RESEARCH ARTICLE

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An Investigation of the Psychological Status of Amateur Athletes Before and After a Triathlon Competition

Claire McDonald, Ciara Losty, and Roisin MacCarthy

ABSTRACT

Triathlon is a multisport, endurance event which places significant psychological demands on athletes. To date, few studies have compared psychological states of triathletes before and after competition. Furthermore, there is a lack of research assessing psychological indicators of overtraining in triathletes. This study aimed to create a psychological profile of amateur athletes before and after a triathlon competition, and to investigate psychological symptoms of overtraining syndrome. Forty amateur triathletes were recruited to participate in this study. Participants completed the Profile of Mood States (POMS), Passion Scale (PS), Pittsburgh Sleep Quality Index (PSQI), and General Self-Efficacy Scale (GES). Questionnaires were administered the day before a triathlon event, and then repeated the day after the competition. Athletes reported poor sleep quality, and mood states followed the iceberg profile (i.e., high vigor, and low anxiety, depression, anger, fatigue, tension, and confusion). Significantly higher pre-competition scores emerged for tension (pre: 8.85±5.4, post: 4.18±5.0, $p < 0.001$) and anger (pre: 3.57±3.8, post: 2.80±4.1, $p = 0.021$). Correlational analyses performed using Spearman's rank correlation coefficient revealed that pre-competition sleep quality ($r = -0.37$, $p = 0.019$) and tension ($r = -0.34$, $p = 0.031$) were related to self-efficacy, and that tension ($r = 0.47$, $p = 0.002$), and fatigue ($r = 0.57$, $p < 0.001$) were related to pre-competition sleep quality. Lower scores for pre-competition vigor ($r = -0.40$, $p = 0.010$) were associated with poorer sleep quality. The study highlights significant relationships with sleep quality, and potential indicators of overtraining syndrome in amateur triathletes. Experimental research analyzing the effects of interventions to target the highlighted psychological characteristics in amateur triathletes is recommended. Coaches and practitioners should monitor athletes' sleep quality before competition to optimize performance and prevent overtraining syndrome.

Keywords: Endurance, Psychological Characteristics, Sleep Quality, Sports Psychology.

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I. Introduction

Triathlon is a multisport event in which competitions differ both in technical requirements and distances. For example, competitions range from shorter distances such as Sprint and Olympic triathlons, to longer distances including half Ironman and Ironman. A standard or Olympic distance triathlon consists of a 1.5-kilometer swim, followed by a 40-kilometer cycle and a 10-kilometer run which are performed sequentially with transitions in between. Competitors are uniquely faced with the physical and psychological demands for all 3 sports (McCormick *et al.*, 2016; Sleivert *et al.*, 1996; Vleck *et al.*, 2014). Examples of psychological demands might be preparing and packing equipment for all three stages, or parking and memorizing location of bikes in the swim-cycle transition area. The demands associated with training for a multisport competition such as triathlon are known to influence athletes' psychological characteristics. The impact of psychological states on sports performance has been widely acknowledged (Abdullah *et al.*, 2016; Swann *et al.*, 2017). In particular, psychological states preceding competition are found to play an important role in performance (Sanchez *et al.*, 2010; Terry & Slade, 1995). Before a sports competition, anxiety levels of athletes tend to increase (Ghorbanzadeh & Bayar, 2013; Jones *et al.*, 1991; Koruç *et al.*, 2004; Krane, 1994). Pre-competition anxiety is thought to be influenced by a number of stressors including travel, sleep quality, confidence, and concerns about performance (di Fronso *et al.*, 2013; Silva *et al.*, 2012). Despite this, there is a dearth of research on triathletes' psychological states before and after competition (Boucher *et al.*, 2021; Parry *et al.*, 2011).

European Journal of Sport Sciences
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Increased exposure to psychological stressors not only directly affects performance, but also puts triathletes at an increased risk of developing symptoms of overtraining syndrome (Main, 2010). Overtraining syndrome is a serious condition caused by an imbalance between stress and recovery (Kreher & Schwartz, 2012). Its symptoms include underperformance, fatigue, and mood disturbances. Due to training for multiple sports, triathletes are at risk of developing overtraining syndrome (Bales & Bales, 2012; Kienstra *et al.*, 2017). Research assessing psychological symptoms of overtraining in triathletes is lacking (Bell & Ingle, 2013; Sinigalli *et al.*, 2021). The current study aimed to address gaps in the literature by creating a psychological profile of amateur athletes before and after a triathlon competition, and by investigating psychological symptoms of overtraining syndrome.

II. Materials and Methods

A. Sample and Procedure

Amateur triathletes were recruited through Triathlon Ireland by sharing a digital poster via email and social media. Participants had to hold an amateur status, be over the age of 18, and have an upcoming triathlon event. The study protocol was approved by the South East Technological University Waterford Research Ethics Committee. Participants were required to read an information sheet and sign a consent form. A power analysis conducted in the G*Power software (Buchner *et al.*, 1996) indicated that a sample size of forty-five participants was appropriate for the current study. Interested individuals were requested to contact the researchers with details of their next triathlon competition. The study used a one-group pretest-posttest design, whereby data was collected the day before competition and the day after competition. Participants were asked to provide a random code of their choosing which could be used to pair pre- and post-test responses. Participants completed a demographics questionnaire, the Profile of Mood States (POMS) (McNair *et al.*, 1971), the Passion Scale (PS) (Vallerand *et al.*, 2003), the Pittsburgh Sleep Quality Index (PSQI) (Buysse *et al.*, 1989), and the General Self-efficacy Scale (GES) (Schwarzer & Jerusalem, 1995).

B. Measures

Demographic data including age, gender, competition location, and weekly training hours were collected. The Profile of Mood States (POMS) is a standard psychological assessment containing sixty-five words describing feelings on which participants must rate themselves. The original questionnaire was altered to ask participants to rate their current feelings rather than considering their feelings over a one-week period. The items are divided into 6 subscales: tension-anxiety, depression, fatigue, confusion-bewilderment, anger-hostility and vigor-activity. The subscale scores are then added to give a Total Mood Disturbance (TMD) score. The Passion Scale (PS) is a fourteen-item scale assessing 2 themes: harmonious passion and obsessive passion. Items 1 to 7 are totaled to give a score for harmonious passion, whereas items 8 to fourteen contribute to a score for obsessive passion. Instructions were altered to ask participants to consider triathlon training while completing the items. The Pittsburgh Sleep Quality Index (PSQI) is a self-report measure of sleep quality. 7 component scores are totaled to form a global score ranging from 0 (no difficulty) to 21 (severe difficulty) in all areas. A global PSQI score of less than 5 indicates good sleep quality, whereas greater than 5 indicates poor sleep quality. The General Self-Efficacy Scale (GES) is a self-report measure of self-efficacy which includes 10 items scored on a 4-point Likert scale. A total score is calculated by finding the sum of all items, and ranges between 10 and forty with higher scores indicating higher self-efficacy.

C. Data Analysis

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) Version 28.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as the mean and standard deviation (SD). The influence of competition on psychological factors (sleep quality, tension, vigor, anger) was estimated using a Wilcoxon signed-rank test or a paired-samples t-test depending on distribution of data. Relationships between pre-competitive self-efficacy and other variables (sleep quality, fatigue, tension), as well as pre-competitive sleep quality and other variables (training hours, fatigue, vigor, tension) were estimated using Spearman's rank-order correlation coefficient. Statistical analysis was conducted at 95% confidence level and an alpha level of 0.05 was used for all analyses.

III. Results

A. Descriptive Statistics

In total, forty amateur triathletes participated in the study; 55% were male, 87.5% were Irish, 87.5% of competitions were domestic, and 50% of participants trained for between 7 and 14 hours per week (Table I).

Pre-competition scores for Total Mood Disturbance (TMD) were higher (M = 5.40, SD = 18.475) than post-competition scores (M = 2.45, SD = 22.618). Average component scores for pre-competition tension (M = 8.85), depression (M = 3.10), anger (M = 3.57), vigor (M = 17.42), fatigue (M = 4.28), and confusion (M = 3.03) followed the iceberg profile (Fig. 1). More participants scored higher in harmonious passion than obsessive passion in both pre-competition (n = 36) and post-competition (n = 39). Passion scores did not differ significantly between pre- and post-competition. Overall, sleep quality was poor in this sample with almost half of participants reporting poor sleep quality. The mean score for pre-competition sleep quality was 5.38 (SD = 2.844), whereas the average post-competition sleep quality score was 5.18 (SD = 2.890). High levels of self-efficacy were reported for both pre- and post-competition (M = 32.55, SD = 4.169).

TABLE I: DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS (N=40)

	Total sample (%)
Age	
18-24	4 (10.0)
25-34	2 (5.0)
35-44	(28.8)
45-54	(20.3)
55+	5 (12.5)
Sex	
Male	22 (55.0)
Female	19 (45.0)
Nationality	
Irish	35 (87.5)
British	4 (10.0)
American	1 (2.5)
Competition location	
Domestic	35 (87.5)
International	5 (12.5)
Time spent training per week	
<7 hours	15 (37.5)
7-14 hours	20 (50.0)
14-20 hours	5 (12.5)
>20 hours	0 (0)

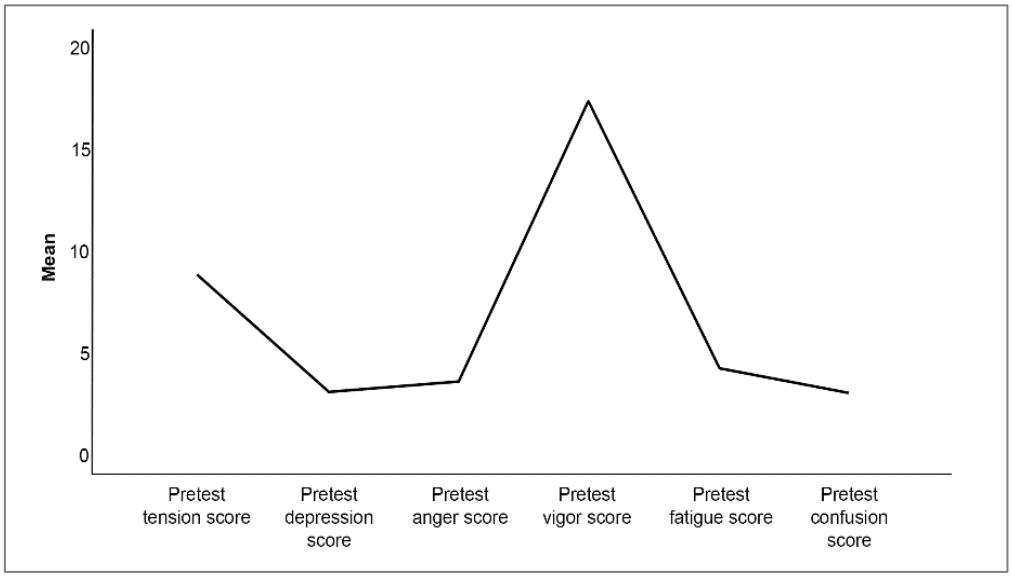

Fig. 1. Mean pre-competition POMS component scores.

B. Statistical Results

Differences between pre- and post-competition sleep quality were not significant (Z = -0.718, p = 0.472). Neither competition location or average weekly training hours had a significant influence on sleep quality. Positive correlations were found between pre-competition sleep quality and fatigue (r(38) = 0.566, p < 0.001), and tension (r(38) = 0.474, p = 0.002). Poorer quality sleep before competition elicited significantly higher levels of fatigue and tension. There was a moderately strong negative association found between pre-competition sleep and vigor, r(38) = -0.404, p = 0.010. Scores for pre-competition vigor decreased with poorer quality sleep. A significant decrease from pre- to post-competition mood states were found for tension (Z = -4.118, p = <0.001), and anger (Z = -2.299, p = 0.021). There was a weak negative correlation found between pre-competition self-efficacy and sleep quality, r(38) = -0.370, p = 0.019.

European Journal of Sport Sciences
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As PSQI scores increased, self-efficacy scores decreased meaning that poorer sleep quality is associated with lower self-efficacy.

A negative relationship was found between pre-competition self-efficacy and tension, $r(38) = -0.342$, $p = 0.031$. Female athletes reported significantly lower self-efficacy when compared to males, $U = 121$, $Z = -2.103$, $p = 0.037$. Self-efficacy was not significantly influenced by weekly training hours. Increased training hours were associated with higher obsessive passion, $r(38) = 0.460$, $p = 0.003$.

IV. Discussion

A. Influence of Competition

The main objective of this study was to determine the influence of a triathlon event on psychological markers. Although participants reported better quality sleep after the competition, differences in sleep quality from pre- to post-competition did not reach statistical significance. Previous research suggests that sleep quality of athletes is particularly disturbed during the pre-competition period, perhaps due to anxiety or travel (Fietze *et al.*, 2009; Juliff *et al.*, 2015; Roberts *et al.*, 2018; Vlahoyiannis *et al.*, 2021). In the post-competition period, sleep quality may be negatively impacted by muscular pain and recovery (Biggins *et al.*, 2021). As the current study measured pre- and post-competition sleep quality the night before and after an event respectively, it is possible that competition affected sleep quality on both nights which may explain the insignificant differences in scores. Overall, approximately half of the participants reported poor pre- and post-competition sleep quality which is similar to previous findings in Irish amateur athletes (Biggins *et al.*, 2018). The current sample reported poorer quality sleep than the general population (Hinz *et al.*, 2017; Lee *et al.*, 2020) which is consistent with previous findings (Halson, 2014; Leeder *et al.*, 2012; Sargent *et al.*, 2014). No significant difference in sleep quality was found between domestic and international competitors. However, travel distance was not assessed for international competitors, therefore it is not possible to know whether this affected the impact of travel on sleep quality. Training volume did not influence sleep quality either. Perhaps a larger sample size would have yielded more significant results.

Differences in mood states of amateur triathletes between pre- and post-competition were assessed using the POMS. A statistically significant difference in tension was found between pre- and post- competition, with reduced tension following competition. This finding is consistent with previous research (Parry *et al.*, 2011). Cognitions about the upcoming competition and the likelihood of success or failure may increase pre-competition tension. The cognitive theories (Lazarus, 1966; Weiner, 1986) may explain differences in pre- and post-competition tension scores. Before competition an athlete may have thoughts that their behavior will not lead to success, or that they do not have the resources to meet the demands of the situation. Although vigor was found to be higher before competition than after, the difference was not statistically significant. Previous research on amateur triathletes has found a significant increase in vigor immediately prior to competition (Boucher *et al.*, 2021). However, this study was conducted over a 6-month training period with monthly assessments. As the current study assessed pre- and post-competition vigor just 1 day apart, it is possible that this may have affected the results. Low vigor was associated with poor sleep quality in the pre-competition period. Both factors have previously been used as indicators of overtraining (Grant *et al.*, 2011; Halson, 2008). Average pre-competition POMS scores followed an iceberg profile (Morgan, 1980) which represents an optimal mood state for performance. Differences in pre- and post-competition Total Mood Disturbance was not significantly different, which is consistent with the literature.

B. Indicators of Overtraining

Previous studies have relied on mood states (specifically, increased tension, anger, fatigue, and reduced vigor) (Grant *et al.*, 2011; O'Connor *et al.*, 1989; Terry, 1995) , poor sleep quality (Cadegiani & Kater, 2017; 2019; Killer *et al.*, 2015; Lastella *et al.*, 2018) obsessive passion (Curran *et al.*, 2011; Gustafsson *et al.*, 2011; Schiphof-Goddart & Hettinga, 2017) and low self-efficacy (Filho *et al.*, 2013; Schwarzer & Jerusalem, 1995) as psychological indicators of overtraining syndrome. A high level of self-efficacy was reported by amateur triathletes in the current study which is consistent with athletic samples (Mukherjee *et al.*, 2014). A significant relationship between self-efficacy and sleep quality was found. Specifically, poor sleep quality was found to be associated with lower levels of self-efficacy. Individuals with severe sleep problems have previously been found to have lower self-efficacy than individuals with no sleep problems (Bihlmaier & Schlarb, 2016; Schlarb *et al.*, 2012). As sleep is important for recovery, poor sleep quality may decrease self-efficacy and put individuals at risk of overtraining syndrome (Kellman, 2010). Self-efficacy was found to differ between genders, with female participants reporting lower self-efficacy. This result supports previous research findings that female athletes have lower self-efficacy than males (di Fronso *et al.*, 2013; Kellman *et al.*, 2001). Low self-efficacy significantly related to higher tension in the period before competition which supports previous findings (De Pero *et al.*, 2013; Hanton *et al.*, 2004; Jerusalem & Schwarzer, 1992; Tirmzai *et al.*, 2019).

The relationship may be explained through cognitive theory (Lazarus, 1966; Weiner, 1986). As low self-efficacy negatively affects an individual's belief in their ability to achieve their goals, pre-competition tension may increase (Bandura, 1977).

A significant relationship was also found between pre-competition tension scores and sleep quality whereby poorer sleep quality was associated with higher tension. This supports previous findings that higher pre-competition tension negatively impacts sleep quality on the night before competition (Andrade *et al.*, 2019; Lastella *et al.*, 2014). It is possible that some participants may be experiencing symptoms of overtraining syndrome including higher tension, as a result of low self-efficacy or poor sleep quality. Higher fatigue was associated with lower self-efficacy, but the relationship was not significant. Although the effect is thought to be individual (Hanin, 2000). Although training positively impacts self-efficacy, training-induced fatigue has been found to negatively affect the relationship between training and self-efficacy. Participants with higher weekly training hours reported higher self-efficacy, however the difference was not statistically significant. There was a significant relationship found between higher training hours and obsessive passion. Although, participants were more harmonious than obsessive in their passion overall.

This study was limited by its sample size which may affect generalizability of its findings. Self-report measures of psychological characteristics were used which are vulnerable to bias. Lastly, pre-competition and post-competition psychological characteristics were assessed one day apart which may not have allowed for significant difference in some variables. Future studies should consider using a larger sample size, and objective measures where possible. Furthermore, the timing of pre-test and post-test assessments should be optimized to ensure both accuracy and respondent retention.

V. Conclusion

The results are conclusive in highlighting that poor sleep quality is associated with lower self-efficacy, and higher tension in this sample of amateur triathletes. Sleep quality is found to be poor in general, and pre-competition anxiety is associated with reduced self-efficacy. These findings indicate that amateur triathletes may be at risk for overtraining syndrome, but further research is necessary for confirmation. Coaches, practitioners, and athletes should be aware of and consider interventions to maintain psychological factors at optimal levels for each athlete according to their needs. Examples of preventative measures include managing individual training loads, psychological monitoring, and ensuring optimal sleep, nutrition and hydration (Kreher, 2016).

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Conflict of Interest

Authors declare that they do not have any conflict of interest.

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