategies. *Anxiety, Stress, & Coping, 24*, 75-89.
<https://doi.org/10.1080/10615801003774210>
- Cohen, R., Baluch, B., & Duffy, L. J. (2018). Defining extreme sport: conceptions and misconceptions. *Frontiers in Psychology, 9*, 1974-1982.
<https://doi.org/10.3389/fpsyg.2018.01974>
- Cronin, C. (1991). Sensation seeking among mountain climbers. *Personality and Individual Differences, 12*, 653-654. [https://doi.org/10.1016/0191-8869\(91\)90264-C](https://doi.org/10.1016/0191-8869(91)90264-C)
- Deaner, R. O., Balish, S. M., & Lombardo, M. P. (2016). Sex differences in sports interest and motivation: An evolutionary perspective. *Evolutionary Behavioral Sciences, 10*, 73-97.
<https://doi.org/10.1037/ebs0000049>
- Depaoli, S., & Van de Schoot, R. (2017). Improving transparency and replication in Bayesian statistics: The WAMBS-Checklist. *Psychological methods, 22*, 240-261.
<https://doi.org/10.1037/met0000065>
- Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepard, S. A., Reiser, M., ... & Guthrie, I. K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72*, 1112-1134.
<https://doi.org/10.1111/1467-8624.00337>
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.
- Freixanet, M. G. (1991). Personality profile of subjects engaged in high physical risk sports.

- Personality and Individual Differences*, 12, 1087-1093. [https://doi.org/10.1016/0191-8869\(91\)90038-D](https://doi.org/10.1016/0191-8869(91)90038-D)
- Gelman, A., & Rubin, D. B. (1992). Inference from iterative simulation using multiple sequences. *Statistical science*, 7, 457-472. DOI: 10.1214/ss/1177011136
- Gross, J. J. (2008). Emotion regulation. *Handbook of Emotions* (2nd ed.). Guilford Press.
- Hayes, A. F., & Coutts, J. J. (2020). Use omega rather than Cronbach's alpha for estimating reliability. But.... *Communication Methods and Measures*, 14, 1-24.
<https://doi.org/10.1080/19312458.2020.1718629>
- Horvath, P., & Zuckerman, M. (1993). Sensation seeking, risk appraisal, and risky behavior. *Personality and Individual Differences*, 14, 41-52. [https://doi.org/10.1016/0191-8869\(93\)90173-Z](https://doi.org/10.1016/0191-8869(93)90173-Z)
- Kruschke, J. K. (2013). Bayesian estimation supersedes the t test. *Journal of Experimental Psychology: General*, 142, 573-603. <https://doi.org/10.1037/a0029146>
- Lee, S. Y., & Song, X. Y. (2004). Evaluation of the Bayesian and maximum likelihood approaches in analyzing structural equation models with small sample sizes. *Multivariate Behavioral Research*, 39, 653-686. https://doi.org/10.1207/s15327906mbr3904_4
- Lester, J. T. (1983). Wrestling with the self on Mount Everest. *Journal of Humanistic Psychology*, 23, 31-41. <https://doi.org/10.1177/0022167883232005>
- Lester, J. T. (2004). Spirit, identity, and self in mountaineering. *Journal of Humanistic Psychology*, 44, 86-100. <https://doi.org/10.1177/0022167803257111>
- Maher, A. M., Thomson, C. J., & Carlson, S. R. (2015). Risk-taking and impulsive personality traits in proficient downhill sports enthusiasts. *Personality and Individual Differences*, 79, 20-24. <https://doi.org/10.1016/j.paid.2015.01.041>

- Muthén, B., & Asparouhov, T. (2012). Bayesian structural equation modeling: a more flexible representation of substantive theory. *Psychological methods, 17*, 313.
<https://doi.org/10.1037/a0026802>.
- Paunonen, S. V., & O'Neill, T. A. (2010). Self-reports, peer ratings and construct validity. *European Journal of Personality: Published for the European Association of Personality Psychology, 24*, 3, 189-206. <https://doi.org/10.1002/per.751>.
- Schöffl, V., Morrison, A., Schöffl, I., & Küpper, T. (2012). The epidemiology of injury in mountaineering, rock and ice climbing. *Epidemiology of Injury in Adventure and Extreme Sports, 58*, 17-43. <https://doi.org/10.1159/000338575>.
- Shaver, P. R., Mikulincer, M., Gross, J. T., Stern, J. A., & Cassidy, J. A. (2016). A lifespan perspective on attachment and care for others: Empathy, altruism, and prosocial behavior. *Cassidy, J.; Shaver, PR (ed.), Handbook of attachment: Theory, research, and clinical applications (3rd ed.)*. New York: Guilford Press.
- Stewart, W. P., & Hull IV, R. B. (1996). Capturing the moments: Concerns of in situ leisure research. *Journal of Travel & Tourism Marketing, 5*, 3-20.
https://doi.org/10.1300/J073v05n01_02
- Thorpe, H., & Dumont, G. (2018). The professionalization of action sports: Mapping trends and future directions. *Sport in Society, 1*, 1639-1654.
<https://doi.org/10.1080/17430437.2018.1440715>.
- Turner, S. F., Cardinal, L. B., & Burton, R. M. (2017). Research design for mixed methods: A triangulation-based framework and roadmap. *Organizational Research Methods, 20*, 2, 243-267. <https://doi.org/10.1177/1094428115610808>.

- Windsor, J. S., Firth, P. G., Grocott, M. P., Rodway, G. W., & Montgomery, H. E. (2009). Mountain mortality: a review of deaths that occur during recreational activities in the mountains. *Postgraduate Medical Journal*, *85*, 316-321.
<http://dx.doi.org/10.1136/pgmj.2009.078824>.
- Woodman, T., Cazenave, N., & Le Scanff, C. (2008). Skydiving as emotion regulation: The rise and fall of anxiety is moderated by alexithymia. *Journal of Sport & Exercise Psychology*, *30*, 424-433. <https://doi.org/10.1123/jsep.30.3.424>
- Woodman, T., Hardy, L., & Barlow, M. (2020). High-Risk Sports. *Handbook of Sport Psychology*, 177-189. <https://doi.org/10.1002/9781119568124.ch9>
- Woodman, T., Hardy, L., Barlow, M., & Le Scanff, C. (2010). Motives for participation in prolonged engagement high-risk sports: An agentic emotion regulation perspective. *Psychology of Sport and Exercise*, *11*, 345-352.
<https://doi.org/10.1016/j.jad.2008.11.022>
- Woodman, T., Huggins, M., Le Scanff, C., & Cazenave, N. (2009). Alexithymia determines the anxiety experienced in skydiving. *Journal of Affective Disorders*, *116*, 134-138.
<https://doi.org/10.1016/j.jad.2008.11.022>
- Woodman, T., MacGregor, A. L., & Hardy, L. (2020). Risk can be good for self-esteem: beyond self-determination theory. *Journal of Risk Research*, *23*, 411-423.
<https://doi.org/10.1080/13669877.2019.1588913>
- Zarevski, P., Marušić, I., Zolotić, S., Bunjevac, T., & Vukosav, Ž. (1998). Contribution of Arnett's inventory of sensation seeking and Zuckerman's sensation seeking scale to the differentiation of athletes engaged in high and low risk sports. *Personality and Individual Differences*, *25*, 763-768. [https://doi.org/10.1016/S0191-8869\(98\)00119-6](https://doi.org/10.1016/S0191-8869(98)00119-6)

Zuckerman, M. (1964). Perceptual isolation as a stress situation: A review. *Archives of General Psychiatry, 11*, 255-276. doi:10.1001/archpsyc.1964.01720270027004

Zuckerman, M. (1979). *Sensation seeking: Beyond the optimal level of arousal* (1st ed.). Hillsdale, NJ: Erlbaum.

Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking* (1st ed.). New York: Cambridge University Press.

Zuckerman, M. (2007). *Sensation seeking and risky behavior* (1st ed.). American Psychological Association.

Zuckerman, M., Eysenck, S. B., & Eysenck, H. J. (1978). Sensation seeking in England and America: cross-cultural, age, and sex comparisons. *Journal of Consulting and Clinical Psychology, 46*, 139-149. <https://doi.org/10.1037/0022-006X.46.1.139>

Tables

Table 1.

Study 1 differences between Traditional climbers, Mountaineers, Sport climbers, Low-risk sport controls for emotion regulation, agency, and sensation seeking difficulty after participation.

Group	Time 1	Time 2	Time 3
Emotion Regulation difficulty	$\omega = .88, \alpha = .88$	$\omega = .94, \alpha = .94$	$\omega = .96, \alpha = .95$
<i>Traditional rock climbers</i>	17.18 [18.97, 15.40] (6.80)	20.05 [22.48, 17.61] (9.24)	21.79 [24.31, 19.27] (9.59) ^a
<i>Mountaineers</i>	15.56 [18.56, 12.56] (8.31)	18.75 [22.30, 15.19] (9.84)	20.43 [23.68, 17.19] (9.00) ^a
<i>Sport climbers</i>	16.62 [20.07, 12.97] (7.79)	16.47 [20.24, 12.60] (8.39)	16.33 [20.68, 11.98] (9.55)
<i>Low-risk sport controls</i>	16.80 [19.04, 14.55] (7.89)	17.26 [19.54, 14.97] (8.05)	17.90 [20.48, 15.31] (9.10)
Agency difficulty	$\omega = .87, \alpha = .87$	$\omega = .94, \alpha = .94$	$\omega = .95, \alpha = .95$
<i>Traditional rock climbers</i>	15.75 [17.64, 13.87] (7.15)	17.75 [20.05, 15.46] (8.72)	19.70 [22.44, 16.96] (10.42)
<i>Mountaineers</i>	14.87 [17.52, 12.22] (7.35)	16.25 [19.52, 12.93] (9.20)	18.28 [21.88, 14.67] (9.99)
<i>Sport climbers</i>	12.28 [14.17, 9.85] (5.33)	12.42 [15.60, 9.25] (6.98)	13.23 [17.63, 8.84] (9.65)
<i>Low-risk sport controls</i>	13.82 [15.81, 11.82] (7.00)	14.72 [17.03, 12.40] (8.14)	16.04 [18.61, 13.46] (9.06)
Sensation need satisfaction	$\omega = .89, \alpha = .88$	$\omega = .92, \alpha = .92$	$\omega = .94, \alpha = .94$

<i>Traditional rock climbers</i>	32.68 [34.67, 30.70] (7.53)	33.63 [35.66, 31.61] (7.69)	34.37 [26.35, 32.40] (7.49)
<i>Mountaineers</i>	31.71 [34.10, 29.33] (6.62)	33.65 [35.91, 31.34](6.42)	34.65 [37.38, 31.92] (7.58)
<i>Sport climbers</i>	30.04 [33.49, 26.60] (7.56)	30.28 [34.13, 26.43](8.46)	31.14 [36.93, 25.92] (11.46)
<i>Low-risk sport controls</i>	30.48 [32.60, 28.35] (7.48)	29.96 [32.24, 27.67] (8.02)	30.46 [32.94, 27.97] (8.75)

Note: ^a = significantly increased in difficulty across time. Time 1 = one day after participation, Time 2 = one week after participation, Time 3 = six weeks after participation, Mean [95% confidence intervals] (SD). *Traditional rock climbers*, $n = 58$; *mountaineers*, $n = 32$; *sport climbers* $n = 21$; *low-risk sport controls* $n = 50$. ω = McDonald's omega; α = Cronbach's alpha.

Table 2.

Study 2 differences between Traditional climbers, Sport climbers, Boulderers, and Low-risk sport controls for emotion regulation, agency, and sensation seeking difficulty after participation.

Group	Time 1	Time 2	Time 3
Emotion Regulation difficulty	$\omega = .83, \alpha = .83$	$\omega = .92, \alpha = .91$	$\omega = .94, \alpha = .94$
<i>Traditional rock climbers</i>	20.42 [23.24, 17.60] (8.47)	24.17 [27.01, 21.31] (8.31) ^b	26.91[30.33, 23.49] (9.95) ^a
<i>Sport climbers</i>	19.70 [22.14, 17.25] (6.53)	21.00 [23.80, 18.19] (7.52) ^b	22.83 [29.22, 19.44] (9.08)
<i>Boulderers</i>	20.84 [23.60, 18.08] (7.64)	20.43 [23.49, 17.38] (8.47)	22.46 [26.09, 18.84] (10.05)
<i>Low risk sport controls</i>	18.72 [21.12, 16.33] (7.17)	18.02 [20.88, 15.16] (8.57)	18.18 [21.26, 15.11] (9.22)
Agency difficulty	$\omega = .85, \alpha = .84$	$\omega = .91, \alpha = .91$	$\omega = .94, \alpha = .94$
<i>Traditional rock climbers</i>	16.94 [19.64, 14.24] (7.86)	19.17 [22.32, 16.01] (9.17)	23.40 [27.18, 19.61] (11.02) ^{ab}
<i>Sport climbers</i>	15.53 [17.74, 13.32] (5.92)	16.36 [19.04, 13.69] (7.16)	18.13 [21.49, 18.13] (8.99)
<i>Boulderers</i>	16.87 [19.51, 14.23] (7.32)	16.68 [19.64, 13.73] (8.18)	17.84 [21.34, 14.34] (9.70)
<i>Low risk sport controls</i>	17.43 [19.92, 14.93] (7.48)	15.40 [18.11, 12.69] (8.12)	15.10 [17.73, 12.48] (7.88)
Sensation need satisfaction	$\omega = .89, \alpha = .88$	$\omega = .89, \alpha = .89$	$\omega = .93, \alpha = .93$
<i>Traditional rock climbers</i>	34.68 [36.90, 34.68] (6.46)	35.14 [37.46, 32.81] (6.76)	36.02 [38.47, 33.58] (7.12)
<i>Sport climbers</i>	35.00 [36.88, 33.11] (5.05)	35.03 [37.36, 32.69] (6.25)	35.40 [37.56, 33.23] (5.81)

<i>Boulderers</i>	34.71 [37.28, 32.15] (7.10)	33.50 [36.28, 30.71] (7.71)	34.43 [36.83, 32.03] (6.65)
<i>Low-risk sport controls</i>	32.72 [34.52, 30.93] (5.37)	33.16 [34.80, 31.51] (4.93)	33.32 [35.78, 30.86] (7.38)

Note: ^a = significantly increased in difficulty across time; ^b = significantly greater than the low-risk sports group. Time 1 = one day after participation, Time 2 = one week after participation, Time 3 = six weeks after participation, Mean [95% confidence intervals] (SD). *n* = sample size, traditional rock climbers *n* = 35, sport climbers *n* = 30, boulderers *n* = 32, low-risk sport controls *n* = 37. ω = McDonald's omega; α = Cronbach's alphas.

Table 3.

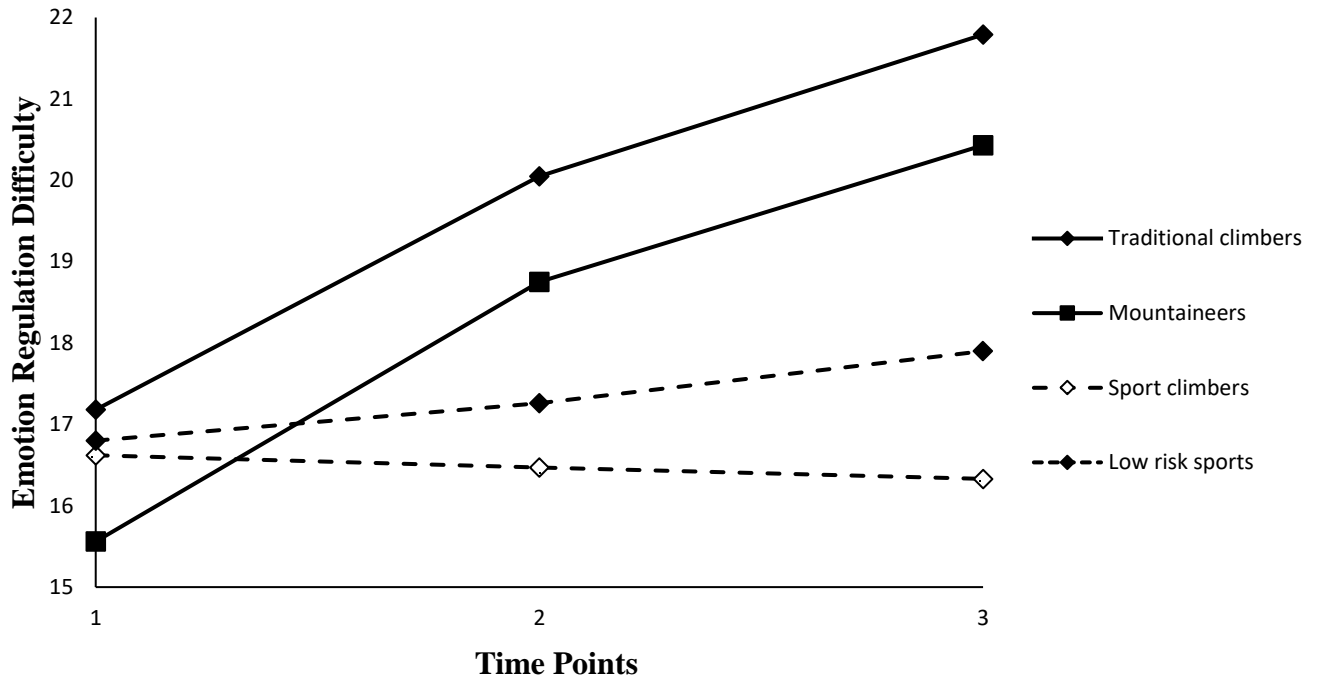
Study 3 differences between Traditional climbers, Sport climbers and Boulderers combined, and Low-risk sport controls for emotion regulation, agency, and sensation seeking difficulty after participation.

Group	Time 1	Time 2	Time 3
Emotion Regulation difficulty	$\omega = .91, \alpha = .91$	$\omega = .92, \alpha = .92$	$\omega = .90, \alpha = .90$
<i>Traditional rock climbers</i>	23.31 [27.95, 18.66] (8.71)	25.43 [29.79, 21.07] (8.18) ^b	26.93 [31.64, 22.23] (8.82) ^{ab}
<i>Sport climbers and Boulderers</i>	25.94 [29.63, 22.24] (7.18)	24.82 [27.80, 21.84] (5.79)	25.05 [28.23, 21.88] (6.17)
<i>Low risk sport controls</i>	18.33 [24.22, 12.43] (9.27)	18.41 [24.05, 12.77] (8.87)	19.00 [23.78, 14.21] (7.53)
Agency difficulty	$\omega = .75, \alpha = .75$	$\omega = .82, \alpha = .82$	$\omega = .90, \alpha = .90$
<i>Traditional rock climbers</i>	25.00 [28.83, 21.16] (7.19)	24.75 [28.87, 20.62] (7.73)	28.18 [32.62, 23.75] (8.32) ^{ac}
<i>Sport climbers and Boulderers</i>	22.88 [25.01, 20.74] (4.15)	21.94 [24.63, 19.24] (5.23)	20.88 [23.71, 18.04] (5.51)
<i>Low-risk sport controls</i>	19.75 [24.85, 14.64] (8.03)	20.33 [25.46, 15.19] (8.08)	21.08 [26.65, 15.21] (9.23)
Sensation need satisfaction	$\omega = .75, \alpha = .76$	$\omega = .89, \alpha = .87$	$\omega = .86, \alpha = .85$
<i>Traditional rock climbers</i>	36.25 [38.57, 33.92] (4.35)	36.93 [39.57, 34.30] (4.94)	37.56 [40.05, 35.07] (4.65)
<i>Sport climbers and Boulderers</i>	37.00 [39.10, 34.89] (4.09)	37.64 [40.19, 35.10] (4.94)	37.05 [39.77, 34.34] (5.28)
<i>Low risk sport controls</i>	34.66 [37.58, 31.74] (4.59)	34.91 [37.40, 32.42] (3.91)	35.58 [38.20, 32.96] (4.12)

Note: ^a = significantly increased in difficulty across time; ^b = significantly greater than the Low-risk sports group; ^c = significantly greater than other two groups. Time 1 = one day after participation, Time 2 = one week after participation, Time 3 = six weeks after participation, Mean [95% confidence intervals] (SD). *n* = sample size, traditional rock climbers *n* = 16, sport climbers and boulderers *n* = 17, low-risk sport controls *n* = 12. ω = McDonald's omega; α = Cronbach's alphas.

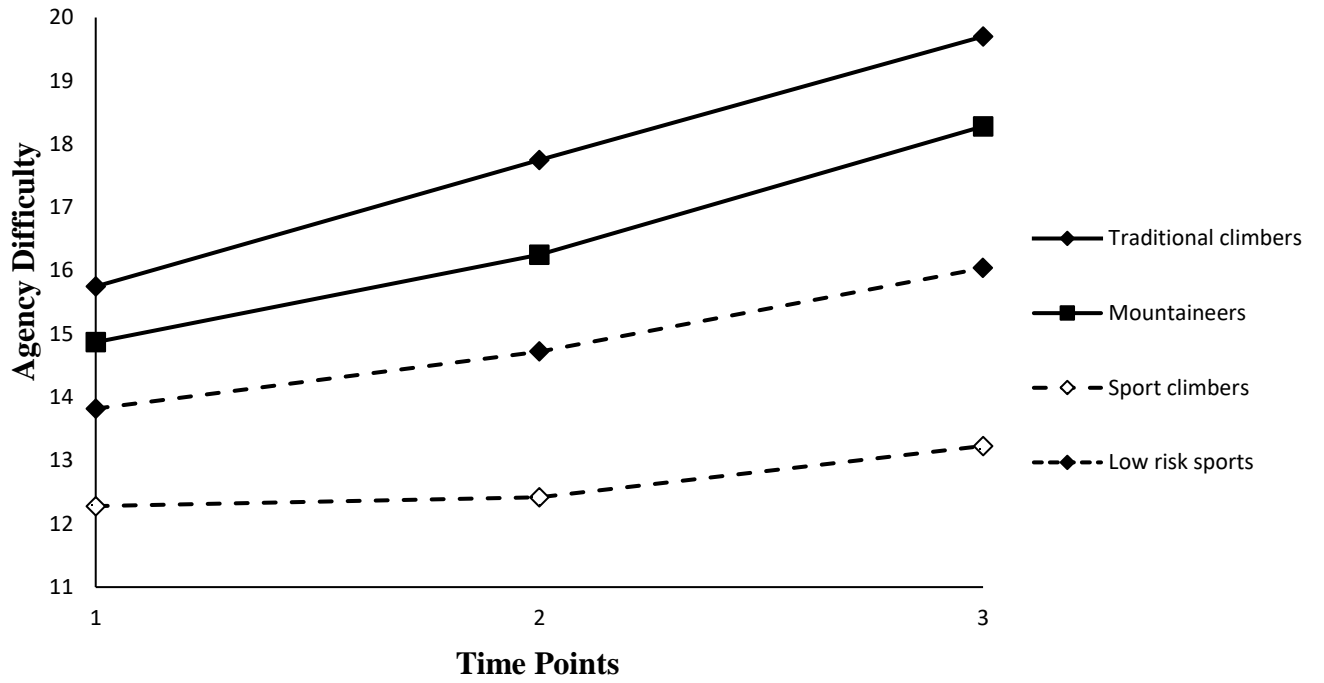
Figures

Figure 1.



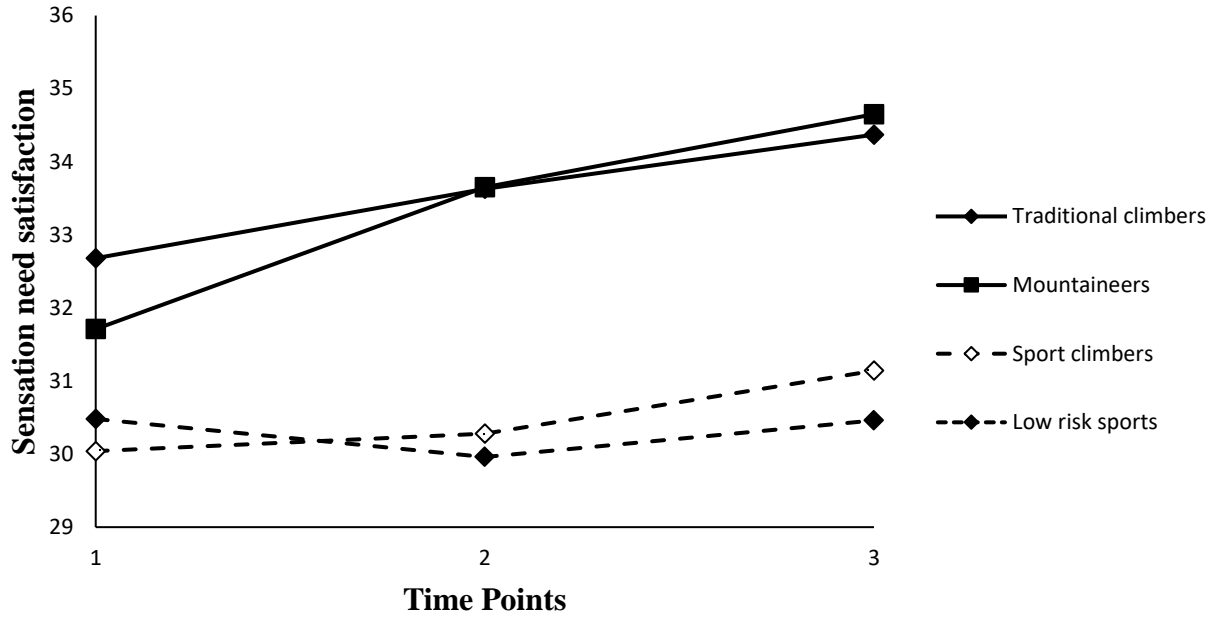
Study 1 Emotion regulation difficulty across one day, one week, and six-week post participation time points.

Figure 2.



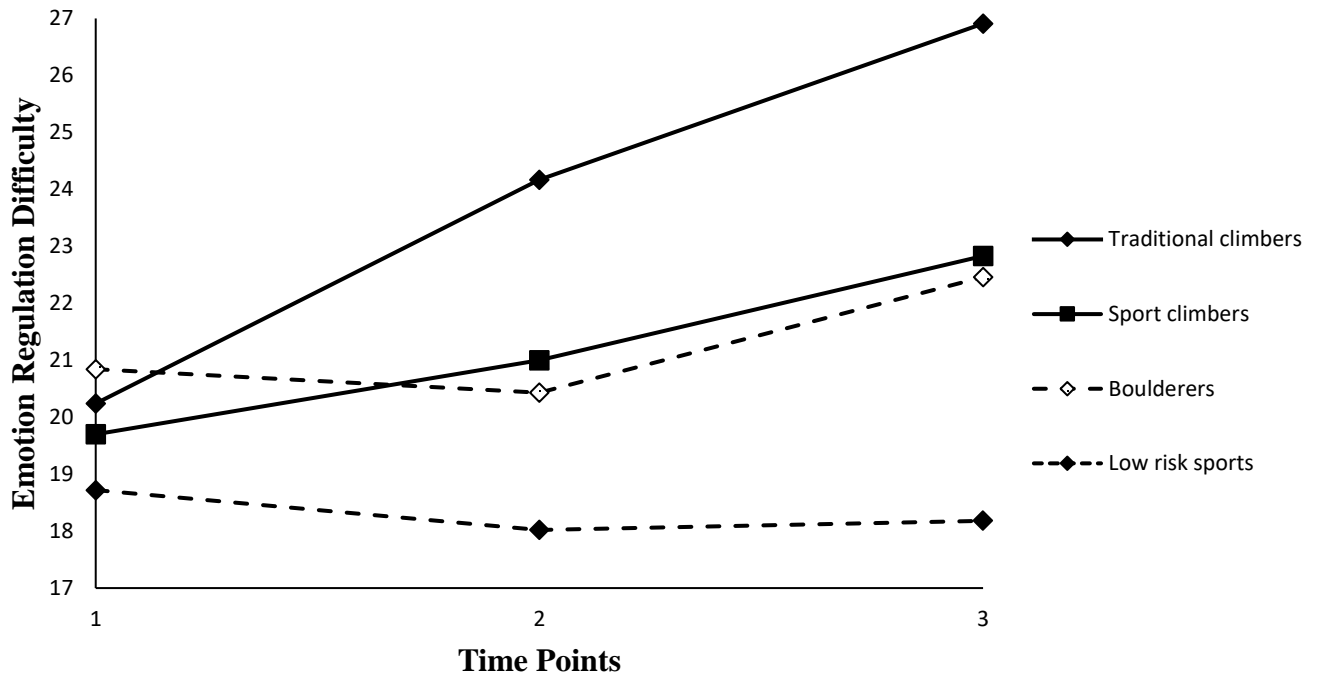
Study 1 Agency difficulty across one day, one week, and six-week post participation time points.

Figure 3.



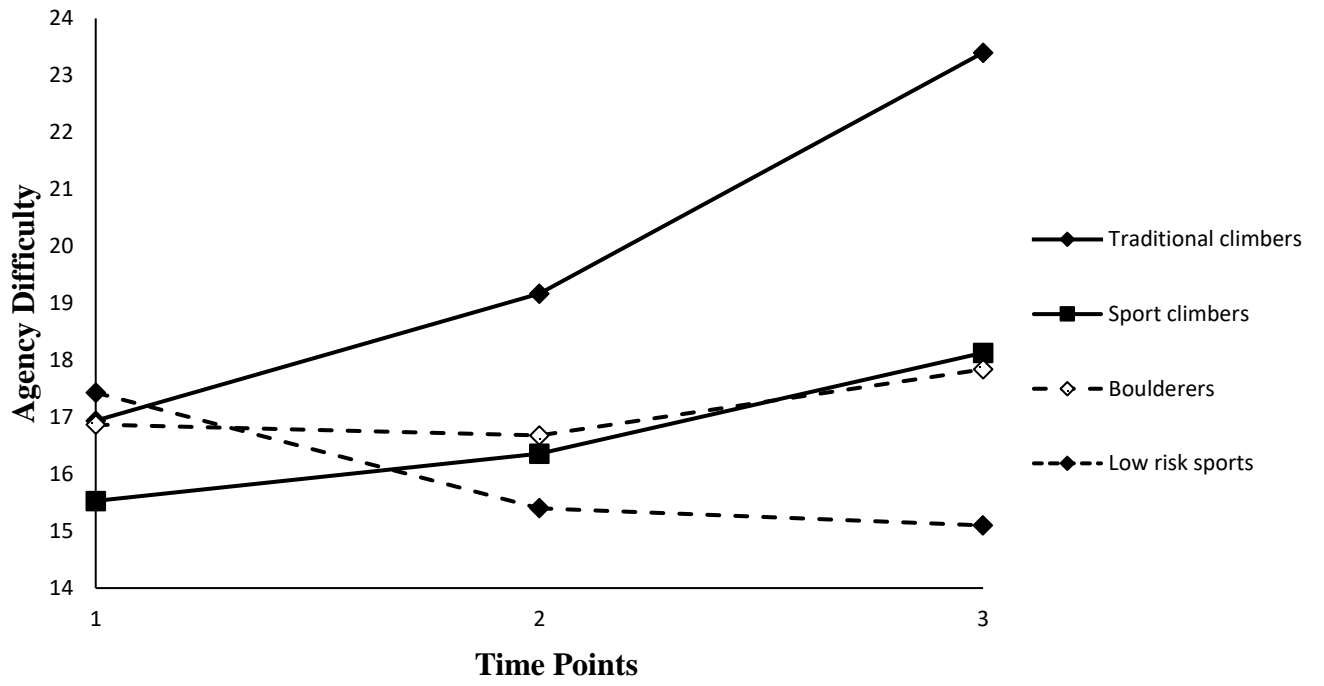
Study 1 Sensation need satisfaction across one day, one week, and six-week post participation time points.

Figure 4.



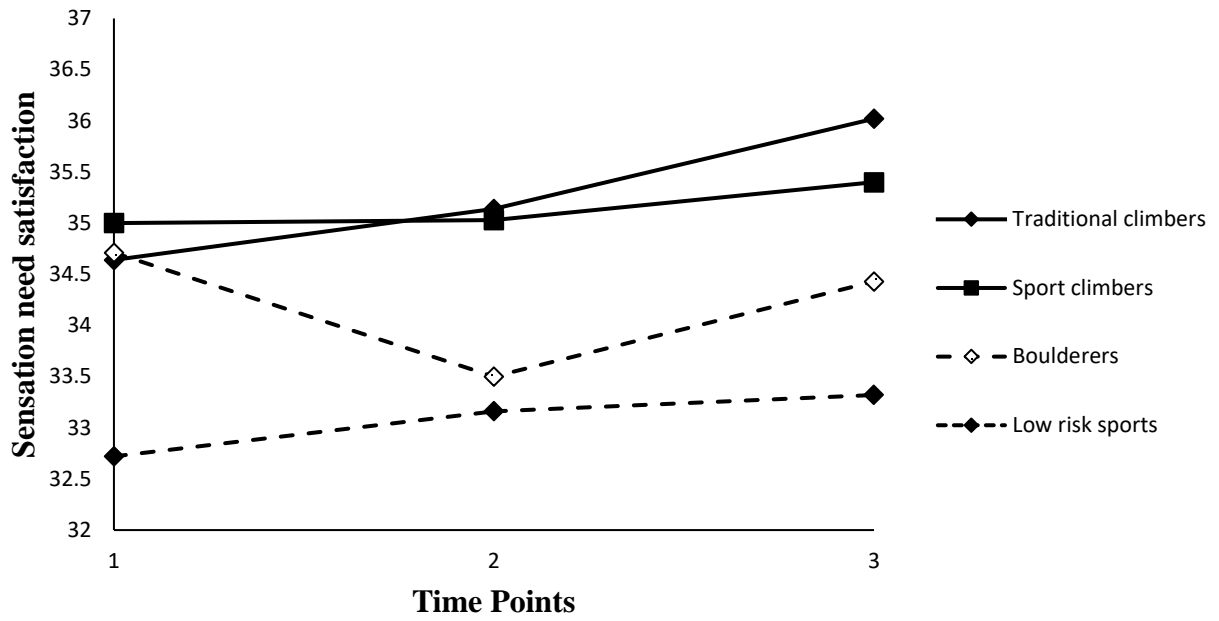
Study 2 Emotion regulation difficulty across one day, one week, and six-week post participation time points.

Figure 5.



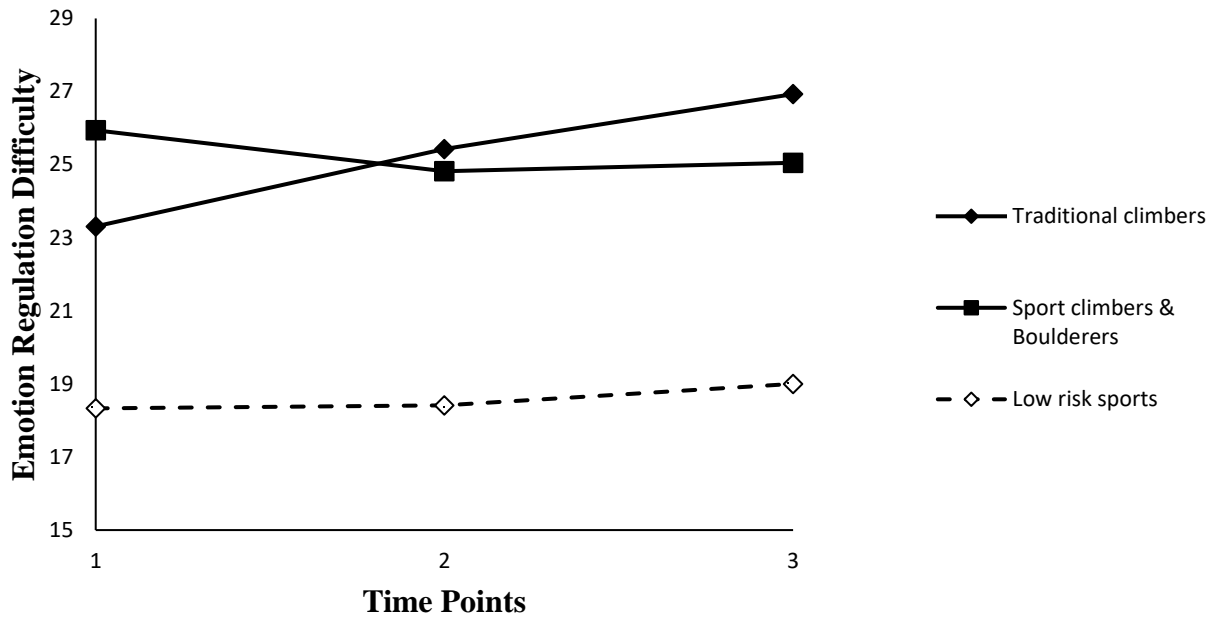
Study 2 Agency difficulty across one day, one week, and six-week post participation time points.

Figure 6.



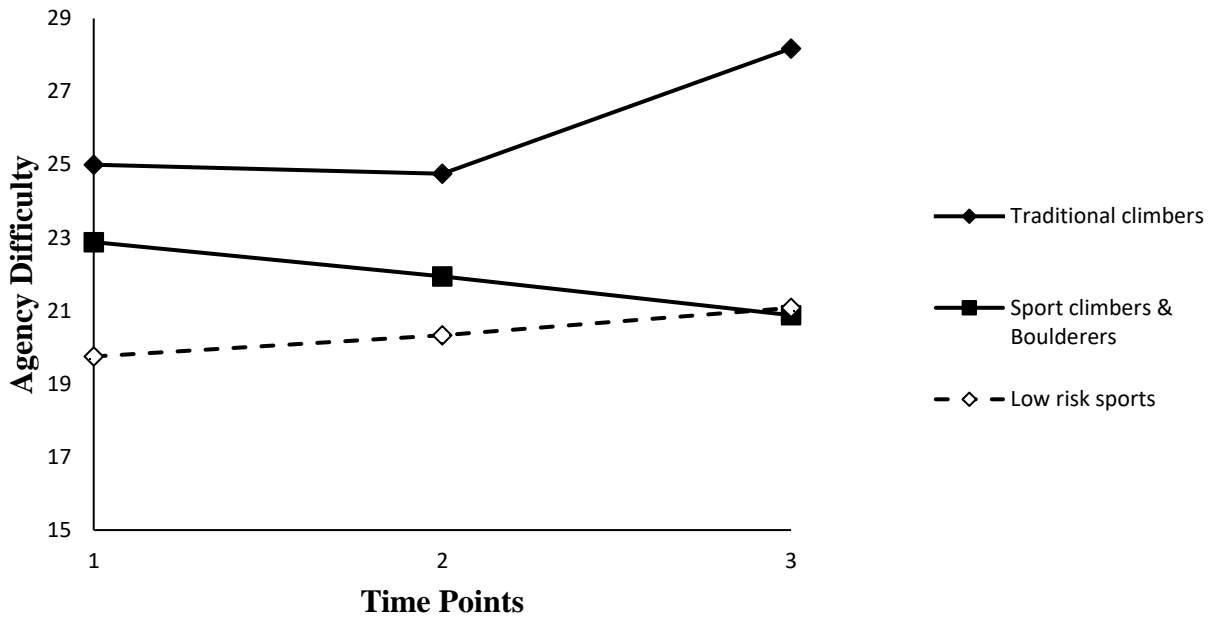
Study 2 Sensation need satisfaction across one day, one week, and six-week post participation time points.

Figure 7.



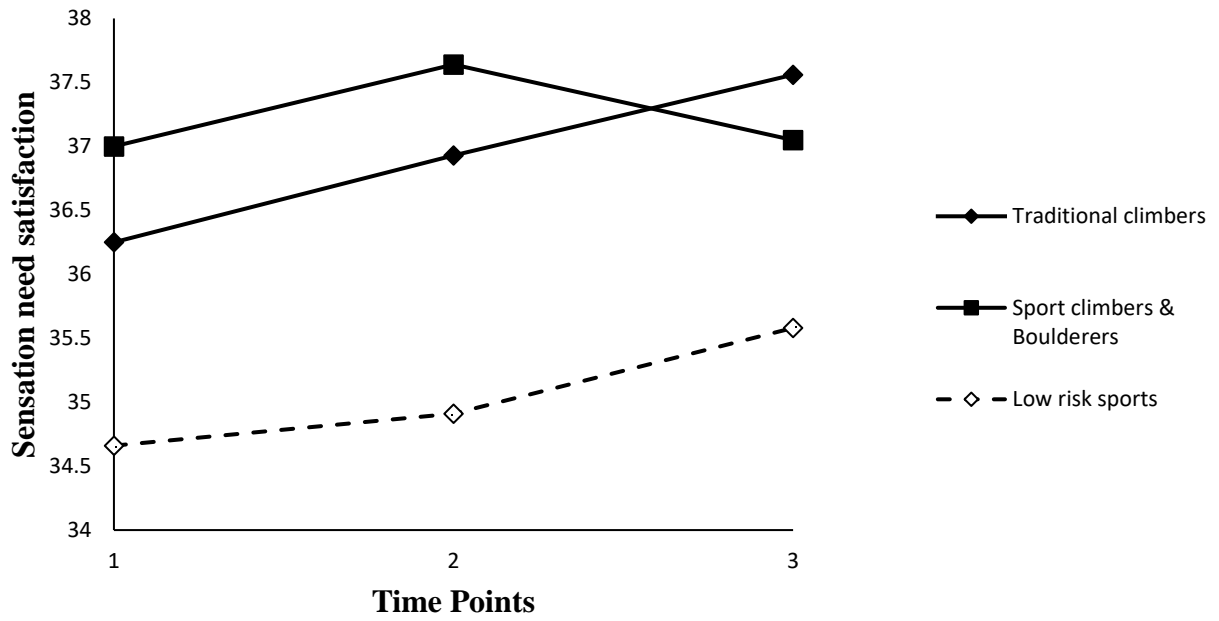
Study 3 Emotion regulation difficulty across one day, one week, and two-week post participation time points.

Figure 8.



Study 3 Agency difficulty across one day, one week, and two-week post participation time points.

Figure 9.



Study 3 Sensation need satisfaction across one day, one week, and two-week post participation time points.

