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1 **Editorial: Athlete Psychological Resilience and Digital Mental** 2 **Health Implementation**

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10 **1 Introduction**

11 An athlete's ability to adapt to stress and adversity is vital for their psychological resilience. While
12 resilience has been traditionally considered from a physiological perspective in sports, in recent
13 years, the importance of the mind–body connection has led to a growing interest in the field of athlete
14 psychological resilience.

15 In this Research Topic, we have received papers evaluating different approaches to psychological
16 resilience in elite athletes, endurance athletes (ranging from competitive amateurs to professional
17 athletes), and tactical athletes also known as high-performance military personnel. Three of the four
18 articles of this collection primarily examined athlete psychological resilience and one article also
19 focused on digital mental health implementation. Each article is presented separately because of the
20 investigation of different types of athletes in addition to the exploration of cognitive and/or
21 psychological resilience.

22 **2 Cognitive Resilience to Psychological Stress in Military Personnel**

23 The existing literature on cognitive resilience showed how cognitive functions oppose the effects of
24 stress (Staal et al., 2008). The individualized experience of psychological stress is related to the
25 perceived or anticipated stressor (Roesch et al., 2002) and mediated by cognitive appraisal, coping
26 and reappraisal (Lazarus and Folkman, 1984). For example, the impact of physical and mental
27 training as well as competition in athletes emphasizes the need for developing and sustaining
28 effective physiological and cognitive functioning skills. Tactical athletes are expected to
29 operationalize a specific role. In addition to physical variations to achieve operational performance,
30 the high prevalence and significant consequences of intense psychological stress in athletes indicates
31 that understanding cognitive resilience is essential for appraising and coping with stressors inside and
32 outside of their occupation.

33 [Flood and Keegan](#) highlighted the complexity of underlying psychological stress experienced by
34 military personnel in a review of the situations where cognitive resilience is challenged. Findings
35 suggest that military personnel experience similar common occupational stressors as civilian
36 populations in addition to potentially traumatizing combat stressors related to injury and death.
37 However, more work is needed to assess these combat stressors or potentially traumatizing events

38 through a validated measure of appraisal and coping in addition to a qualitative interview to clarify
39 that they are appraised as stressful. The results have shown that the psychological stress of modern
40 warfare has exacerbated the impact on cognitive performance. For example, the 'persistent conflict'
41 state marked by the unpredictability of insurgent attacks and the increased use of technology such as
42 operating unmanned aerial vehicles (UAVs) justifies provoking stress in an ecologically valid way.
43 Virtual Reality (VR) exercises may help prepare combatants to be adaptive in their cognitive
44 functioning when experiencing the subjective accumulation of stress.

45 The beneficial effect of cognitive resilience is reinforced by existing theoretical models about
46 mitigating the effects of stress on cognitive performance through effortful allocation and reallocation
47 of attention to achieve task effectiveness. The integration of these models into military settings in
48 addition to the detection of decreased processing efficiency was proposed by Flood and Keegan to
49 contribute to a better understanding of cognitive resilience to psychological stress. Consequently, it
50 was suggested to extrapolate the subjective experience of stress and its impact on the performance of
51 cognitive operations through broader use of self-report measures and mixed methods approaches to
52 enhance cognitive resilience. Additionally, it was recommended to use tailored technology for
53 examining the evolving environment in which tactical athletes operate.

54 **3 An App-enhanced Cognitive Fitness Training Program for Athletes**

55 The existing literature on using technology to improve fitness is focused on translating physiological
56 biofeedback signals into meaningful and actionable insights. The next frontier for utilizing
57 technology in sports is to explore brainwave patterns from training cognitive fitness to enhance both
58 physical and mental performance in addition to wellbeing and better results in competition.

59 [Aidman et al.](#) introduced digital mental health implementation to operational performance in elite
60 athletes through the development of a cognitive fitness training smartphone app. The Cognitive Gym
61 program applies the Cognitive Fitness Framework (CF2) which is based on the Research Domain
62 Criteria (RDoC) Framework. The app aims to identify the cognitive processes underlying normal and
63 abnormal functioning to improve psychological resilience and reduce stress. The prototype involves
64 30 minutes of daily practice with the app for 3 weeks. Training drills address the domains of
65 confidence, self-belief, and a mastery versus outcome focus. The training is primarily delivered
66 through educational videos and reading adapted from the CF2 model. The app includes guided
67 cognitive workouts, breathing sessions, user engagement tools, completion trackers, leaderboards,
68 and a social feed. A pre- and post-training evaluation is conducted by a machine learning algorithm
69 in addition to the users' and coaches' evaluation of the users' performance.

70 Although qualitative feedback found there is promise of efficacy and user acceptance, the expectation
71 is that use of the Cognitive Gym app and its supporting materials will lead to better overall cognitive
72 fitness and wellbeing because it is 1) based on the CF2 model 2) targets constructs throughout the
73 performance cycle 3) uses drills that passed rigorous testing 4) applies a comprehensive psycho-
74 educational package and 5) provides the core sequence of the prototype for external evaluation. The
75 athlete-focus of the Cognitive Gym app may counter COVID-19 disruptions to sports industry
76 support programs through providing self-guided, gold-standard training for mental capacities, mental
77 readiness and adjustment skills to assist athlete psychological resilience in competition.

78 **4 Coping and Resilience Among Endurance Athletes during COVID-19**

79 The existing literature on the effect of pandemics on psychological wellbeing focused on stress and
80 social isolation which can negatively impact mental and cardiovascular health. Similar findings were

81 reported for COVID-19 lockdowns which invoked increased stress (Di Fronso et al., 2020), reduced
82 physical activity (Ruiz et al., 2021) and decreased wellbeing (Lades et al., 2020), as well as an excess
83 of negative psychological outcomes: primarily anxiety, depression and stress (Chtourou et al., 2020).
84 Although the worst of COVID-19 and associated lockdowns appear to be in the past, the threat of
85 future pandemic disruptions provides the context for obtaining insights into athletes' resilience and
86 general coping strategies. It is relevant because athletes were constrained in their training
87 opportunities resulting in physical and mental adversity. Resilience theory is well-established in the
88 athlete population marked by appraisal before emotional and coping responses leading to a positive,
89 protective impact. Coping theory was described as a response to stress with differing effectiveness in
90 resolving significant issues.

91 [Harman et al.](#) investigated the extent that endurance athletes exercised during lockdown to
92 understand how they enacted dispositional resilience and coped with subjective perceived barriers to
93 training. The analyses indicated that endurance athletes who exhibited greater athletic levels also
94 exhibited a greater lockdown resilience and adaptive cognitive-emotional coping strategies in
95 addition to perceived lower barriers to training during lockdown. The experience of lockdown
96 hardship depends on the level of the athlete, with elite athletes having more contextual adversity than
97 amateur athletes from disrupted training plans.

98 Overall, the mixed methods study supports previous findings on psychological resilience that it is a
99 personal asset critical to promoting functional adaptation to the potential negative affect of stressors.
100 In this case, endurance athletes were found to have been likely to overcome unfavorable lockdown
101 conditions. The cross-sectional study also supports the previous claim that the resilience of elite
102 athletes depends on the accessibility of resources and the context. However, COVID-19 was noted as
103 a particularly unique disruption in terms of the barriers to training resources and psychological
104 support. Remarkably, the study applied the commonly used Connor-Davidson Resilience Scale (CD-
105 RISC-25) which focuses on an individual's ability to regain biopsychological balance through
106 maintaining goal focus in challenging circumstances. It was recognized as a limitation that there is a
107 need for a sporting resilience measure that integrates athlete-specific mental health considerations in
108 a biopsychosocial approach. Subsequently, it was recommended that future research extend into a
109 longitudinal design to capture the factors internal and external to sport that influence resilience.

110 **5 The Sporting Resilience Model**

111 Psychological resilience has grown incrementally in the past two decades and is broadly used as a
112 common language to efficiently thwart socio-cultural differences. The disruptive impact of COVID-
113 19 changed the structure of sport, making sporting resilience of even more consequence. The existing
114 literature on athlete psychological resilience emphasized how athletes are confronted by adversity
115 and intense experiences that contribute to their unique stressors and mental health issues. However,
116 narrative reviews preceded the recent increase of publications in the sporting domain.

117 [Gupta and McCarthy](#) conducted a systematic review of resilience research in sport and exercise
118 psychology with theoretical considerations also from positive and clinical psychology to provide an
119 up-to-date summary of the evidence base and future directions for research. The integrative and
120 inductive review found that the foundational definition of athlete psychological resilience required
121 updating to improve empirical precision specific to the sporting domain. For example, the
122 operationalization of resilience to-date is comprised of different components including the influence
123 of environmental and sociocultural contexts inside and outside of sport in addition to the maintenance
124 of positive equilibrium in one's biopsychosocial system when confronted by multiple challenges. The

125 review found a need to go beyond protection from stressors/adversities to also encompass positive
126 adaptation over time including rebounding when new challenging situations arise.

127 Fundamentally, the existing theory on dynamic process-trajectory underpins sporting resilience
128 whereby performance and adaptation capacity increases while sustainably engaging with protective
129 resources. The collation of empirically supported sporting resilience components was synthesized
130 into a distinct process involving dynamic person-environment-adversity interaction. The new
131 definition centered on an athlete's ability to assess their experience in the face of adversity which lets
132 them perform in line with their existing level and continue adapting beyond that. The Sporting
133 Resilience Meta-Model presented a new theory suggesting that a resilience filter comprised of
134 biopsychosocial protective factors controls the impact of adversity and determines the course of
135 positive adaptation. However, the protective factors differ between individuals and environments
136 may change over time. Thus, the new definition of sporting resilience proposed a quite stable notion.
137 The flexible list of protective factors may be tested and adjusted to reflect future interaction and
138 dynamicity as well as a resource for mapping the trajectory of an athlete's resilient adaptation.

139 **6 Conclusions**

140 The Research Topic is timely and topical after COVID-19 related sporting disruptions lifted interest
141 in athlete psychological resilience as an important concept for achieving optimal performance in the
142 face of stress and adversity. Primarily, the systematic review synthesized the evidence base into a
143 new theory that typifies how resilient athletes overcome various challenges to procedurally adapt to
144 adversity over a course of time. This was integrated into a testable model based on the individualized
145 experience of filtering biopsychosocial protective factors inclusive of environmental and
146 sociocultural influences inside and outside of sport.

147 This collection's 3 other articles discuss innovative cohort engagement. A review of cognitive
148 resilience in military personnel found the need for tactical training for efficient and effective high
149 performance in operationalizing warfare tasks (e.g., applying VR training to prepare against the
150 threat of UAVs). The promise of tailored digital solutions is also exemplified by the Cognitive Gym
151 app protocol which describes a program that contributes to self-guided training in elite athletes to
152 increase their cognitive capacity to be psychologically resilient in competition. The research findings
153 with endurance athletes revealed the importance of the context in which athletes train and compete –
154 the more that was at stake from barriers and adverse disruptions, the more resilience was exhibited.

155 Overall, the articles point towards the next steps such as implementing mixed methods in
156 longitudinal studies to grow the evidence base and evaluating the new model with international
157 comparisons. Future studies are recommended to 1) build upon the evidence-based foundations for
158 athlete psychological resilience; 2) integrate technology in high performance-resilience interventions;
159 3) test and provide an outcome measure for mapping the trajectory of athlete psychological
160 resilience; and 4) advance a model of delivery for effectively measuring athlete psychological
161 resilience.

162 **7 Conflict of Interest**

163 The authors declare that the research was conducted in the absence of any commercial or financial
164 relationships that could be construed as a potential conflict of interest.

165 **8 Author Contributions**

166 LB contributed to the writing and DDL and MT contributed to the review – all authors have made a
167 direct and intellectual contribution to the work and approved it for publication.

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